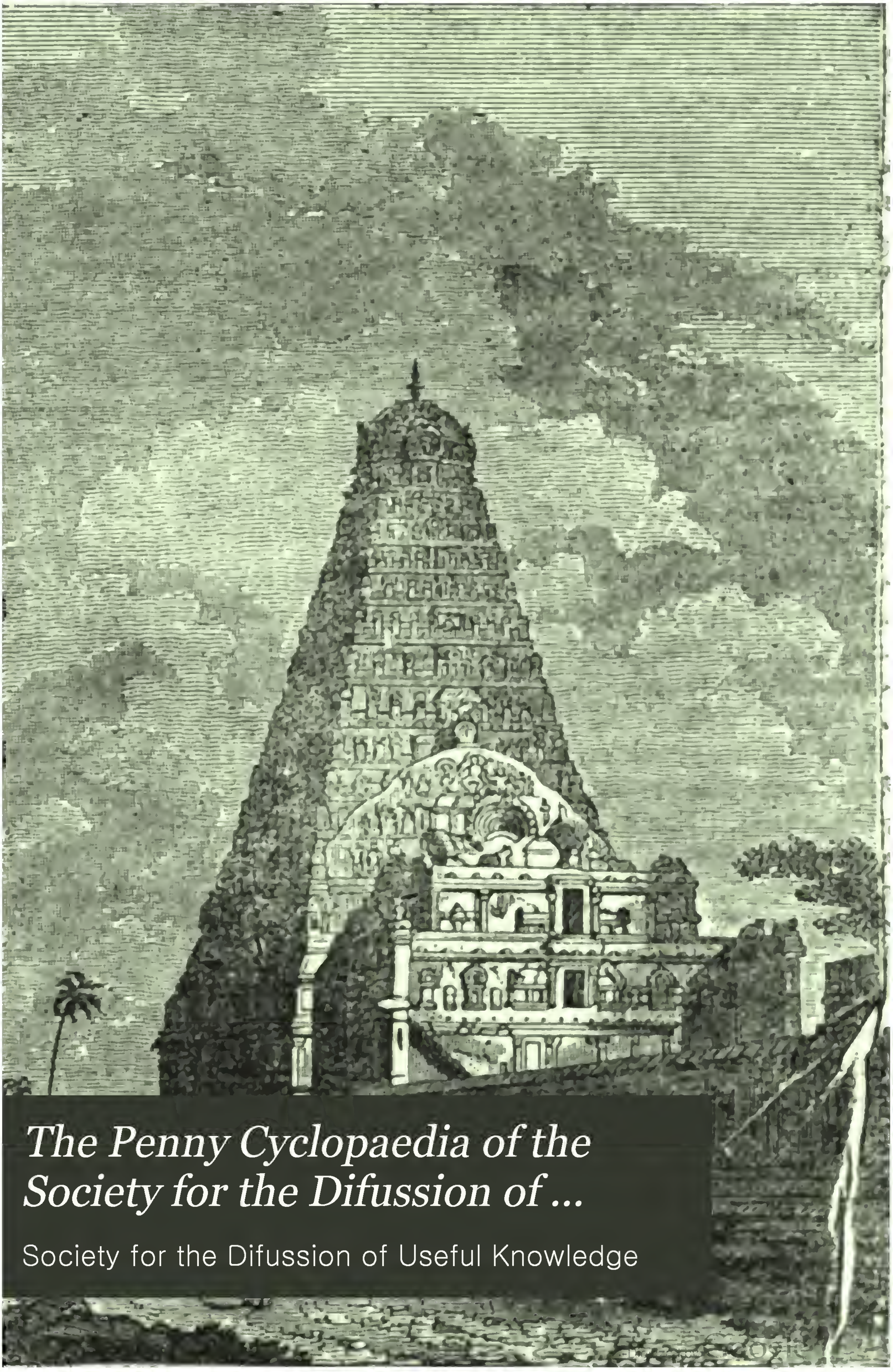


12-3-12

20.957

THE

PENNY CYCLOPÆDIA

OF

THE SOCIETY

FOR THE

DIFFUSION OF USEFUL KNOWLEDGE.

VOLUME XII.

HADLEY, JOHN——INTESTINA.

LONDON:
CHARLES KNIGHT AND Co., 22, LUDGATE STREET.

MDCCCXXXVIII.

Price Seven Shillings and Sixpence, bound in cloth.

London: Printed by William Clowes and Sons, Stamford Street.

THE PENNY CYCLOPÆDIA

OF

THE SOCIETY FOR THE DIFFUSION OF USEFUL KNOWLEDGE.

HADLEY, JOHN, the reputed inventor of the sextant which bears his name, became a Fellow of the Royal Society in 1717, and died February 15, 1744. He was author of several useful papers, which appear in the Transactions of the Society, from vol. 32 to vol. 39. He was also upon intimate terms with Sir Isaac Newton, from whom it is supposed he borrowed, without acknowledgment, the idea of the sextant. It is now generally believed that Newton and Godfrey were the original and independent inventors of that instrument. [GODFREY.] Hadley gave an account of the instrument in the 'Philosophical Transactions' for 1731; but Newton, previous to his death in 1727, had given a description of the instrument to Dr. Halley, by whom it was, for some unknown reason, suppressed, though it was communicated to the Royal Society in the year 1742, after Halley's death, by his executor, Mr. Jones. (Hutton's *Dictionary*, 1815; Herschel's *Astronomy*, p. 102; and *Trans. of the American Society*, vol. i., p. 21, Appendix.)

HADRAMAUT. [ARABIA.]

HADRIA'NUS, ÆLIUS, son of Ælius Hadrianus Afer, a cousin of Trajan, and a native of Hatria Picena, but of Spanish descent, and of Domitia Paulina of Cadiz, was born at Rome, in January, A.D. 76. He was left an orphan at ten years of age, under the guardianship of Trajan and of Tatianus, a Roman knight. He made great progress in literature, especially in the study of Greek. In the reign of Domitian he served as commander of an auxiliary legion in Mœsia. Trajan gave him his niece Sabina in marriage, and he accompanied the emperor in his Dacian and Eastern campaigns. When Trajan died at Selinus, in Cilicia, in August, 117, Hadrian, whom he had left in charge of the army in Syria, was proclaimed emperor by the soldiers at Antioch, and he wrote to the senate, requesting their confirmation. Plautina, Trajan's widow, favoured his views by pretending that Trajan on his death-bed had appointed him his successor, and for this service Hadrian showed his gratitude to Plautina to the end of her life. The fact of Hadrian being adopted by Trajan a year before his death has been asserted by some writers and denied by others. His election being confirmed by the senate, Hadrian, after withdrawing the troops from the countries east of the Euphrates and making peace with the Parthians and the Armenians, set off for Rome, where he assumed the consulship in the following year (A.D. 118) with T. Fuscus Salinator. He refused to appropriate to himself the triumph which had been destined for Trajan, and he caused the image of the deceased emperor to be carried in the triumph: according to Spartianus he himself carried it. He remitted all the arrears due to the public treasury by individuals in Rome and the rest of Italy, and all that was due from the provinces for sixteen years past; and he burnt in the Forum of Trajan the schedules of the debts, which are said to have amounted to several millions sterling. Medals were struck on this occasion with the figure of Hadrian holding a torch and setting fire to the heap, and the legend 'He enriches the whole world.' In the following year Hadrian was consul again with Rusticus; and hearing that the Sarmatians and the Roxolani had made an irruption into Illyricum, he repaired to Mœsia, defeated the invaders, obliged them to recross the Danube, and to sue for peace. He appointed Marcius Turbo governor of Pannonia and Dacia. From his camp in the Illyricum he wrote to the senate, accusing of high treason four senators of consular families, who were ordered for immediate execution. Other persons were arrested and put to death as accomplices in the alleged conspiracy, and a general alarm spread at Rome, when Hadrian hurried back and affected to blame the precipitancy of the senate. He compelled Tatianus, his former guardian, whom he had made præfect of the Prætorian soldiers, and who had abused his power, and had advised the proscriptions, to resign his office. The year after, Titus Aurelius Fulvius, afterwards the Emperor Antoninus Pius, was made consul; and in the same year Hadrian began his travels through the various parts of the empire, which may be said to have occupied, with few interruptions, the remainder of his reign, a period of about eighteen years. We have memorials of his travels in numerous medals, struck in the various provinces on the occasion of his visit, which form an interesting series. An Italian medalist, Mezzabarba Birago, has put these medals in order and illustrated them. Hadrian began with Campania, where he distributed sums of money to the poor of the various towns which he visited. Indeed liberality in this respect was one of the most conspicuous qualities of this emperor. He next went to Gaul, where he visited all the principal towns and fortresses; from thence he proceeded to Germany, where the best legions of the empire were stationed, and he remained a considerable time among them for the purpose of restoring the discipline, which had become relaxed. He himself set the example by living as a soldier among the soldiers. Hadrian was not fond of pomp or show, and he went about with as little state as possible. He drew up a series of military constitutions or laws, which remained long in use after his time, and are quoted by Vegetius. He attached to every cohort a certain number of builders, masons, and other workmen.

In the following year, in the consulship of Annius Verus, grandfather of Marcus Aurelius, he left Germany, and returned to Gaul, from whence he passed into Britain, where he is said by Spartianus to have reformed many abuses. Although Hadrian did not live on very good terms with his wife Sabina, he punished those who presumed to fail in respect to the empress; among others Suetonius Tranquillus, the biographer, who was Hadrian's epistolographer, or secretary, whom he dismissed, as well as Clarus, the præfect of the Prætorium. While in Britain he constructed a rampart of earth, extending from the Solway Firth to the German Ocean near the mouth of the Tyne, a little to the south of the more substantial wall afterwards raised by Severus. On his return to Gaul, Hadrian built a magnificent palace at Nismes for Plautina, Trajan's widow. He thence proceeded into Spain, and spent some time at Tarraco (Tarragona), where he held a general assembly of the deputies of the various provinces of Spain, and settled several disputes and complaints. While walking in the palace garden at Tarraco a slave attempted to kill him. The emperor parried the blow, and consigned the assassin to his guards, but on hearing that the man was insane, he ordered him to be taken care of by his physicians. Hadrian returned to Rome in the consulship of Aulius Aviola and Cornelius Pansa, A.D. 122; but he left it again soon after, and the next year we find him at Athens, a city to which he was much attached. He ordered the embankment of the Cephisus, which had damaged the town of Eleusis, and the construction and reparation of various edifices. From thence he went to Syria, and had a conference with the king of the Parthians, when peace was confirmed between the two empires. In the year following he visited various parts of Asia Minor, and after building temples and other edifices at Nicomedia, Cyzicum, Nicæa, and other towns, he sailed to the islands of the Ægean Sea, and returned to spend the winter at Athens, where he was initiated in the Eleusinian mysteries, presided at the public games, and showed many marks of favour to the Athenians. He next went to Sicily, and ascended the summit of Ætna to see the sun rise. He returned to Rome under the consulship of Verus and Junius Bibulus, A.D. 126, and we know nothing of his movements for the two following years. He appears to have been at Rome in the year 129, under the consulship of Juventius Celsus and Julius Balbus, when a violent earthquake having destroyed the towns of Nicomedia and Nicæa in Bithynia, and others, he ordered them to be rebuilt at his own expense, for which he is styled on some medals the Restorer of Bithynia. In the same year he set off for Africa, where he distinguished himself, as he had done on his previous travels, by his munificence. Plautina having died meantime, Hadrian returned to Rome, and celebrated her funeral with great ceremony, and had her numbered among the gods. In the following year, 130, he raised a magnificent temple in honour of Venus and Rome, some remains of which are still seen near the arch of Titus. The plan of the building was made by Roman architects, and sent by the emperor to Apollodorus, a celebrated Grecian architect, for his opinion. Apollodorus observed that the building appeared too low for the size of the statues of Venus and Rome, which were intended to be placed therein, and which it would appear were represented seated, as Apollodorus remarked that those divinities, when once within, could not stand upright or walk out of the temple, if they should take a fancy to do so. Hadrian, stung at this sarcasm, sent Apollodorus into exile; and it is added by some writers that he afterwards ordered him to be put to death on some frivolous pretence. In that year Hadrian set off again for the East. He visited Cappadocia, where he held a conference with several kings or chiefs of the Caucasian tribes, the Abaxi, Zidretes, &c., whom he sent back loaded with presents. Even the Bactrians sent an embassy to propose an alliance with Rome. He next proceeded to Syria, Palestine, and Egypt, in which last country he remained two years. While he was in Egypt, and under the consulship of Lænas Pontianus and Antonius Rufinus, A.D. 131, the jurist Salvius Julianus completed, by his order, the Perpetual Edict, which may be considered as the first general code of Roman law published by authority.

There is a letter of Hadrian, written from Alexandria, to Servianus, his brother-in-law, in which he describes the state of the population of Egypt, and speaks of the various sects, Jews, Christians, Samaritans, &c., who were very numerous in that country; he says that they all adored but one god, namely, their own interest. He also notices as an extraordinary thing, that at Alexandria everybody, even the blind, followed some trade or occupation; a circumstance which probably struck him by contrast with the habitual idleness of the people of Rome. He restored the palace and museum of Alexandria, and held disputations with the learned men there. About this time his favourite Antinous died; some say he drowned himself in the Nile, and Hadrian disgraced himself by the apotheosis and other absurd honours which he paid to his memory. He next went to Cyrenaica, where he is said to have killed a large lion. Hadrian was an expert sportsman, and is said to have killed many wild beasts in his travels. Under the consulship of Hiberus and Sisenna, A.D. 133, Hadrian repaired to Syria, from whence he set off for Thrace and Macedonia, and lastly stopped at Athens. The insurrection of the Jews of Palestine under Barcochebas raged about this time. They took Jerusalem, and spread all over Syria, and Hadrian was obliged to send for his best general, Julius Severus, who was in Britain, to assume the direction of the war against them, which lasted about three years. [BARCOCHEBAS.] Hadrian raised a new city on the ruins of Jerusalem, which he called Ælia Capitolina, and he peopled it with a Roman colony, forbidding by an edict all Jews from setting their feet within it. The Christians, who were still confounded with the Jews by the Romans, were included in the prohibition. Hadrian meantime made another long residence at Athens, and in the festivals of Bacchus he appeared in the dress of an archon, and distributed money and corn to the people. He greatly embellished that city, a district of which was called by the name of Hadrianopolis. [ATHENS.] He also completed the temple of Jupiter Olympicus, which had been commenced a long time before. He returned to Rome under the consulship of Lupercus Pontianus and Rufus Aquilianus, A.D. 135, where he received the visit of Pharasmanes, king of Iberia, who came to answer several complaints laid against him by Vologesus, king of Armenia. An exchange of rich presents took place, and Hadrian took care that his should exceed in value those brought to him by his visitor. Soon after, falling ill, he thought of choosing a successor, and he fixed his choice upon Lælius Aurelius Ceionius Commodus Verus, whom he adopted and appointed Cæsar by the name of Ælius Verus. In the following year Hadrian retired to the neighbourhood of Tibur, where he built a magnificent villa, many remains of which are still existing, and which contained representations of the wonders of nature and of art which he had seen in his travels. Protracted illness seems to have soured his naturally suspicious temper, and he condemned several individuals to death, among others his brother-in-law Servianus, a man far advanced in age. Ælius Verus having died in the second year after his appointment as Cæsar, Hadrian now fixed his choice upon Titus Aurelius Antoninus, on condition that he should adopt Lucius Verus, son of Ælius Verus. After some deliberation Antoninus accepted the proposal, and the double adoption was solemnized with the usual ceremonies in February, 137. Sabina, Hadrian's consort, died about this time, and was numbered among the gods. Hadrian still finding his illness increasing, at last removed to Baiæ, where, in spite of the prescriptions of his physicians, he began to eat and drink according to his pleasure. Seeing his end approach, he composed some lines addressed to his soul, which show his doubts and fears concerning another existence:

> 'Animula vagula blandula,
> Hospes comesque corporis,' &c.

He died in July, A.D. 138, in his sixty-third year, and the twenty-first of his reign. (Spartianus, *Life of Hadrian;* Dion; Aurelius Victor; Eusebius.)

In his personal character Hadrian had many valuable qualities, tarnished by some vices. As emperor, his reign may upon the whole be considered a happy one for the empire, which enjoyed almost uninterrupted peace. Less warlike than Trajan, he made himself respected by foreign nations without having occasion to resort to arms. His extensive travels form an important epoch in the history of Roman civilization, which they must have tended to spread, while he corrected many abuses of provincial administration, and thus cemented the union between Rome and its vast dependencies. He used to say that an emperor ought to be like the sun, visiting by turns all the regions of the earth. He built numerous towns, embellished others, and peopled them with fresh colonies. Dion, who is in general not favourable to Hadrian's character, admits that he never appropriated to himself other people's property, and that he would not receive anything left him by will when the testator had children. Hadrian gave no power to his liberti, and punished those about him who boasted of their influence for the purpose of extorting money. He was attentive to business, and an enemy to pomp and parade. If he cannot be counted one of the best emperors, he certainly must not be reckoned among the bad. He had an extraordinary memory; was a good orator, grammarian, poet, and musician; was acquainted with mathematics and medicine and delighted in the company of learned men; he was also a great friend to the arts of sculpture and architecture. He was the first emperor who let his beard grow— in order, it is said, to conceal some blemish in his face.

The busts, statues, and medals of Hadrian are very numerous, and all bear a striking resemblance to each other in the character of the countenance. There is a full-length statue of him and two busts in the Townley Gallery, British Museum.

Coin of Hadrian.
British Museum. Actual Size. Copper. Weight, 360 grains.

Reverses of Coins of Hadrian.

HÆMATE'MESIS (from αἷμα, blood, and ἐμέω, to vomit), a bleeding from or into the stomach. [HÆMORRHAGE.]

HÆMATO'CELE (from αἷμα, blood, and κήλη, a tumour), an effusion of blood into the scrotum.

HÆ'MATOPS, a name given by Mr. Gould to a genus of birds inhabiting Van Diemen's Land and New South Wales, and thus characterized by him in 'Zool. Proc.' for 1836 (Dec. 27).

Bill shorter than the head, slightly curved, without any denticle at the apex, rather compressed. *Nostrils* longitudinal, and covered by an operculum; no bristles at the gape. *Wings* moderate, first quill short, third and fourth nearly equal and longest. *Tail* moderate, equal or slightly forked. *Tarsi* moderate, the rather strong *hallux* and claw equalling the middle *toe* and claw; external *toes* equal in length. Ensanguined spots or marks (*nævi sanguinolenti*) above the eyes.

Mr. Gould recorded two species, *Hæmatops valdirostris*, 6¾ inches in length (Van Diemen's Land), and *H. gularis*, 6 inches long (New South Wales).

These were among the specimens from which drawings had been taken for the first part of Mr. Gould's new work on the Birds of Australia. The name, in sound, comes rather near to *Hæmatopus*.

HÆMA'TOPUS. [OYSTER-CATCHER.]

HÆMATORNIS. [FALCONIDÆ, vol. x., p. 174.]

HÆMATO'XYLON CAMPECHIA'NUM (Logwood), a tree native of Campeachy, but cultivated also in Jamaica. The finest wood is the produce of the former place. The bark and alburnum being removed, there is within a dark red coarse-fibred duramen, having a violet-like odour, and a taste at first sweetish, afterwards astringent. It dyes the saliva violet-coloured, and produces a similar change on many of the other secretions. Specific gravity 1·057. Ten pounds of wood yield 16-18 ounces of extract. Its chief constituents are volatile oil, resinous or fatty matter, and a principle termed *hæmatoxyline*, which is occasionally found in the wood in the form of crystals.

Logwood acts as a mild astringent in hæmorrhages or increased secretions; and in some forms of diarrhœa it often effects a cure where more powerful astringents fail. (See Abercrombie on 'Diseases of the Stomach, &c.') It may be exhibited in the form of infusion or of extract: the former is preferable. Logwood is also used extensively in the arts, especially for dyeing. It gives the peculiar colour to the paper in which sugar-loaves are always wrapped.

HÆMATU'RIA (from αἷμα, blood, and οὖρον, urine), voiding of bloody urine. [HÆMORRHAGE; KIDNEYS, DISEASES OF.]

HÆMO'CHARIS. [LEECHES.]

HÆMODORA'CEÆ. Under this name Dr. Robert Brown proposed, in the year 1810, to separate from the natural order Iridaceæ, the genera Hæmodorum, Conostylis, Anigozanthos, Phlebocarya, Dilatris, Lanaria, Heritiera, and Wachendorfia. He remarked that they are abundantly different, especially in being hexandrous, or in having the stamens, if only three in number, stationed opposite the petals, and in having the anthers opening on the side next the stigma; the habit was moreover different. This distinguished botanist mentioned in connection with his new order, without actually adding it, Xiphidium. The latter genus has more recently been introduced along with Hagenbachia as an undoubted member, notwithstanding its having a superior ovary. All the species have equitant leaves, and perennial fascicled fibrous roots or bulb-like cormi; there is also a general appearance of wool upon their flowers, in some cases to such an extent as to bury all the outer surface. The order may be considered a connecting link between Iridaceæ and Liliaceæ. One species, Dilatris Heritieri, yields a dyeing matter in its rhizoma.

Hæmodoraceæ. Wachendorfia Thyrsoidea.

1, a flower spread open to show the position of the three stamens; 2, a ripe capsule; 3, a seed.

HÆMO'PIS. [LEECHES.]

HÆMO'PTYSIS (from αἷμα, blood, and πτύω, to spit), a spitting or coughing of blood. [HÆMORRHAGE; LUNGS, DISEASES OF; PHTHISIS PULMONALIS.]

HÆMORRHAGE (from αἷμα, blood, and ῥήγνυμι, to break). The most common cause of hæmorrhage is external violence, by which the vessels of a part are divided, and the blood escapes from their cavities. When an artery of some calibre is wounded, a bright scarlet stream of blood is propelled to a distance proportioned to the size of the vessel, in a current continuous, yet increased in force at intervals corresponding with the pulsations of the heart. This is called a jetting stream. If a vein of some size be divided, a stream of dark crimson blood is projected in a perfectly continuous and equable current, and with less force than from an artery of the same calibre, in consequence of the loss of power which the blood sustains in its passage through the minute capillary vessels. In wounds in which no vessel of more than a line in diameter has been divided, the blood flows in a constant more or less rapid oozing, but is not projected to any distance from the body; and when it issues from both kinds of vessels at once, and in equal quantities, its colour is intermediate between those peculiar to each of them. The same mixture of the two kinds of blood may sometimes, when a number of small vessels of both kinds, and a large one of either kind, are simultaneously divided, make it doubtful, from the colour alone, to which kind it belongs; and the distinction becomes still more difficult if the arterial blood be long detained in the tissues, for then it assumes a venous colour.

When a large artery, as one of the main trunks of the limbs or head, is divided, the blood rushes forth with such impetuosity that life is often destroyed almost instantaneously. The quantity of blood lost however, and the rapidity with which death ensues, will depend in some measure on the freedom of exit which the blood finds after issuing from the wounded vessel, as well as on the mode in which it is wounded. If there be a free external aperture, no obstacle is presented to its flow, and death speedily follows: if, on the contrary, the aperture be small, as in a punctured wound, the blood can escape but slowly, and is liable to coagulate in the passage, so as partially to block it up and render it still more narrow. If again the artery be completely divided, its extremities will retract into the tissues around, and be thus partly covered, so that the hæmorrhage will be retarded. If it be cut longitudinally, the blood will flow much less rapidly than if the wound be transverse, because the aperture will gape much less widely. If, lastly, the wound be not cleanly made, if the edges be rough and torn, as by a gun-shot, no blood at all will flow, at least for some time. None of these circumstances however is likely to do more than retard the fatal consequence of a wound of a large artery, unless immediate assistance be given.

When an arterial branch of the second magnitude, as one of the primary divisions of the main trunks in the leg or fore-arm, is wounded, the flow of blood is at first profuse, and a large quantity is soon lost; but after a time the patient faints from extreme exhaustion, and then the heart ceasing to act the blood no longer flows, but begins to coagulate both within and around the vessel, whose extremities contract, and further loss may thus be prevented. More frequently, however, as soon as the patient recovers from his exhaustion, and the heart regains some of its power, the slight obstacles formed during the fainting are forced away, and the hæmorrhage recommences and continues till the patient is again exhausted. Thus by a succession of hæmorrhages and of temporary staunchings, he may at last be destroyed by extreme debility. From arteries of smaller size, as those about the fingers, &c., the blood flows at first in a rapid little stream, but after a few minutes, if they are exposed to the cold air, they retract; their orifices contract and close, and the bleeding altogether ceases, without much danger of returning.

Hæmorrhage from wounded veins is of less importance. It is much more slow, for the blood is prevented by the valves from flowing from that part of the vein which is between the heart and the orifice, and in the part which is beyond the orifice it has only the force of that in the smaller arteries. Hence it is seldom immediately fatal, and when the patient becomes faint the edges of the vessel fall together, instead of remaining open as those of arteries. Thus a coagulum forms within and round them, and, except from the largest trunks, prevents any further flow. Other cases in which bleeding takes place from large vessels are those in which they are burst by sudden efforts, as sometimes happens in the aorta, especially when it or the heart is diseased; those in which the walls of an aneurism or otherwise diseased artery or vein burst or ulcerate; those in which ulceration, whether in internal or external organs, spreads from surrounding parts, and at last (though they always resist for a long time) invades the walls of arteries and veins. The bleeding so common from ulcerated surfaces, and from various vascular morbid growths, probably depends on rupture of the very delicate vessels which they contain; and the same delicacy of the walls of its vessels, with their great liability to disease in advanced life, may be assigned for many cases of hæmorrhage in the more vascular parts of the brain producing apoplexy.

But bleeding to a great extent may take place without visible rupture of any vessel. This form of hæmorrhage, which may take place in various parts of the body, is that popularly supposed to arise from the 'bursting of a blood-vessel;' but in the large majority of cases where blood is poured forth in the interior of the body, the most careful examination can discover no aperture through which it had flowed. It is therefore called hæmorrhage by exhalation, from the idea that the vessels which in health are traversed only by the fluids of the exhalations or secretions, now permit the passage of the blood. The only instances in which the blood has been seen flowing in those cases are those extremely rare ones of hæmorrhage from the skin of the face, hands, feet, &c. In these the surface is covered by a dew of blood; if this be wiped away no unnatural appearance is perceptible, but the blood soon exudes again. From this the process would appear to be very similar to that of menstruation. When internal organs from which hæmorrhage has taken place are examined after death, they are sometimes found loaded with blood, but at others quite pale, their vessels having been completely emptied; when pressed, small clots of blood like grains of sand sometimes ooze out on the surface, as if proceeding from the orifices of secreting ducts. From these and other circumstances it is probable that the blood does pass through the vessels which naturally are permeated by the secretions, though the minute details of neither process are yet wholly explicable. It cannot however be certainly affirmed that the minute blood-vessels are not ruptured, for neither the apertures nor the cicatrices in them could be in any way visible.

The circumstances under which these hæmorrhages take place are various. In some cases they arise from distension of the vessels in consequence of some local excitement, either with or without increased activity of the circulation generally, and in these the flow of blood is preceded by a sensation of fullness and throbbing in the part, which, if visible, appears red and swollen. Such are those which take place in bronchitis, producing some rare cases of hæmoptysis; in dysentery and acute inflammation of the intestines; from the membrane of the nose, producing the epistaxis so common in young persons in robust health; in the brain, producing some forms of apoplexy, especially those connected with hypertrophy of the heart; and occasionally in the acute inflammations of nearly all the tissues. In other cases the main cause of the hæmorrhage is the existence of some obstacle to the free passage of the blood through the vessels. Such are those very frequent cases in which hæmoptysis, or spitting of blood, takes place in consumption, where the blood is obstructed in its passage through the pulmonary arteries by the masses of tuberculous matter deposited around them; those of hæmatemesis, or vomiting of blood, which arise from obstruction of the splenic or portal vein, by coagula, or by disease of the liver or other adjacent organs, and the consequent congestion of the vessels of the stomach; many of those which occur from the stomach, uterus, and other organs, in the early stages of various structural diseases; those which depend on disease of the heart, producing obstruction in the large vessels, and which may take place in the brain, lungs, and various other organs; and those arising from obstacles in the veins, as in hanging, or even from the influence of gravitation.

But a simply mechanical distension of the vessels, whether from an increased afflux of blood into them, or a retarded removal of it from them, cannot explain all the phænomena of these spontaneous hæmorrhages. In many cases a peculiar condition of the vessels, or of the blood itself, must be assumed, and is indeed nearly proved. To these must be referred many cases of what is called idiopathic hæmorrhage, as in some instances of hæmatemesis, hæmaturia, &c. In some persons indeed there appears to be a peculiar disposition to bleeding, a hæmorrhagic diathesis. Mr. Abernethy (*Surgical Lectures*) used to speak of a bleeding family, in all of whom it was extremely difficult to staunch the blood from even the slightest wound; and among other similar cases are not a few in which fatal hæmorrhage has followed the extraction of a tooth, or, in children, the application of leeches. Every surgeon also must have observed that in the same operations in different persons the number of vessels requiring to be tied varies greatly; in some amputations, for example, it is not necessary to secure more than the main artery, while in others eight or more must be tied, and this not admitting of any explanation from local differences. Many other circumstances might be adduced to show that there are conditions of the smaller vessels in which they may not only more easily permit hæmorrhages, but are less capable of effecting those changes which are necessary for arresting them, and on these conditions the majority of the hæmorrhages termed passive must be supposed to depend. Such are especially those from the nose, rectum, and other organs, which occur in persons of weak lax habit, and which may be distinguished from the first class we have noticed rather by the general appearance of the patient than by any local circumstances.

Lastly, there are cases in which the hæmorrhages that take place, often coincidently from several organs, may be presumed to depend on alterations of the blood itself. Such are those that occur in scurvy, in which the blood, when drawn from a vein, does not separate, as in health, into a firm coagulum and a clear serum, but settles into a loose, livid, or dark jelly-like mass, and rapidly putrefies. Such too are probably the petechial and other effusions of blood in fever.

Hæmorrhages by exhalation may take place habitually or constitutionally, without injuring the health; most commonly the blood flows from the nose or rectum, more rarely from the lungs or stomach, or even from the skin. They are sometimes periodical; and when occurring in men, have seemed to favour the idea of a periodic action of the system in the male sex as in the female, and the more so as the menstrual evacuation, when suppressed in the latter, is not unfrequently compensated for by hæmorrhage from some other organ. Most of the cases of spontaneous bleeding from the skin are of this class, and in other instances the blood has flowed at regular periods from the gums, the breasts, umbilicus, axillæ, or kidneys, but most frequently from the stomach or lungs. Similar vicarious hæmorrhages occur in men when an habitual discharge from any organ has been suppressed, or when an old ulcer has been suddenly healed.

Of the means of arresting Hæmorrhages.—When an artery is wounded, unless death rapidly follow, a natural process takes place by which further bleeding may be prevented. If completely divided, both extremities retract into the sheath of cellular tissue in which they lie, so that a considerable interval is produced between them, bounded by loose and irregular walls, into which the blood as it flows infiltrates, and coagulating, tends to fill it up and obstruct the vessel. The open mouths of the artery also contract, and gradually, but at last completely close, either at or just above their extremities. As the stream of blood is thus checked by the narrowing and closure of its canal, at the same time that by the faintness induced by the previous loss the action of the heart is weakened and the whole circulation retarded, it begins to coagulate within the vessel itself, till its tube is nearly filled by a clot adhering loosely to its walls. Further changes then ensue; the divided vessel and the parts around become inflamed; coagulating lymph is effused from the edges of the wound into the artery itself and over its extremities, forming a firmer plug than the blood alone had: in process of time this lymph becomes organized, vessels enter it from the parts around, and it becomes firmly and permanently united to them and the vessel, till at length its tube is rendered impervious from the point of division up to the first branch given off from it, and is at last converted into a solid cord, closely connected with the substance of the cicatrix around it. If the artery be only partially divided, the same effects follow; though, if the cut be extensive transversely, with less certainty, because retraction cannot take place, and the internal coagulum, if formed, is washed away by the stream which still partly passes along the vessel. The natural cessation of hæmorrhages from veins is effected in the same manner, but far more easily, for the valves prevent any bleeding from the part nearest to the heart, and both orifices, instead of gaping open, fall together, and soon become adherent.

But in the human subject it is only in the very small arteries that the hæmorrhage can be confidently expected to terminate thus naturally, and hence various artificial means of checking bleeding from the larger ones have been invented. The simplest of these is pressure: if the finger be placed with moderate firmness over the mouth of a small bleeding vessel for a minute or two, on removing it the orifice will be found closed and no more blood will flow. Pressure is also especially useful when a number of small arteries are bleeding together, with a constant oozing rather than a rapid flow of blood. in such cases, when the edges of the wound are brought together, a compress should be laid on, and bandaged firmly and steadily over them. The same means, or a tourniquet applied a short distance above the wound, so as to compress the trunk of the artery, may be useful by lessening the force and volume of the current, and thus permitting the natural processes to take place undisturbed. But if these means be insufficient, the artery must be tied; if it be completely divided, ligatures must be placed on both extremities; and if only partially cut, then on both sides of the opening, for, from the numerous communications of the arteries, when the main current is checked, another in a retrograde direction is always established into the part beyond the ligature. The operation of the ligature is not merely to prevent mechanically the flow of blood from the opened vessel. When a fine cord is drawn tightly round an artery, something is felt to give way under it, and, on removing it and opening the artery, its inner and middle membranous coats are found cleanly cut through as with a knife, while the outer coat remains entire. When the ligature is left on, it embraces this outer coat closely, and thus rendering the canal impervious, completely prevents further bleeding. The blood thus becoming stagnant coagulates in the lower part of the vessel and adheres to its walls; these at the same time inflame, coagulating lymph is effused from their cut edges, and becoming organized, at last, as in the natural process, completely fills up the canal of the vessel, while the part constricted by the ligature ulcerates and gives way, permitting the cord to be safely drawn away at the end of from six to sixteen days.

Previous to the general use of the ligature, introduced by Ambrose Paré in the sixteenth century, numberless means for checking hæmorrhages, then so frequently fatal, were resorted to by surgeons, under the names of styptics, astringents, &c. They were in the habit of applying hot irons to the stumps of amputated limbs to stop the bleeding, which it is probable the eschar thus formed would generally effect. At present however the use of the actual cautery is nearly abolished in this country; it can only be justifiable in the few cases where, from peculiarity of situation, the vessel can neither be tied nor compressed, and for such cases it is certainly the most effectual styptic known. Cold air or ice is nearly as useful, and far oftener applicable: it is quite sufficient in all common cases where only small vessels are divided. In the very few cases where any astringents are required, as in some of external bleeding from diseased surfaces or from tumours, the best are solutions of sulphate of copper and of alum. Another class of remedies that may be usefully employed are those which act mechanically —as sponge, agaric, lint, and other light very porous bodies, which placed over a small bleeding orifice will soon completely obstruct it by favouring the coagulation of the blood.

Such are the principal modes of treatment applicable in cases of external or surgical hæmorrhage in which vessels are divided by external injury, and are within reach of the eye or fingers. In internal hæmorrhages however it is obvious that mechanical means can rarely be employed. From the varied nature of the cases from which they arise it is evident that different means may be required in the several kinds of cases. In those so closely related to inflammation, in which there is accumulation of blood from local or general excitement, the hæmorrhage is itself a naturally curative means of its cause, and need not be checked unless it implicates some important organ, as the brain, and then the most advisable means of arresting it is to bleed from the arm. So, too, in cases of habitual or vicarious hæmorrhages, if not dangerous or very inconvenient from locality, it will seldom be advisable to check them, for they are generally outlets by which a plethoric condition that would else be highly injurious is cured; at any rate they should be arrested gradually and cautiously. Where external means are applicable none are so useful as cold, or, as a last resourse, pressure; as by plugs put in the nostrils, &c. Where a mechanical obstacle to the passage of the blood exists, medicine can often do nothing for the permanent cure of the hæmorrhage that it produces. For the time, the most effectual means are cool air, cold water or ice applied as near as convenient to the seat of bleeding, iced drinks, perfect quietude, and the avoidance of all stimuli; the body should be placed in that position in which blood may gravitate from the affected part, and if there be any indication of plethora or accelerated circulation blood should be drawn from the arm to an amount to be determined by the circumstances of the case. In many cases great benefit results from exciting the vessels, of and near the part, to a copious secretion of the usual fluids, as in some cases of hæmatemesis by administering purgatives. If astringent remedies be deemed advisable, and in many cases they are highly useful, the acetate of lead will generally be preferable, and next to it the different vegetable compounds of gallic acid. [ASTRINGENTS.] The treatment of the peculiar class of hæmorrhages from alteration of the blood is considered under FEVER, &c. (J. F. D. Jones, *On Hæmorrhage and the Ligature;* T. Watson, *Cyclopædia of Medicine*, art. ' Hæmorrhage.')

HÆMORRHOIDS (from αἷμα, blood, and ῥέω, to flow), varicose tumours of the veins of the rectum. [VEINS, DISEASES OF.]

HÆ'MULON, a genus of fishes of the section Acanthopterygii and family Sciænidæ. Generic characters:—a single dorsal fin; seven branchiostegous rays; lower jaw compressed, a small oval opening and two small pores under its symphysis; the vertical fins partially covered with scales.

These fishes generally approach to an elongate oval form; the body is moderately compressed; the tail is forked; the dorsal fin, which occupies the greater portion of the distance between the back of the head and the tail, although continuous, has a considerable indentation at that part where the spinous rays join the flexible. The portion of the under-jaw which is covered by the upper when the mouth is closed, is invariably of a bright red colour. The species of Hæmulon chiefly inhabit the Caribbean Sea, and are eaten by the inhabitants of the West Indian islands. They are of moderate size, varying from six inches to one foot in length, and generally adorned with longitudinal or oblique dark markings on a pale ground colour.

HÆMUS. [BALKAN.]

HÂFIZ, MOHAMMED SHEMS EDDÎN, a celebrated Persian poet, was born at Shiras, at the beginning of the fourteenth century of the Christian æra. From his earliest years he received a lettered education; and paid great attention to the study of religion and Mussulman jurisprudence. He afterwards cultivated poetry, and became so celebrated that the Sultan of Bagdad invited him to his court. Hâfiz however appears to have remained in his native town the greater part of his life. His Persian biographers relate an interview he had with the celebrated Timur (Tamerlane), who conquered Shiras, A.D. 1387. The date of his death is uncertain; it is placed by Daulet Shâh, A.D. 1389. A splendid monument was erected over his grave, which is described by Kaempfer (*Amœnitates Exoticæ*, p. 301); and Franklin (*Observations on a Tour from Bengal to Persia*, pp. 90-7) gives us an account of another monument erected to his memory in more modern times.

The poems of Hâfiz, like those of Anacreon, celebrate the pleasures of love and wine. They have always been greatly admired in Persia; though many Mohammedans have condemned them for their irreligious and licentious tendency. The admirers of Hâfiz, on the other hand, contend that his poems are not to be understood in a literal, but in a figurative or allegorical sense; and that they express in emblematical language the love of the creature to the Creator. The sect of the Sûfis, who interpret the poems of Hâfiz in this manner, possess many similar poems. They maintain that by wine he meant devotion, by perfume the hope of divine favour, and some have gone so far as to compose a dictionary of words in the language of the Sûfis (see Sir W. Jones, ' On the Mystical Poetry of the Persians and Hindus,' *Asiatic Researches*, v. 3). But we are not sure that any of the poems of Hâfiz ought to be interpreted in this manner. Sir W. Jones, who was a great advocate for such a mode of interpretation, remarks, in the essay referred to above, ' It has been made a question whether the poems of Hâfiz must be taken in a literal or figurative sense; but the question does not admit of a general and direct answer; for even the most enthusiastic of his commentators allow that some of them are to be taken literally, and his editors ought to have distinguished them, instead of mixing the profane with the divine, by a childish arrangement according to the alphabetical order of the rhymes' (p. 172-3). We are aware that many Europeans justify the allegorical mode of interpreting the poems of Hâfiz, by a reference to Solomon's Song and the Sanscrit poem ' Gita Govinda' by Jayadêva. It is however very doubtful whether these poems ought to be interpreted in an allegorical manner. [SOLOMON; JAYADEVA.] The poems of Hâfiz have had a great number of Sûfi commentators, such as Shuri, Seid Ali, Lamei, Sururi, and Shemei; but the most celebrated are the Turkish commentators Feridun and Sudi.

The poems of Hâfiz were arranged after his death, by Seid Kâsem Anvâri, and were entitled the ' Divân.' The ' Divân' contains, according to the best MSS., 571 odes, called ghazels. They were published in the original Persian, at Calcutta, 1 vol. fol., 1791; this edition contains only 557 ghazels, and 7 cassidehs, or elegies. Rewuski published a few of the odes with a Latin translation and the commentary of Sudi, under the title of ' Specimen Poeseos Asiaticæ, sive Haphyzi Ghazelæ, sive odæ sexdecim,' Vienna, 1771. Several of the odes are inserted in Sir W. Jones's ' Commentarii Poeseos Asiaticæ;' Wahl's ' Neu Arabische Anthologie,' 8vo., Leip., 1791; Ousley's ' Persian Miscellanies,' 4to, Lond., 1791; ' Asiatic Miscellany,' 2 vols., Calc., 1785-6. The whole ' Divân' was translated into German by Von Hammer, Tübing., 1812; and several of the odes have been translated into English by Richardson, ' Specimen of Persian Poetry, or the odes of Hâfiz, with an English translation and paraphrase, chiefly from the *Specimen Poeseos Asiaticæ* of Baron Rewuski,' Lond., 1774; Nott, ' Select Odes of Hâfiz translated into English verse,' 4to., Lond., 1787; Hindley, ' Persian Lyrics, or scattered poems from the Diwan-i-Hâfiz,' 4to., Lond., 1800.

Further particulars concerning the life and writings of Hâfiz are given in the life prefixed to the Calcutta edition of his poems; in the biography of Daulet Shâh, in Wilken's *Chrestomathia Persica*, Leip., 1805; and in the 4th vol. of the *Notices et Extraits des MSS. de la Bibliothèque du Roi;* in the article ' Hâfiz' in the *Biographie Universelle*, by Langlès: and the same article in Ersch and Gruber's *Encyclopädie*, by Kosegarten.

HAGGAI (חַגַּי, Ἀγγαῖος), one of the twelve minor Hebrew prophets. We know nothing concerning the place or time of his birth. The pseudo-Epiphanius, in his Lives of the Prophets, states that he was born at Babylon; and according to the Rabbis he was a member of the Great Synagogue. The date of Haggai's prophecy is fixed by himself (i. 1), and by Ezra (v. 1), in the second year of the reign of Darius Hystaspis (B.C. 519). We learn from Ezra that the Jews, who returned to their native country in the first year of the reign of Cyrus, commenced rebuilding the Temple, but were interrupted in their undertaking by the neighbouring satraps, till the second year of the reign of Darius Hystaspis, when the building was again continued in consequence of the exhortations of Haggai and Zechariah.

The prophecy of Haggai may be divided into four parts: in the first, the prophet urges the people to continue building the temple, by the promise that God would bless them in their undertaking, and that their previous neglect had been the cause of the drought and bad seasons which they had experienced (i.); in the second, he encourages them by the promise that this second temple should surpass the first in glory; this prophecy is supposed by many to have been fulfilled by Christ entering the temple (ii. 1—9); in the third, he promises the people an abundant harvest, since they had begun to build the temple (ii. 10—19); and in the fourth, he fortels the prosperity of Zerubbabel, governor of Judah (ii. 20—23). Zerubbabel is considered by many commentators to be a type of the Messiah; and the prophecy is supposed to relate to the glory of the Messiah's kingdom.

The canonical authority of this book has never been disputed. It is quoted by the author of the Epistle to the Hebrews, xii. 26; compare Hag. ii. 7, 8, 22.

The prophecy of Habakkuk is written in a dull and prosaic style, and bears traces of having been composed in a late period of Hebrew literature. It possesses none of that vigour and sublimity which distinguish the works of most of the Hebrew prophets who lived before the Babylonish captivity.

The Septuagint, Vulgate, and Syriac versions of the Old Testament attribute the 111th, 126th, 127th, 146th, 147th, and 148th Psalms to Haggai and Zechariah.

(Eichhorn, *Einleitung in das Alte Testament*, iv. 422—427; Augusti, *Einleitung in das Alte Testament*, p. 344—348; Rosenmüller, *Scholia;* and the list of commentators in Watt's *Bibliotheca Britannica*.)

HAGGARD. [FALCONIDÆ, vol. x., p. 181.]

HAGUE, THE (*'s Gravenhaag*), a large and beautiful town, the capital of the province of South Holland, in the kingdom of the Netherlands. It is not fortified, but is surrounded with a moat with drawbridges over it. Though from being thus open it has been generally designated as a village, it may be ranked among the handsomest cities of Europe for its stately buildings, its broad and regular streets traversed by canals, and for its pleasant situation on a dry soil, which is rather more elevated than the surrounding country, so that the air is tolerably pure and healthy. Many of the streets are planted with rows of trees and paved with coloured bricks. The finest parts of the town are the Voorhout and the Vyverberg, of which the latter, with a fine avenue of trees and a walk on one side, and on the other a spacious basin of water with magnificent buildings, is peculiarly agreeable. Among the most remarkable public buildings may be reckoned the royal palace, the exterior of which is by no means beautiful, with a large garden; the former residence of the Stadtholder, beautified by Louis Bonaparte, in which the two chambers of the States-General now hold their sittings, and in which there are many public offices; the palaces of the Prince of Orange and Prince Frederick; the Buitenhof, which contains a gallery of pictures; the town-hall, with very fine paintings; the cannon-foundry, erected in 1668; the theatres, and the state-prison. Among the churches are three Dutch Reformed, and the French church, formerly Reformed, now Roman Catholic. The Portuguese and German Jews have large synagogues, and the Lutherans, Presbyterians, Remonstrants, and Jansenists have chapels. There are likewise numerous charitable and scientific institutions, and fine private collections. On one side of the town there is a canal constantly covered with vessels, and on the other a fine wood of oaks called the Bosch, in which is the country-palace of the royal family, resembling a gentleman's country-seat, but with a fine collection of pictures, and extensive gardens laid out in a less stiff and formal manner than the usual Dutch style. There are numerous elegant villas in the environs, and on the west of the town is Scheveling, or Scheveningen, a neat fishing-village, containing about 700 houses, and which has become, especially of late years, much frequented for its sea-bathing. Between that and the Hague is a fine avenue of oaks, beeches, and limes.

The Hague seems to have owed its origin to a hunting-seat of the counts of Holland in the wood (Haag), which however so early as 1250 became a palace, round which many other houses were soon erected. In the sixteenth century the Hague became the residence of the States-General of the States of Holland, the Stadtholder, and the foreign ambassadors. In the course of the seventeenth century it was gradually enlarged, and at the commencement of the eighteenth was the centre of the most important diplomatic negotiations. [Anne, Queen of England; George I.] The prosperity of the Hague was very materially injured by the Revolution in 1795, and afterwards by the government of Louis Bonaparte, who removed the great public offices, &c., to Utrecht and Amsterdam: the return of the Prince of Orange in 1813, who was most enthusiastically welcomed by the inhabitants, restored it to its former splendour. The population, which had greatly decreased, has since gradually recovered. In 1817 there were 42,000 inhabitants, and in 1837, 54,000. The Hague never having been either a commercial or a manufacturing town, the inhabitants have not the mercantile habits of the generality of their countrymen. (N. G. Van Kampen, *Staat-en aardrijkskundige Beschrijving van het Koningrijk der Nederlanden*; Stein, *Handbuch*.)

HAILES, LORD. [Dalrymple.]

HAINAN, an island situated in the Chinese Sea, opposite the southern extremity of the province of Quan-tong, or Canton, to which it is annexed, and from which it is divided by the channel of the Junks, a straight only 15 or 16 miles wide. It lies between 18° 10′ and 20° 24′ N. lat., and 108° 50′ and 111° E. long., and encloses the gulf of Tonquin on the east. Its length from south-west to north-east may be about 200 miles, and its average breadth perhaps not less than 100 miles; its surface may cover an area of 20,000 square miles, or nearly the double of Sicily.

The interior of the island is occupied by an extensive mountain-mass, called Ta Utshi Shan, or the Great Utshi range: from this there issue a great number of offsets, which towards the south-west and north-east advance close to the sea, but are separated from the south-eastern and north-western shore by a level tract of considerable width. These plains, which are of great fertility and well cultivated, yield annually two or three crops of rice and other grains. the small rivers which descend from the mountain-region are used for irrigating this tract. Sweet potatoes form the principal food of the people, though they cultivate fruits, sugar-cane, tobacco, indigo, and cotton on a large scale. But the extensive forests which cover the sides of the mountains form the principal wealth of the island. Besides different kinds of timber-trees, these forests produce sandal-wood, brasiletto, ebony, rosewood, and many other kinds, which are used as dye-woods, or for furniture. Wax is gathered in large quantities. An insect called Pelatshhung produces a white wax, from which candles are made at Khiung-tsheou, and exported to other parts of China. The climate of the island is not very hot, being exposed to the wind which blows over a large expanse of sea: fogs and heavy dews are frequent, and maintain a vigorous vegetation. The coast is frequently laid waste by hurricanes, which are peculiar to the ocean that surrounds the island.

According to the census of 1823 Hainan was inhabited by 987,725 persons, subject to the Chinese government; but the higher parts of the mountains are possessed by aboriginal tribes, which are still independent, and called Li. Those which are subject to China resemble the Chinese in figure, and have adopted their usages, but they speak a different language, though they use the Chinese characters. They are very industrious husbandmen. There are some very populous towns in this island. Khiung-tsheou, the capital, situated at its northern extremity on the channel of the Junks, is said to have 200,000 inhabitants; and Kai Kheou-so, where the governor resides, is said to contain as many. Some others have 80,000 or 90,000 inhabitants each. (Du Halde, *History of China*; Klaproth's *Description de l'Isle de Hainan*, in 'Nouv. Ann. des Voy.,' vol. vi.; and Captain Purefoy's *Diary of a Journey to the Coast of Hainan*, in 'Asiat. Journ.,' vol. xx.)

HAINAULT (in Flemish, Henegouwen), a province of Belgium, bounded on the north by East Flanders and South Brabant; on the east by Namur, on the south by France, and on the west by West Flanders. Hainault lies between 49° 58′ and 50° 48′ N. lat., and between 3° 17′ and 4° 33′ E. long.; its greatest length from south-east to north-west is about 55 miles, and its breadth 30 miles. Its area is 372,193 bonniers, equal to 1438 square miles (English), thus divided:—

Cultivated	295,178	bonniers.
Uncultivated	2,071	„
Woods	61,832	„
Towns and Buildings	3,659	„
Rivers and Canals	1,165	„
Roads and Paths	8,288	„
Total	372,193	bonniers.

The province does not contain any mountains, but is hilly towards the south and east. It is watered by the Schelde, the Sambre, the Dender, the Haine, from which the province derives its name, the Trouille, and the Senne. The Schelde enters the province from France, near to its confluence with the Scarpe at Condé, and flows to the north-north-west to Tournay; then changing its course to north-north-east, it forms the boundary-line between Hainault and West Flanders, and quits the province at Escancffles, its north-western extremity. The Sambre also enters the province from France, near Maubeuge, flows north-west to Charleroy, and soon after enters Namur. The Dender rises within the province at Herchies, flows north-east to Ath, and then north-north-west, quitting Hainault at Grammont. The Haine is formed by three brooks which rise in the commune of Anderlues, a little to the west of Charleroy; it flows from east to west, near to Mons, and falls into the Schelde at Condé. The Trouille rises at Grandreng, near the frontier, and flows from east to west; it enters France, but leaves it again almost immediately, flows then north-north-west to Mons, and falls into the Haine near Jemappes.

The soil of the province is for the most part fertile. The arrondissement of Tournay is the most productive, and that of Charleroy the least so. The chief agricultural productions are wheat, rye, oats, winter barley, potatoes, beans, rape, flax, and hops: tobacco and chiccory are cultivated in some parts. Much of the land near the rivers, where irrigation can be practised, is natural meadow. In othor places trefoil, lucern, and sainfoin are cultivated.

Hainault is divided into three arrondissemens, Mons, Tournay, and Charleroy; and contains 21 towns and 424 communes. The towns are Antoing, Ath, Beaumont, Binch, Braine-le-Compte, Charleroy, Châtelet, Chièvres, Chimay, Enghien, Fontaine l'Evêque, Gosselies, Lessines, Leuze, Mons, the capital of the province, Péruwelz, Rœulx, St. Ghislain, Soignies, Thuin, and Tournay. [Ath; Beau-

MONT; BINCH; CHARLEROY; MONS; TOURNAY.] Antoing is a small town, with 1922 inhabitants, on the right bank of the Schelde, and on the high road from Mons to Tournay, about 4 miles south-east from Tournay. Some limestone quarries and some large breweries are situated there. Braine-le-Compte, about 4 miles north-east from Soignies, contains 4218 inhabitants; it stands on the high road from Brussels to Mons. This town contains some cotton-mills, breweries, dye-houses, tanneries, and oil-mills. Châtelet is a small town, about 4 miles east from Charleroy, with 2555 inhabitants. Cotton and woollen manufactures, pottery, salt-refining, brewing, and tanning are carried on in this town. Chièvres, a small town with 3055 inhabitants, stands 2½ miles north-north-west from Ath. Flax-spinning and linen-weaving occupy a great number of hands, and there are in the town several breweries and oil-mills. Chimay has 3300 inhabitants: it stands 28 miles south of Charleroy, and 32 miles south-south-east from Mons; it contains a college and four schools. A great part of the working-class in this town are employed either in the iron-works or in procuring fuel for their use: the proximity of the place to the French frontier causes a brisk contraband trade to be carried on. Enghien, 12 miles east-north-east from Ath, and 8 miles north from Soignies, contains 3739 inhabitants. The town is built on the side of a hill; it is regularly laid out and well built: it contains a college, four schools, and a hospital. The castle and park of Enghien were built and formed in 1712, by Duke Leopold of Aremberg. The cattle was destroyed at the close of last century: the park, which was laid out with much taste and embellished with groups of statuary, is said to have served as the model for the gardens at Versailles. Fontaine l'Evêque, 6 miles east from Charleroy and 16 miles east from Mons, contains 2825 inhabitants. Nail-making is the chief branch of industry carried on in this town. Gosselies, a town with 4240 inhabitants, is about 3 miles north from Charleroy: great part of the malo inhabitants are employed in the coal-mines; nail-making, salt-refining, and glass-blowing are also carried on. Lessines, a small town with 4592 inhabitants, is 7½ miles north of Ath; it is so surrounded by the Dender as almost to form an island. This is a place of much trade. The quarries furnish large quantities of paving-stones, and likewise some stone for building. The other chief branches of traffic are coal, wood, and vegetable oil. Leuze has 5386 inhabitants, many of whom are employed in the cotton and woollen manufactures. A considerable number of persons are also employed in preparing mercery and small wares. The town is 10 miles east from Tournay; the high road from Brussels to Lille passes through it. Péruwelz, on the road between Valenciennes and Ghent, about 11 miles south-east from Tournay, is a town of 6958 inhabitants, who are principally occupied in manufacturing hosiery goods, cotton and woollen cloths, and leather. A considerable trade was formerly carried on in the article of alum, prepared from aluminous schistus found on the spot; but since the discovery of the method of chemically composing this salt from its components by a cheap and easy process, this branch of industry has ceased at Péruwelz. Rœulx is a small town containing 2450 inhabitants, situated 8 miles north-east from Mons. The castle of Rœulx is a very antient building, the principal façade of which was rebuilt in 1760 in a very handsome style; the gardens and grounds are extensive, and laid out in the English style. There are not any manufactures and but little trade is carried on in this town. Saint Ghislain, 7 miles west from Mons, is a small town built on the river Haino, and containing 1573 inhabitants. Standing in the middle of the coal district, various manufactures which depend for their prosecution upon an abundauce of cheap fuel have been established; among these may be mentioned salt-refining, soap-boiling, and brewing. The town stands on the high road from Mons to Tournay. Soignies, a well-built town on the Senne, is situated 10 miles north-north-east from Mons, and contains 6313 inhabitants. Many of the houses are largo and handsome. The town is surrounded by ramparts, which were formed in 1150, and are now crumbling through age. The church of St. Vincent is said to be the oldest building in the province. There is a college within the town, which in 1827 contained above 280 students. There are many religious and charitable establishments in Soignies, and it is said that 2200 of the inhabitants are regular pensioners; altogether two-thirds of the population are in an indigent condition. The chief means of employment is afforded by some limestone quarries, whence considerable supplies of building-stone are procured. Thuin, on the Sambre, is 10 miles south-west from Charleroy, and contains 3686 inhabitants. An iron-work established at this place produces 1100 tons per annum: there is but little other trade. Boussu, 7 miles west from Mons, stands on the Haine. This is a considerable village, containing a church, a chapel, two schools, and 500 houses. The population in 1829 was 2887, many of whom are employed in raising coal or burning lime. Courcilles, 5 miles north-west from Charleroy, contains 3226 inhabitants, whose principal employments are nail-making and weaving napkins and tablecloths. Dour, a large bourg, 8 miles south-west from Mons, has a population of 5484 inhabitants, many of whom find employment in the productive coal-mines of the district. there are also ropewalks, tan-yards, lime-kilns, and a manufactory of safety-lamps. Fontenoy, an inconsiderable village, containing 678 inhabitants, is 4 miles south-east of Tournay, on the high road from that town to Mons. A battle was fought near Fonteuoy in May, 1745, between the French under Marshal Saxe and the allies under the duke of Cumberland, in which the latter were defeated with the loss of 15,000 men. Hornu, a village 5 miles west from Mons, is the seat of considerable coal-mines, giving employment to from 1500 to 1800 men. The village is chiefly composed of the cottages of the miners, which are built on a regular plan, and so arranged that the steam-engine which discharges water from the mines is also employed to distribute both warm and cold water to each habitation. There are likewise warm and cold baths, two large squares for promenading and public games, and a dancing-room for the use of the workmen, all established by the proprietor of the mines, who likewise supports a school for 400 children and a library. There are employed in these works 12 steam-engines, whose united power is equal to that of 320 horses. The village of Jemappes, on the high road from Mons to Valenciennes, about 3 miles from Mons, with a population of 4667, is also the site of considerable coal-mines. This place is celebrated for the victory gained on 5th November, 1792, by the French over the Austrians, and which led the way to the conquest of Belgium. Jumetz, to the left of the high road from Charleroy to Brussels, contains 6528 inhabitants, many of whom are engaged in prosecuting various manufactures, among which glass-blowing, brewing, distilling, and tanning are the most considerable; severa. are also employed in coal-mining.

The number of persons accused and convicted before the courts of assize and the correctional tribunals in this province, during each of the four years from 1831 to 1834, was, according to official returns, as follows:—

	Courts of Assize.		Correctional Tribunals.	
	Accused.	Convicted.	Accused.	Convicted.
1831 . .	95	48	1,936	1,366
1832 . .	35	13	2,488	1,876
1833 . .	21	19	2,526	1,851
1834 . .	116	12	3,031	2,211

The great difference in the number accused before the courts of assize in these years arose from 48 persons in 1831 and 77 persons in 1834 having been concerned in riots, the greater part of whom were acquitted. The only capital conviction occurred in 1834, when one man was found guilty of murder. In proportion to its population, Hainault presented in the above years fewer delinquents than any other province of the kingdom; and it is deserving of remark, that, with the exception of Luxembourg and Namur, the proportion of students is greater also. In 1831 there were 888 schools, giving instruction to 35,671 boys and 29,048 girls, being very nearly 1 in 9 of the whole population. [BELGIUM.]

HAINAULT SCYTHE AND HOOK. [FLANDERS AGRICULTURE.]

HAIR. The hairy coverings of mammalia are composed of long delicate processes of a horny substance, which grow from bulbs situated in or beneath the skin. Each hair is contained at its lower part in a delicate sheath, or follicle, which passes obliquely from the surface of the skin on which it opens to a greater or less depth, and at its base dilates into a pouch containing the bulb of the hair. The bulb of the hair consists of a small cone-shaped body, the pulp. soft and delicate, and apparently made up of blood-vessels and nerves, and covered by a reflection of the smooth lining of the sheath of the hair, which is continued from the cuticle covering the surrounding skin. On the whole surface of this bulb the substance of the hair is secreted, and as each layer which is deposited pushes that previously formed onwards, the whole gradually advances along the sheath till it projects beyond the skin, and thence continues to grow free. In the early embryo the sheath or follicle in which the hair is afterwards formed is alone seen, then a delicate vessel may be traced to its base, where a little black spot is soon formed, and this, as all the other parts increase, is gradually developed into a hair. Into each hair-follicle, as Gurlt has shown, there open the ducts of one or two little glands, by which the oily matter is secreted to lubricate the hair and keep it supple and firm, and where these are deficient the same purpose seems to be performed by the follicle itself. The annexed cut will explain the general mode of formation of hairs, which, it may be observed, is effected in the same manner as that of horn, nail, and many other extra-vascular appendages of animal bodies, viz. by the deposition of successive layers of organic matter on the surface of an abundantly vascular tissue. *Fig.* 1 represents an oblique section of the pulp and lower part of the whisker of a lion, in the Hunterian Museum, in which *a* is the body of the hair, *b* the conical pulp, and *c* a blood-vessel passing into and ramifying in it. *Fig.* 2 is a section of the skin of the upper lip of a lion, with part of a whisker completely formed, and another in progress of growth, from the same collection; *a* is the outer part of the hair-follicle, formed by a deep depression in the skin; *b* is its internal cuticular lining; *c* the contained hair; *d* the sheath containing the vessels and nerves, passing to the base of the follicle and bulb of the hair. *Fig.* 3 is a section of the skin, containing a hair from the human scalp, from the figure by Gurlt, in Müller's 'Archiv für 1835:' here *a* is the thin cuticle, *b* the cutis, *c* the subjacent fat, *d* the cellular tissue, in which the base of the hair follicle *e* is seen; *f* is the hair itself, enlarged at its base, and *g g* are the two sebaceous glands opening into the sheath. These views are of course all much magnified; indeed in man the component structures are so minute that part of the description is of necessity taken from the analogous structures in other animals.

Fig. 1.

Fig. 3.

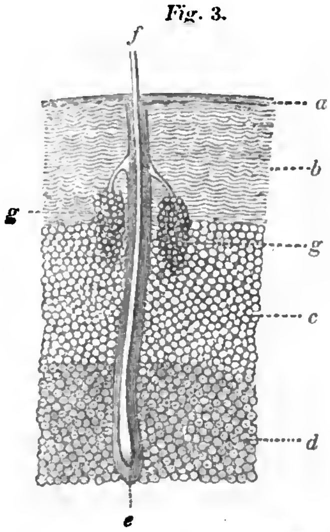
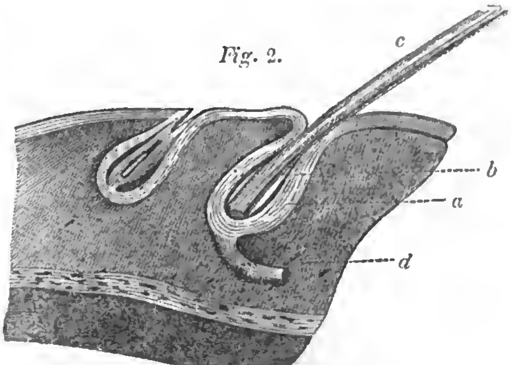


Fig. 2.



In man the hairs are not, as has been generally supposed, perfectly cylindrical. Weber has shown that they are all more or less flattened, so that a transverse section presents an elliptical form, or sometimes, from one side being grooved, has the shape of a bean. The hair of the whiskers, beard, and mustachios, and in general all short curly hair, is most flattened. In most instances flatness and curliness are directly proportionate, and both attain their maximum in the crisp woolly hairs of the negro, which are sometimes as much as two-thirds broader in one direction than in the other. The hair of the negro however, though called woolly, differs considerably from the wool, properly so named, of sheep and other animals: the latter is not spirally curled, but wavy, all its curves being nearly in the same plane; it is much more delicate, and perfectly round, and hence, from its being equally fitted to curl in any direction, is peculiarly adapted for spinning, while the flattened hairs of men have always a tendency to turn their broadest surfaces towards the middle of the curl.

Except at their base, into which the conical pulp enters to a variable distance, the hairs are perfectly solid, and in most animals their substance is similar throughout. Weber has shown that the appearance of a central canal running along them, and of a softer internal than external material, has resulted from microscopic errors, occasioned by the unequal refraction of light passing through their rounded or grooved surfaces. Only in the lion, zebra, and llama did Weber find that the internal part seemed rather paler than the outer; in the roebuck and a few other animals he found the cellular structure which has been sometimes erroneously supposed to exist in all hair. The cells are all hexagonal, much like those in the cellular tissue of plants. The average diameters of hairs from the human head are respectively about $\frac{1}{300}$th and $\frac{1}{500}$th of an inch, and hairs often attain a length of 6 or 7 feet in women. Instances are recorded also of the hair of the beard growing to a length of nine feet. They are generally of the same thickness throughout their whole length in man, but in the finer kinds of wool they are of unequal size at different parts. This seems to indicate an occasional alteration in the size or activity of the pulp, a supposition which is further supported by the varieties of colour which the same hair sometimes presents, as in those animals which seem to have grey furs, but in which each hair is made up of alternate bands of black and white. In man however nothing of this kind occurs; the colour of each hair is uniform, the appearance of greyness being produced by a mixture of completely white with dark hairs. The colour of the human hair generally varies with the colour of the iris and the general dark or light hue of the skin. Commonly the darker the hair, the more robust the body, and the coarser the skin and other tissues; and this holds still more with animals than in man, for not only are white or grey horses less healthy and vigorous than dark ones, but if one or two of a dark horse's legs be white, they are always most liable to injury and to disease.

Hairs are very elastic; they admit of being stretched nearly one-third of their length, and regain their original length almost completely: in proportion to their size, they are very tough and firm. In masses they are impenetrable, except to very great violence, and hence one of their uses in the thick coverings of animals: they are also adopted in armour, as for the coverings of helmets. They are extremely bad conductors of heat, and they are generally found most thick and abundant in animals subject to long exposure to cold, in whom moreover an additionally thick coat is provided at each winter after the annual shedding. They are non-conductors of electricity, and when rubbed with almost any other substance so large a quantity of negative electricity is developed, that in the dark even sparks may be seen, and the peculiar crepitating sound of rapid little electrical discharges may be heard. This is especially the case with the drier hairs of cats, dogs, &c., but weaker electrical phenomena may be observed by rubbing the human scalp. Hair is also remarkably hygrometric, attracting and retaining in its tissue a large quantity of moisture, in consequence of which it becomes flaccid and lengthens, and hence it is used in the construction of the more common hygrometers. It assists also to shield the skin from moisture by its oily surface, and when thick presents almost an impenetrable barrier to water. Thus serving to isolate the animal from the three most powerful external agents, heat, electricity, and moisture, it is scarcely possible to imagine any structure better adapted for the external covering of the wholo body, whose motions it is too light to impede, and to whose beauty it so remarkably contributes.

In chemical properties hair resembles horn, nails, &c. It is soluble in water at a very high temperature, as in a Papin's digester, leaving a large quantity of oil mixed with sulphuret of iron, and some sulphuretted hydrogen. It is this oil, with the sulphuret of iron, which gives the colour to the hair, and by whose absorption greyness is produced. The iron is most abundant in the darkest hair, and the sulphur is the ingredient on which the action of the various black dyes for red or grey hair depends. These are all composed of some salt of silver or lead, which, mixed with some oily or fatty substance in the form of pomatum, insinuates itself into tho hair, where it is decomposed and a black sulphuret of silver or lead is formed. Hair is soluble in alkalis and alkaline earths, and for this reason the depilatories in common use are chiefly composed of quiok-lime, which however is materially injurious to the skin at the samo time that it removes the hair. Hair contains a vory small quantity of water, and when burnt leaves a large proportion of ashes, containing iron, manganese, and various salts of lime; it is owing to these properties that hair is peculiarly indestructible, and has been found unaltered on mummies more than twenty centuries old. It has even been supposed to grow after death, but it is probable that, in the few authentic cases in which this is stated, it was owing to the lengthening of the hair by the attraction of moisture from the body or surrounding atmosphere, and to the more rapid drying and contraction of the adjacent tissues.

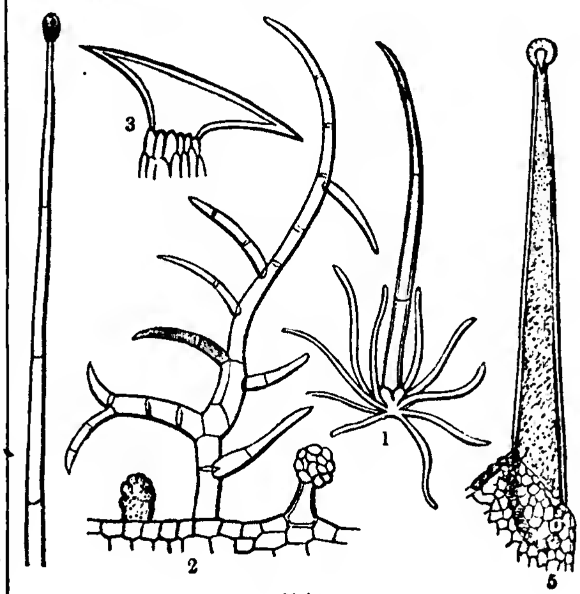
Little need be said of the diseases of hairs. Possessing neither vessels nor nerves, except at their base, they are rarely altered except by the diseases of the skin itself. Their fall, as it is called, is in most animals annual, but in man seems not to occur except by accident, or after particular diseases. The process by which it takes place is unknown, but is probably similar to that of the shooting of the quills of the porcupine, by the gradual approximation of tho base of the follicle to the surface. Their loss of colour, which is sometimes exceedingly rapid, is owing to deficient secretion of the colouring oil, and can only very rarely be remedied. When sufficient moisture is not supplied, they sometimes split at their points like bristles; at others they break at the middle of the shaft, snapping off, and leaving a little fringed extremity to the stump. The most singular alteration however to which they are subject is that called the plica polonica, from its occurring almost exclusively in some towns in Poland, in which, with so much general disease as sometimes proves fatal, the hair of the head becomes sticky and matted together, when touched gives extreme pain, and is sometimes said even to bleed when cut. This fact cannot however be regarded as evidence of the hair naturally containing vessels, though it indicates an elongation of the pulp to some distance beyond the skin, just as is the case in dogs, whose whiskers will sometimes bleed if cut very close to the surface.

(Weber, in Hildebrandt's *Anatomie*, vol. 1; Gurlt, in Müller's *Archiv für Anatomie und Physiologie*, 1835.)

HAIRS. In plants these are long expansions of the cuticle, chiefly intended to answer the double purpose of collecting moisture from the atmosphere and of protecting the surface of a plant from the too powerful influence of the sun's rays. It is supposed that they are also destined to assist in the conveyance of certain kinds of seeds through the air, and in other cases, as in that of cotton, they are specially adapted for the use of man. That the two first purposes are those for which hairs growing on the surface of plants are intended, seems sufficiently indicated by tho following facts. Hairs are seldom found on water-plants, which have no occasion for absorbing organs, and when water-plants are accidentally obliged to grow in dry places they acquire them; while on the other hand species naturally found in hot dry places or in arid climates are as usually provided with them, unless in those cases where the cuticle becomes excessively thickened. If a hairy-leaved plant is observed in dry weather it will be found that all its hairs are weak and flaccid; but no sooner does a shower of rain fall, or the atmosphere become humid, than the hairs acquire a rigid consistence.

In all cases hairs are composed of lengthened cells of cellular tissue, extending from one or more of the cells of the cuticle. Most commonly they are quite simple, and are merely formed of several cells of equally diminishing size, placed end to end, or of a single cell. Of the latter kind are the long entangled hairs that clothe the surface of the cotton-seed, and which are manufactured into thread and linen. Sometimes several such hairs spring from a common point as in Malvaceous and Euphorbiaceous plants, and Marrubium creticum (*fig.* 1); these are technically called *stellate*. Others branch in various ways, as in Nicandra anomala (*fig.* 2), and from such the woolly appearance of the surface of plants often takes its origin. It somotimes happons that the cell, out of which a hair is formed, instead of growing perpendicular to the surface, lengthens in a parallel direction, growing at two opposite sides; cases of this sort are found commonly in Malpighiaceous plants, and in the common hop (*fig.* 3). Finally, in those instances where the the terminal cell enlarges and is furnished with an aperture, hairs becomo glands, and consequently secreting organs (*figs.* 4 and 5).

In consequence of the hairs of plants being an extension of cellular tissue, which is naturally thin-sided, all hairs are much weaker than the tough thick-sided tubes of which woody tissue is composed. This accounts for the well known fact that all goods manufactured from cotton, which is vegetable, are far less tough and durable than those which, like linen, are prepared from the tissue of bark or wood. When the two forms of matter are submitted to microscopical examination, the thin sides and transverse partitions of the former will usually distinguish it from the thick-sided tubes of the latter, in which no partitions are discoverable.



Hairs.

HAJE, a name of a venomous serpent, *Coluber Haje* of Linnæus. [NAIA.]

HAKE, a fish allied to the cod. [MERLUCIUS.]

HAKLUYT, RICHARD, born in 1553, studied at Christ Church, Oxford, and applied himself particularly to the study of geography, or cosmography, as it was then called, and he was made a lecturer on that subject at Oxford. In order to promoto the study of his favourite scienco he published narratives of several voyages and travels, both English and foreign, which ho afterwards brought together in his great collection. About 1584 he went to Paris with Sir Edward Stafford, ambassador of Queen Elizabeth to the French court, where he remained five years. On his return to England he was made by Sir Walter Raleigh a member of the company of gentlemen adventurers and merchants of London, for the inhabiting and planting 'of our people in Virginia,' as appears from his 'Collection of Travels,' edition of 1589, p. 815, which he published in one vol. fol., and which he afterwards enlarged and published in 3 vols. fol., 1599—1600, under the title, 'The Principal Navigations and Discoveries of the English Nation, by Sea or over Land, to the remote and farthest distant quarters of the Earth, at any time within the compass of these 1500 years.' Tho first volume embraces the discoveries by tho English in the north and north-east by sea, towards Lapland, the Straits of Waigatz, Nova Zembla, and towards the mouth of the river Oby, and also travels through the empire of Russia, Georgia, Armenia, Bactria, Tartary, &c. The second volume contains accounts of the discoveries of the English by sea and land in the southern and south-eastern parts of the globe; and the third, their discoveries in the new world of America. Hakluyt has inserted many curious documents, such as letters of various sovereigns; charters and privileges granted by the Czars of Russia, the Sultan, and others, to English merchants; tables of weights, coins, and distances of different countries, &c. Most of the voyages and discoveries contained in this collection were effected in the sixteenth century, although a few are of a prior date. A new and improved edition, in 5 vols. 4to., was published in London 1809-12. Hakluyt published also or edited translations of several foreign narratives of travellers, of which a selection has been since made: 'A Selection of curious, rare, and early voyages and histories of interesting discoveries, chiefly published by Hakluyt, or at his suggestion, but not included in his celebrated compilation,' 4to., London, 1812. It contains among others La Brocquière's 'French Narrative of a Visit to Palestine,' in 1442-3; the 'Travels of Louis Vertomanus of Romo to Arabia, Persia, and the East Indies in 1502;' and 'Virginia richly valued by the description of the mainland of Florida, her next neighbour,' from the Spanish of Fernando de Soto. Hakluyt died in 1616 and was buried in Westminster Abbey.

HALBERSTADT, an antient bishopric, founded in the year 804, was secularised by the treaty of Westphalia in 1648, and assigned, under the name of a principality, to Frederick, the great elector of Brandenburg, as a compensation for hither Pomerania, which he was obliged to cede to Sweden. It has ever since belonged to Prussia, except that after the treaty of Tilsit it formed part of the ephemeral kingdom of Westphalia. The principality had a superficial extent of about 600 square miles, with 13 large and small towns, 431 villages, and about 135,000 inhabitants, chiefly Lutherans. It is a level and fertile country. The four circles of the principality now form part of the government of Magdeburg, in the province of Saxony, and the name of Halberstadt is confined to one of those circles, about 50 square miles in extent, with 20,000 inhabitants.

HALBERSTADT, the chief town of the circle, is pleasantly situated on the river Holzemme. It is an antient city, said to have been founded by the Cherusci; though the actual date of its foundation is unknown. It became a bishop's see in 804. The most antient part is the Dom Platz (Cathedral Square), formerly a castle. In 1179 the greater part of the town was burnt by Henry the Lion; it was rebuilt in 1203 and surrounded with ramparts. In the Thirty Years' War it made a brave resistance; in the Seven Years' War the French destroyed the gates and a large portion of the ramparts. In 1809 Duke William of Brunswick-Oels stormed the city and made prisoners of the whole Westphalian garrison under Count Wellingerode. In 1813 the Westphalian General Ochs, who was posted here with 20,000 men and 14 pieces of cannon, was suddenly attacked by the Russian General Czernitscheff, who took 1000 of his men and many officers prisoners. The streets of Halberstadt are for the most part long, broad, and tolerably straight. It has many good manufactures of various kinds, and a considerable trade. It is the seat of a high court of justice, and has many public institutions worthy of notice, such as tho cathedral school, with a library of 8000 volumes, a cabinet of natural history, and a collection of instruments; a gymnasium, a seminary for schoolmasters, a literary society, several charitable foundations, &c. There are 7 Lutheran churches, 2 Reformed, or Calvinist, 3 Roman Catholic churches, and a Jewish synagogue which is perhaps the handsomest in Germany. The most remarkablo of the churches are St. Mary's Church, which was completed in 1003, and the cathedral dedicated to St. Stephen, built in the noblest style of the fifteenth century—it is 412 feet long, 72 wide, and 94 high inside, and has 32 altars. The cathedral contains several valuable pictures as well as interesting antiquities and some paintings on glass. The number of the inhabitants is now about 17,000, of whom 1300 or 1400 are Roman Catholics, 450 Calvinists, and as many Jews. About half a mile from the city is the Spiegelsberg, formerly a barren hill, which Baron von Spiegel, dean of the chapter, converted into a public promenade, or what the Germans call an English garden, and left a fund to keep it in order. Halberstadt is in 51° 53′ 55″ N. lat., and 11° 3′ 53″ E. long. (*Top. Stat. Handbuch*, Von Furst; Stein, *Handbuch*; Huber, *Lexicon*.)

HALCYO'NIDÆ. [KINGFISHERS.]

HALDE, DU, born at Paris in 1674, entered the society of the Jesuits, and being distinguished for his information and laboriousness, he was entrusted by his superiors with the care of collecting and arranging the numerous letters written by the missionaries of the society from various parts of the world. This employment furnished him with materials for the collection styled 'Lettres Edifiantes et Curieuses,' which he edited, and which contain much interesting and valuable matter. He also compiled from the reports of the Jesuit missionaries and their translations of Chinese works, a full and well digested description of that empire, which was the first published in Europe: 'Description Historique, Géographique et Physique, de l'Empire de la Chine et de la Tartarie Chinoise,' 4 vols. fol., with an atlas, Paris, 1735, reprinted soon after at the Hague, in 4 vols. 4to., and translated into English by R. Brookes, 4 vols. 8vo., London, 1736. Du Halde made a conscientious use of the best materials which he could get at the time from his brethren of the Chineso missions, and his authorities must answer for the charge brought by some against his work, that it is too favourable to the Chinese and their social system, and that he is too credulous as to the accounts of the Chinese concerning the prodigious amount of their population, the size of their towns, &c. Subsequent writers, chiefly Jesuits, have increased and improved our stock of information concerning China. [AMIOT, LE PERE.] A clever, though sarcastical and somewhat desultory notice of Du Halde's work appeared in England not long after its publication, under the title, 'An Irregular Dissertation occasioned by reading Father Du Halde's Description of China,' London, 1740.

Du Halde was at one time secretary to Father le Tellier, confessor of Louis XIV. He died at Paris in 1743.

HALE, SIR MATTHEW, was born on the 1st of November, 1609, at Alderley, in the county of Gloucester His father had been educated for the bar, but he abandoned the practice of the law because he could not understand the reason of giving color in pleading, which, as he thought, was to tell a lie. Both his parents having died while he was yet an infant, Matthew Hale was educated, under the directions of a near relation on his mother's side, by a clergyman professing puritanical principles. At the age of seventeen he was removed to Magdalen Hall, Oxford, where he speedily got rid of his puritanical notions, and plunged into dissipation with a looseness proportioned to his former austerity. At this period he was upon the point of becoming a soldier in the army of the Prince of Orange, then engaged in the Low Countries. Accidental circumstances however introduced him to the notice of Serjeant Glanvil, who, perceiving the valuable qualities which the young man possessed, persuaded him to apply himself to the study of the law. Acting under this advice he was admitted a student of Lincoln's Inn on the 8th of November, 1629, and immediately commenced a course of arduous study. One of his companions in a debauch having been taken suddenly and dangerously ill, Hale was so struck with remorse that he gave up his intemperate habits. After having studied with great diligence the laws of England and the civil law, and also several other branches of learning, he was called to the bar some time previous to the commencement of the civil war. He resolved not to take any part in the political dissensions and contests which then agitated the country, and he steadily kept his resolution. This part of his conduct is mentioned by some of his biographers with commendation, whereas in reality it arose from a weakness in his character which showed itself on several subsequent occasions. Indeed he seems to have been aware at a later period of his life that it is not the part of a good citizen during times of political agitation, when the liberties of his country are at stake, to prefer his own individual ease and quiet to the general good. His neutrality was highly favourable to his interest as an advocate; he was engaged as counsel for the court party in a number of the most important stato trials, and was notwithstanding held in such esteem by the parliamentary party, that he was constituted counsel to the commissioners deputed by parliament to treat with the royal commissioners as to the reduction of Oxford. After the execution of Charles I., Hale took tho engagement to be true and faithful to the Commonwealth, and accepted the appointment of one of the commissioners for reforming the law. In 1653, after having shown some hesitation as to accepting the dignity, he was made one of the judges of the Common Bench; resolving, after discussing his doubts with lawyers and divines, 'that as it was absolutely necessary to have justice and property kept up at all times, it was no sin to accept a commission from usurpers.' To this his biographer Burnet goes on to add, 'if he made no declaration acknowledging their authority, which he never did.' This addition has given rise to much of tho odium which has attached to Hale's memory in consequence of this apparent insincerity; but credit can hardly be given to the statement, for it is impossible to suppose that Hale, who was unquestionably an honest and sincere man, though perhaps weak in matters of conscience, could have been guilty of the pitiful and shallow attempt to evade the evident conclusion, that acting as a judge under his commission was the most effectual and formal declaration he could make of his submission to Cromwell's authority. Some colour however is given to Burnet's imputation by Hale's subsequent conduct. After having discharged the duties of his office with consummate skill and strict impartiality, he suddenly, and without any apparent cause, affected to feel scruples of conscience at acting as judge in criminal cases, and refused to preside in the crown courts, though he still continued to administer the law in civil cases. This conduct was directly contrary to his reason for accepting the office of judge, and appears to be founded on no just view. On the death of Cromwell, Hale refused to act under a commission from tho Protector Richard, alleging that he could no longer sit under such authority. He was a member of the parliament which recalled Charles II., and was made chief baron of the exchequer in 1660, and knighted. In 1671 he was raised to the chief-justiceship of the King's Bench, where he presided with honour to himself and advantage to the public till 1675, when, from the state of his health, he resigned his office. He suffered considerably from repeated attacks of asthma, and died from dropsy on Christmas-day, 1676.

As a lawyer Hale's reputation is high, and his integrity is unimpeached: indeed his punctilious feelings were carried to a fantastical excess, as many anecdotes related by his different biographers show.

The only spot upon his memory as a criminal judge is the notorious fact of his having condemned two wretched women for witchcraft, at the assizes at Bury St. Edmunds, in the year 1665. Hale in the course of the trial avowed himself a believer in witchcraft, and the jury found the prisoners guilty, notwithstanding many impartial bystanders declared that they disbelieved the charge. No reprieve was granted, and tho prisoners were executed. An anecdote is mentioned by his biographers of having hastened the execution of a soldier found guilty of murder, for fear he should be reprieved; but in so doing he certainly overstepped the bounds of his duty as a judge.

Sir Mathew Hale was a voluminous writer, though none of his productions were printed during his life. His 'Pleas of the Crown,' 'History of the Common Law,' and some other treatises connected with the law, have been published since his death, and also several others upon scientific and religious subjects. His manuscripts, which he had collected at a very considerable expense, he bequeathed to the Society of Lincoln's Inn, and he directed that they should not be lent out or printed, saying, 'As they are a treasure not fit for every man's view, nor is every man capable of making use of them, I would have nothing of these books printed;' and he also directed that any of his posterity, members of that society, might, on giving security, have ono book at a time lent out to them by the society.

A catalogue of the manuscripts was contained in his will, and a full account and catalogue of all his works is printed in Dr. Williams's 'Life of Hale'—recently published. His life has also been written by Burnet and Roscoe, and many anecdotes relating to him are detailed by that amusing gossip Roger North, in his 'Life of Lord-Keeper Guilford,' though it should be observed that the author does not write in a very friendly spirit towards Hale. Notices of his life will also be found in the 4th vol. of tho *Biog. Brit.*

Sir Matthew Hale was twice married: first to Ann, daughter of Sir Henry Moore, by whom he had ten children; and secondly, late in life, to one of his own domestic servants.

HALEB (commonly but erroneously called ALEPPO), the capital of a pashalik of Asiatic Turkey of the same name, is situated in tho north part of Syria, in 36° 11′ 32″ N. lat. (according to Niebuhr), and 37° 9′ E. long. It is one of the largest and most important towns in Western Asia. Tavernier, in 1670, estimated the population at 258,000; D'Arvieux, in 1683, at about 258,000; Russell, in the last century, at 235,000, of which 200,000 were Mohammedans, 30,000 Christians, and 5,000 Jews; Volney reduces the number to 100,000; but Rousseau, who lived for some time at Haleb as French consul, estimates it at 200,000. Rousseau also informs us that the town is built on four hills, called Djeleb beni el-Kaka, on one of which there is a fortified castle; that it is surrounded by a stone wall, and has seven gates*; that it contains 5 serais, or governor's palaces, 100 mosques, of which the most celebrated is that of Zacharias; 50 mesjeds, or oratories, of which the most beautiful, called Helawie, is supposed by Pococke to have been formerly a Christian church built by Helena, mother of Constantine; 10 or 12 public schools, 2 public libraries, 5 mehkems, or courts of justice, 60 baths, 100 coffee-houses, 40 or 45 great bazaars, 31 khans, occupied principally by Franks or other strangers, 200 fountains, about 15 wakfs, or religious institutions, 1 mewla-khâné, or college of dervishes, 5 Christian churches, and 40,000 houses. But the state of the city has been greatly changed by an earthquake which happened in August, 1822, and which destroyed almost two-thirds of the buildings. The population is a mixture of Turks, Arabs, Christians, and Jews. The Christians principally belong to the Greek, Syrian, and Armenian churches: of these the Greeks are the most numerous and the richest. The small river Koik runs along the west side of the town.

Before the earthquake of 1822 Haleb was supposed to possess 12,000 artisans, and was celebrated for its gold and silver lace, its manufactures of silk and cotton goods, shawls, &c.; but its prosperity was chiefly owing to its situation, which rendered it one of the great commercial marts between Europe and Asia. It carries on a great caravan trade with Bagdad, Persia, and the eastern parts of Asia. The goods destined for the European market are shipped from the port of Latakia. Consuls from all the commercial states of Europe reside at Haleb.

The antient name of the town was Chaleb, or Chalybon, which was changed by Seleucus Nicator into Berœa. It continued to be called by that name until its conquest by the Arabs under Abu Obeidah in 638, when its original name of Chaleb or Haleb was restored. It afterwards became the capital of an independent monarchy under the sultans of the race of Hamadan, under whose rule it appears to have enjoyed great prosperity. In the latter part of the tenth century Haleb was again united to the Greek empire by the conquests of Zimisces, emperor of Constantinople. During the crusades Haleb was subject to the Seljuke princes. In 1260 it was plundered by the Moguls, and again in 1401 by Timur. It was afterwards annexed to the dominions of the Mameluk sultans of Egypt, but was conquered by Selim I., the Turkish sultan, and has since that time been subject to the sultans of Constantinople. It is at present however in the possession of the pasha of Egypt.

The pashalik of Aleppo is bounded on the west by the Mediterranean, on the east by the Euphrates, on the north by an imaginary line drawn from Scanderoon (the antient Alexandria) on the coast to El Bir on the Euphrates, and on the south by another line drawn from Billis to the Mediterranean, passing by Murrah and the bridge of Shogher. The northern part is occupied by high mountains, known to the antients under the name of Amanus, which is only a branch of Mount Taurus. The southern part is sterile and sandy; but the plains at the foot of the mountains are fertile, and afford good pasturage for the numerous flocks of the Arabs and Kurds, which graze upon them during the greater part of the year. The inhabitants only cultivate the land in the mountainous districts, which produce wheat and other sorts of corn, melons, olives, cotton, tobacco, figs, &c.: the level parts of the country are abandoned to the Kurds and Arabs. The heat of the climate is seldom oppressive, in consequence of the west winds which blow from the Mediterranean. Tho country is reckoned healthy; but the inhabitants of Haleb are very subject to a disease, which first appears under the form of an eruption on the skin, and afterwards forms into a sort of boil: it dies away in about eight months from its appearance. Volney and many other travellers

* In Niebuhr's plan, 1766, there are nine gates.

attribute the disease to the badness of the water which the inhabitants drink.

The pashalik of Haleb is watered by the Euphrates, the Orontes, and the Koik. The Koik rises near Amtab in the north, and passing by Haleb, loses itself in a morass about 16 miles south of the city.

The pashalik contains no other towns of any importance, with the exception of Haleb. Alexandria (Scanderoon) and Antioch, which were once so celebrated, are now of little importance.

(Russell's *Natural History of Aleppo*, 2nd edition, 2 vols. 4to., 1794; Rousseau's *Description du Pachalik de Haleb*, in 'Fundgruben des Orients,' vol. iv., pp. 1-25, 93-97; Volney's *Voyage en Syrie et en Egypte*; Olivier's *Voyage dans l'Empire Othoman, l'Egypte, et la Perse*; the third vol. of C. Niebuhr's 'Reisebeschreibung,' published at Hamburg in 1837, contains a ground-plan of Haleb, as it existed in 1766.)

HALES, STEPHEN, D.D., was born at Beckesbourn, in Kent, September 7, 1767, entered of Benet College, Cambridge, in 1696, was elected Fellow in 1702; and having taken holy orders, was presented about 1710 to the perpetual curacy of Teddington, near Twickenham, where, though he obtained other church preferment, he resided to the end of his life. He was elected F.R.S. in 1717, and in 1753 was admitted a foreign associate of the Académie des Sciences, in place of Sir Hans Sloane. He died in 1761.

During his residence at Cambridge he applied himself diligently to physical researches, which continued to be his favourite pursuit through life. His first important publication was 'Vegetable Statics, or an Account of some Statical Experiments on the Sap in Vegetables, &c.;' and he has the honour of having made the first essays towards the modern discoveries in vegetable physiology. This work, which is still referred to for excellent evidence concerning many facts in vegetable physiology, obtained for him a foreign reputation, being translated into French, Italian, Dutch, and German. 'Hæmastatics,' a similar treatise on the circulation of the blood, followed in 1733. Dr. Hales's genius was of a very practical turn: most of his numerous inventions and writings refer to some direct application of science to daily use. They comprehend anatomical and surgical treatises, analyses of medicines, experiments on the preservation of provisions during long voyages, the distillation of salt water, and the like; with several sermons. Of all these labours the most brilliantly successful was his plan of ventilating prisons, the holds of ships, and other close and unhealthy places. Having bestowed great pains on this object, he procured, in 1749, the erection of one of his machines in the Savoy prison; and the benefit obtained is stated by Mr. Collinson to have been so great, 'that though 50 or 100 in a year often died of the gaol distemper before, yet from 1749 to 1752 inclusive no more than four persons died, though in 1750 the number of prisoners was 240.' By the introduction of his system into the old gaol of Newgate the mortality was reduced in the proportion of 7 to 16. In France it was extensively adopted with similar beneficial result in prisons, hospitals, ships of war, the preservation of corn in granaries, &c. Numerous papers of Dr. Hales are printed in the 'Phil. Transact.' A list of his works will be found in Watt's 'Bibl. Britann.' (CHEMISTRY, p. 34; Memoir, by Peter Collinson, in the *Ann. Reg.*, 1764.)

HALIÆ'ETUS. [FALCONIDÆ, vol. x., p. 170.]

HALICARNASSUS. [ANATOLIA; HERODOTUS.]

HALICHŒ'RUS. Professor Nilsson's name for a genus of seals. [PHOCIDÆ.]

HALI'CORE, or HALI'CORA, a name for the Dugongs. [WHALES.]

HALI'DRACON, Wagler's name for the genus *Plesiosaurus*. [PLESIOSAURUS.]

HA'LIEUS, a name for the Cormorants. [PELECANIDÆ.]

HALIFAX, a market-town and parish in the West Riding of the county of York, in the wapentake of Morley, was created a parliamentary borough by the Reform Act, and now sends two members to parliament. The borough includes the town and townships of Halifax, Owram, and Ovenden. It is about two miles long and one mile broad, and includes 31,317 inhabitants, of whom 1300 occupy houses of 10*l.* and upwards. The population of the town was, in 1831, 15,382. Halifax is 194 miles north-north-west from London, 17 miles west-south-west of Leeds, 22 miles north-east of Manchester, and 7 miles south-west of Bradford.

The parish is one of the largest in England, and includes the following 23 townships:—Barkisland, Elland-cum-Greetland, Erringden, Fixby, Halifax, Heptonstall, Hipperholme-cum-Brighouse, Langfield, Midgley, Norland, Ovenden, Northowram, Southowram, Rastrick, Rishworth, Shelf, Skircoat, Sowerby, Soyland, Stainland, Stansfield, Wadsworth, and Warley. These townships are divided into three parochial chapelries for ecclesiastical purposes. They comprise 75,740 acres, a population (in 1831) of 109,899 persons, and 23,139 houses. The united annual value of their lands and buildings, as assessed for the property-tax in 1815, amounted to 140,272*l.*, and their yearly moduses, in lieu of vicarial tithes, amount to 1406*l.* 15*s.* 6*d.*, with the exception of Elland-cum-Greetland and Stainland, which townships were not parties to the Act of 1829 for the commutation of the vicarial tithes. In addition to the parish-church and two other churches in Halifax, and the two parochial chapels-of-ease of Elland and Heptonstall, there are in this parish fourteen chapels-of-ease, supported chiefly by the inhabitants of the respective townships or the united chapelries.

Halifax ranks next to Leeds and Bradford as a seat of the woollen and worsted manufactures. The town seems, on approaching it, to stand in a low valley, which is owing to the ranges of hills by which it is almost wholly surrounded; but it is in reality situated on the south-eastern declivity of an eminence which rises to a considerable height above the river Hebble. The Hebble flows through the eastern parts of the town, and falls into the Calder. The scenery in the immediate vicinity of the town is of a highly interesting and beautiful character. The soil, which in a merely agricultural district would have remained uncultivated, has been brought from its original barrenness to a state of luxuriance by its proximity to the town. The situation of Halifax is well adapted for the purposes of manufactures and commerce. The descent from the neighbouring hills of numerous brooks, so important as agents of power before the introduction of the steam-engine, gave to Halifax those facilities in manufacturing which were early a source of wealth. Its situation with reference to Manchester and Leeds, its abundant supply of coal and water, its inland navigation by means of the Rochdale Canal and the rivers Calder and Hebble, have severally tended to increase its importance as a seat of manufactures. The commencement of its woollen trade is traced to the time when the manufacturing Flemings sought refuge in England, in the reign of Henry VII., from persecution in their own country. Many of these foreigners are supposed to have settled here, though Halifax had manufactures long before this time. In an early period of the history of the woollen manufacture there was a peculiar local law designed to afford protection to clothiers from the depredations to which their goods were exposed during the progress of manufacture. It was then, as now, customary to stretch the cloth on wooden frames, or tenters, in the fields to dry; and it was therefore liable to be stolen from being thus left during the night. The magistrates were invested with power to inflict capital punishment on all persons who stole property of the value of *thirteen-pence-halfpenny* within the liberties or precincts of the forest of Hardwick. The felon was however to be deliberately and publicly tried by a jury consisting of the frith-burgers within the liberty; and they could only convict on three grounds, namely, if he were taken in the act of thieving, if the stolen goods were found on him, or on his own confession. On the first market-day following the conviction he was taken to the scaffold or gibbet, the stone platform of which may still be seen on Gibbet Hill, and the execution was performed by means of an instrument in some respects similar to the guillotine. [GUILLOTINE.] The 'Halifax Gibbet Law' was not alone exercised for the protection of the clothiers, but it was also used for the punishment of other felonies. The original axe of this instrument is preserved at the gaol in Halifax.

The chief articles at present manufactured at Halifax are worsted stuffs, including shalloons, tammies, calamancoes, duroys, everlastings, moreens, shags, serges, merinoes; also baizes, narrow and broad cloths, and kerseymeres. Bombasins, crapes, and other fabrics, composed of silk and worsted, are also manufactured here, and the cotton-trade is carried on to a considerable extent. The Vale of Ripponden is celebrated for its blue cloth: it is said that the whole of the British navy is clothed from this small district. Of the twenty-three townships of which Halifax is composed, nineteen are said to be manufacturing, and contain 141 mills in operation, which have an aggregate power of 2319 horses; 57 of them are cotton-mills, 35 woollen, 45 worsted, and 4 silk mills. They employ together 18,377 persons, of whom 8,978 are females. A considerable portion of the population is employed in making mill-machinery and wool-cards. The manufacture of these cards gives occupation to numerous wire-workers and curriers. The wire teeth of the cards are fixed in leather, and nearly 20,000 people are employed, at a very low rate of wages, in fixing the wires in the leather.

A weekly market is held on Saturday, chiefly for the sale of woollen cloth. The Piece Hall, which was erected in 1779 by the shalloon and other worsted manufacturers, is a large quadrangular structure of stone, which cost 12,000*l.*, and which occupies an area of 10,000 square yards of land, which were given for this purpose by Mrs. Caygill. It is 100 yards long and 91 yards broad; the centre is occupied by a grass-plot. It contains 315 apartments for the reception of goods, the quantity of which exposed for sale at one time is often of the value of 50,000*l.* The east side has three stories, being on a descent; the other sides only two. Each story is fronted by a colonnade, with spacious walks round the whole square, having columns in the front opposite to the partitions of the rooms, each of which has a door, and sash-window to the galleries. The simplicity and elegance of the design accord with the magnitude of the building. It was erected from a design by Mr. Thomas Bradley, and is said to be fire-proof in every part except the roof. The appearance of the town of Halifax is generally handsome; it contains many edifices entirely of stone; it is well lighted with gas, and amply supplied with soft water from reservoirs about a mile north-west of the town, which were opened about 1827. Under the act of 1823 for paving, cleansing, and otherwise improving the town, many great improvements have been effected by the widening of streets, the formation of drains, and the removal of unsightly buildings. The modern streets are spacious, and lined with good houses.

The parish-church of Halifax is a handsome and spacious edifice of pointed Gothic architecture, erected at different dates. It is said that the chancel is an addition to the original fabric, and that the tower was built by the munificence of the Lacys and Saviles. There are several monumental inscriptions worthy of notice in the chancel, one of which is to Archbishop Tillotson. Trinity Church is a handsome Grecian building, with Ionic pilasters, and an elegant tower surmounted by a dome: it was built in 1795. St. James's Church, built in 1831, is in the Pseudo-Gothic style, with turrets at the west end. The other places of public worship in Halifax are the Catholic chapel, which was built in 1836, three chapels belonging to the Independents, two belonging to the Baptists, two of the Wesleyan Methodists, two of the new Connection Methodists, one of the Primitive Methodists, a Friends' meeting-house, and a Unitarian chapel. A general cemetery was formed in 1837 by a company of shareholders. To the above-named places of worship Sunday-schools are attached, and the religious and charitable institutions of the town and county are liberally supported. The free grammar-school at Skircoat was established in 1585 by letters-patent of Queen Elizabeth: it is under the direction of twelve governors, chosen from the discreet and honest men of Halifax. Its property yields 187*l.* per annum, exclusive of the school-house, garden, and offices, which are occupied by the master. The school is free for classical instruction to all the sons of parishioners. The national school will accommodate 400 pupils; it generally contains about 200. The British school contains about 300 children of both sexes. There are also some smaller school charities. Waterhouse's Charity, established in 1636, provides almshouses for twelve poor widows, a stipend for the lecturer at the parish church, small yearly stipends to the curates of certain chapels-of-ease within the district, and various sums for other local purposes. The property of this trust has of late years greatly increased in value. The infirmary is a very noble building, which is just opened to the public: the first stone was laid in September, 1836. It affords medical and surgical assistance both to in and out patients. A subscription of 5000*l.* was raised, to which an addition of 2500*l.* was made by the trustees of the dispensary, which institution is now consolidated with it. The public baths are delightfully situated in a valley on the road to Huddersfield. They afford all the various accommodations of the most superior bathing establishments: attached to them is a large garden and a bowling-green. The literary institutions of Halifax are the Literary and Philosophical Society, which has an elegant hall and a museum; the Mechanics' Institution, with a library of upwards of 1000 volumes; and the news-rooms, which also comprise a subscription library. There are also assembly-rooms and a theatre. Daniel De Foe resided here when he wrote 'Robinson Crusoe;' and Sir William Herschel was for some time organist at the parish church. In January, 1837, the parish of Halifax was formed into two unions for the administration of the poor-laws. The Halifax Union comprises nineteen townships, and the Hebden Bridge Union the five townships of the Heptonstall parochial chapelry, and the town and chapelry of Todmorden. For other interesting particulars respecting Halifax reference may be made to White's 'Gazetteer and Directory of the West Riding,' a laborious and useful work, whose accuracy we have had the opportunity to test and confirm. (*Communication from Yorkshire.*)

HALIFAX. [NOVA SCOTIA.]

HALILIMNOSAURUS. [GEOSAURUS, vol. xi., p. 180.]

HALIME'DA, a portion of the genus Corallina, Linn., for which Lamarck had used the name Flabellaria, is thus styled by Lamouroux. (*Exposition Méthodique des Genres.*) The articulations are flat or compressed, rarely cylindrical, almost always flabelliform; the axis fibrous, surrounded by a thin cretaceous substance.

HA'LIMUS. [MAIADÆ.]

HALIO'TIDÆ, HALIOTIS TRIBE, or FAMILY. The species belonging to this section of Gastropods, commonly called 'Ear-shells,' or 'Sea-ears,' are more numerous than is generally supposed. Mr. Swainson, in his first series of 'Zoological Illustrations,' observes, when writing on the 'Small-holed Californian Ear-shell' (*Haliotis Californiensis*) (1820-21), that the definitions given by conchologists up to that time were so imperfect that they had left our knowledge of these shells nearly the same as in the time of Linnæus. Seventeen species only are enumerated in Mr. Dillwyn's work;* although thirty-four have fallen within my own observation during the last few months.'

Linnæus, who records the seven species known to him under the generic appellation of *Haliotis* (Sea-ear), describes the *animal* as a slug (*Limax*) and the *shell* as ear-shaped and open (*patens*) with a lateral hidden spire, and the disk longitudinally pierced with holes (*poris*). He places the genus between *Nerita* and *Patella*.

Cuvier, in the first edition of his 'Règne Animal' (1817), makes the *Ormiers* (Haliotis of Linnæus) the first genus of his sixth order of Gastropods, *Scutibranchiata*. [GASTEROPODA, vol. xi., p. 93.] He observes that it is the only genus of the order which has its shell turbinated, and that among these sort of shells that of the *Ormiers* is remarkable for the excessive amplitude of its aperture, its flatness and the smallness of the spire, which is seen from within. This form, he adds, has caused it to be compared to the ear of a quadruped. Cuvier divides the genus into the following subgenera:—1. The *Haliotids, properly so called* (Haliotis of Lamarck). 2. The *Padolli* of De Montfort. 3. The *Stomatiæ* of Lamarck. The *Ormiers* are immediately followed by the *Cabochons* (Capulus of De Montfort—*Patella Hungarica*).

Lamarck ('Animaux sans Vertèbres,' 1817) arranges the genus *Haliotis*, which is immediately preceded by *Stomatia*, as the last genus of his *Macrostomes*. The following is his definition of *Haliotis*:—

'Shell ear-shaped, most frequently flattened; with a very short spire, sometimes depressed, nearly lateral. Aperture very ample, longer than it is wide, entire in its perfect state. Disk pierced with holes disposed on a parallel line near the left-hand border, the last commencing with a notch.'

The same zoologist makes the following observations on the genus as restricted by him:—'The *Haliotids* constitute a very beautiful genus, rather numerous in species and remarkable for the singular form and the brilliant nacre of their shell. They have received the name of *Sea-ears*, because they in fact represent sufficiently well the form of the cartilage of the ear in man. Their shell is an oval-oblong, flattened in general, slightly spiral near one of its extremities, and furnished with a row of holes disposed on

* 'A Descriptive Catalogue of recent Shells,' arranged according to the Linnean method, by Lewis Weston Dillwyn, F.R.S. and L.S., &c. &c., 2 vols. 8vo., London, J. and A. Arch, 1817.

a curved line near the left-hand border and parallel to it. As the animal increases in growth, it forms for itself a new hole on the edge of the anterior part of the shell; this hole commences with a notch which serves to give a passage to the siphon of the animal, and is afterwards completed; when another is formed posteriorly. In its natural situation and when the animal crawls, this shell may be considered as a reversed basin with its convexity upwards. Its circumference is then considerably exceeded by the very large foot of the animal, and the spire is found on the posterior part of its body. Following the description of the *Ormier* (the animal of the Haliotis) given by Adanson, I had supposed that the branchiæ of this animal were exterior, like those of tho *Phyllidians:* but M. Cuvier has undeceived me by showing me that they are hidden in a particular cavity. *Haliotis* therefore belongs to the family of *Macrostomes*. With regard to the tentacula, it has not perhaps really more than two. But as it is not uncommon (assez fréquent) among the marine trachelipods to find tho eyes carried each upon a tubercle which springs at the external or posterior base of the tentacula, theso tubercles are apparently more elongated here than elsewhere: in this case the two larger tentacles are the anterior ones.' Lamarck records fifteen species, including *Haliotis dubia*.

Mr. Swainson ('Zool. Illustr.' 1st series) remarks that 'the genus *Padollus* of Montford' (De Montfort?) 'resting entirely on the unevenness of the outer lip, without any knowledge of the animal,' appears to him an unnecessary distinction, for such, he observes, is the character of all young shells, and also of mature ones, whose outer surface is rugged or uneven.

De Montfort (1810) gives the following generic characters for *Padollus*:—Shell free, univalve, in the form of an ear, pierced with one or two holes; summit spiral, flattened, dorsal; aperture oval, wide open (évasée), entire, perpendicular; left lip reflected and trenchant; back covered with an epidermis, having a gutter in the middle and in the direction of the spire. He gives as the type of the genus *Padollus rubicundus*, and proceeds nearly as follows:—'In arranging this shell as intermediate between the *Sigareti*, the *Stomatiæ* and the *Haliotides*, we consider that we have been able to establish upon it a new genus. Sufficiently similar to the *Haliotides* by its general contour (l'ensemble de ses formes), it is in some manner nevertheless approximated to the *Stomatiæ*, inasmuch as it has very few holes; but it presents, more than almost any of these shells, a spiral gutter, hollow in the interior, elevated on the back, placed in the middle and curved in tho direction of the spire. This hollow, or gutter, is independent of the curved and serial line of holes, which are nearly all obliterated. The right lip is also more opened out (s'épanouit aussi d'avantage), it juts out and festoons (festonne) over the left lip towards the summit, and to the height of the spire: the interior offers an iridescent and undulated nacre. Externally it is of a brick-red, and the summit, in consequence of losing its exterior calcareous and coloured coat, is nacreous. The back is finely striated and reticulated, and the successive periods of growth are very strongly marked there. There is no doubt that the obliteration of the holes of the *Padolli* are a consequence of the absence of some organs, with which the *Haliotides* must be eminently provided, and it is even probable that the singlo hole which notches their border serves during the life of these mollusks to lodge a fold of the border of the mantle, rolled into a tube and serving for respiration; a tube which we shall find among many of the spirivalve mollusks.'

Considering the time at which De Montfort wrote, there is much good reasoning in this passage; it must be recollected that he evidently gavo his description from a young shell; for he says in the course of it that the shell sometimes reaches more than an inch in its greatest diameter.

Dr. Leach (1814) adopted De Montfort's distinction and name. The Doctor says that this genus is readily distinguished from *Haliotis* (*Ear-shell*) by the irregular form of the outer edge or lip; the disk, he adds, has fewer perforations and the spire is placed farther on the back. He states, in conclusion, that the animal is unknown, but is probably not very unlike that of tho ear-shell.

Mr. G. B. Sowerby (*Genera of Recent and Fossil Shells*, No. xiv.) observes, that with the exception of a few that are commonly known by collectors and Linneans as *Imperforate Ear-shells*,the genus Haliotis has not suffered any dismemberments. 'An attempt,' continues Mr. Sowerby, 'has indeed been made by Montfort to separate from the genuine *Haliotides* two or three species under the name of *Padollus*, in which he has been followed by Leach, but as far as respects general adoption this attempt appears to have been as unsuccessful as it was unnecessary. Not so the separation of the *imperforate Haliotides*, which are easily distinguished by wanting the row of perforations so very characteristic of the true Haliotis.'

The *Otidea* form the first family of *Scutibranchiata*, tho the third order of *Paracephalophora Hermaphrodita* in M. De Blainville's arrangement (*Manuel de Malacologie*, 1825). The first genus of this family is *Haliotis*, divided into four sections, and including the genera *Padollus* and *Stomatia*.

M. Rang (*Manuel*, 1829) continues the *Ormiers* (*Macrostomes* of Lamarck, *Otidea* of De Blainville, *Auriformes* of Latreille) as the first family of *Scutibranchiata*, Cuvier: but he makes it consist but of one genus, *Haliotis*, Linn The genus *Stomatia* of Lamarck he places under the *Sigarets* of Do Férussac, as well as the genus *Stomatella* of Lamarck, which he seems to consider as including the *Padollus* of De Montfort. Tho *Sigarets*, in this arrangement, are made to form the 9th family of the *Pectinibranchiata* of Cuvier.

In Cuvier's last edition of the 'Règne Animal' (1830), the position and arrangement of the *Ormiers* remains as in the first edition, with the exception that in the last edition the Scutibranchiata form the eighth order of his Gastropods.

In the present state of our information, it will perhaps be as well to select the arrangement proposed by Cuvier, and in great measure adopted by M. Do Blainville. M. Rang, in his description both of *Stomatella* (including *Padollus*), and *Stomatia*, says 'Animal unknown.'

Haliotis (properly so called; *Haliotis*, Lam.).

Animal.—One of the most ornamented of Gastropods. All round its *foot* to its mouth there is, at least in the more common species, a double membrane cut out into leaflets (feuillages) and furnished with a double row of filaments. On the outside of its long *tentacles* are two cylindrical pedicles for carrying the eyes. The *mantle* is deeply divided on the right side, and the water, which passes by means of the holes in the shell, can, through this slit, penetrate into the branchial cavity; along its edges again are also threo or four filaments, which the animal can also cause to come out through these holes. The mouth is a short proboscis. (Cuvier's description for all Gmelin's Haliotides, except *H. imperforata* and *perversa*.)

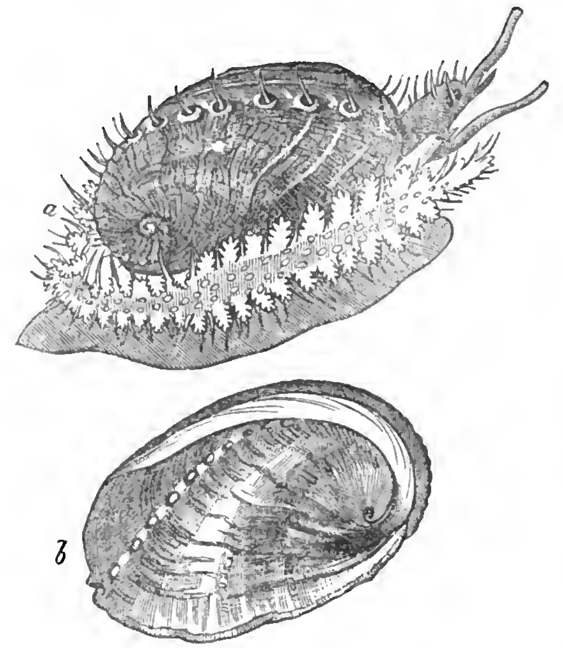
Body oval, very much depressed, hardly spiral behind, provided with a large foot doubly fringed on its circumference. *Head* depressed; *tentacles* a little flattened, joined (connés) at the base; *eyes* carried on the summit of prismatic peduncles, situated on the external sido of the tentacles. *Mantle* very delicate, deeply divided on tho left side; the two lobes pointed, forming by their junction a sort of canal for conducting the water into the branchial cavity situated on the left, and inclosing two very long, unequal, pectinated *branchiæ* (peignes branchiaux).—(De Blainville.)

Animal oblong, depressed, furnished with a large *head* and a short proboscis, at the extremity of which is the *mouth*, containing a *tongue* armed with points (aiguillons); tentacles two, long and cylindrical; *eyes* on pedicles, implanted at their external base, a little backwards. *Mantle* short, delicate; *foot* very large, oblong, furnished all round with a double row of festoons agreeably cut out or pinked (decoupés). *Organs of respiration* composed of two unequal pectinated *branchiæ*, in a cavity open to tho left, tho *muscle of attachment* occupying the middle of tho animal; vent (anus) opening into this cavity opposite the slit which forms its aperture. (Rang.)

In addition to the general account of the organization given by Cuvier, we refer the reader to No. 489 (Gallery) of the Physiological Series of preparations in the Museum of the Royal College of Surgeons. A small specimen is there prepared to show the stomach. The floor of the branchial cavity, the gills, and anus, are turned back, and the integument is removed from above the œsophagus and first stomach. A bristle is passed through the mouth into the œsophagus, and another from the first to the second stomach. The latter cavity is imbedded in the liver, and receives the secretion of that gland by such wide orifices, that portions of the alimentary substances have entered the biliary ducts, which thus appear to be ramifications of the alimentary canal. (Catalogue. Gallery. Vol. 1.)

Shell nacreous, very much depressed, more or less oval, with a very small spire, very low, nearly posterior, and lateral; aperture as large as the shell, with continuous borders, the right border delicate and trenchant, the left flattened, enlarged and trenchant; a series of complete or incomplete holes, parallel to the left side, serving for the passage of the two pointed lobes of the mantle; a single large muscular impression, median, and oval. (De Blainville.)

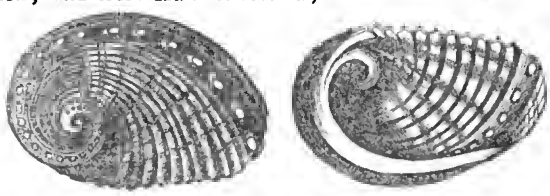
These, the true Haliotides, forming M. De Blainville's section A, consisting of species whose disk is rounded forwards and pierced with a series of holes, vary much in size and shape. The general form may be imagined from that of *Haliotis tuberculata*, the most common species, the size,



Haliotis tuberculata.

a, animal and shell; *b*, interior of shell.

shape, &c., of which is too well known to require description; and from *Haliotis costata*; but there are some of



Haliotis costata.

the species from the warmer climates that are as large as or larger than the crown of a hat, and are absolutely dazzling from the splendid iridescence of their nacre. The shape too varies considerably. Thus we have among the comparatively small species a form very nearly round (*Haliotis excavata*), whilst *Haliotis Asinina* is very much elongated.

The effect of treating the shell of *Haliotis* with acid, so as to deprive it more or less of its earthy material, and to exhibit the shape still retained after the removal of that earthy matter, will be seen in the specimens numbered 98, 98 A, 98 B, in the gallery of the same museum.

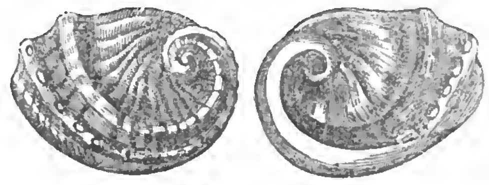
Geographical Distribution.—Both M. de Blainville and M. Rang state that species of Haliotis exist in all the seas; the latter uses the expression 'elles sont très répandues dans toutes les mers,' but their limits seem not to go far beyond temperate climates. None appear to have been seen by our northern voyagers; and though *Haliotis tuberculata* (which there can be little doubt is the ἀγρία λεπάς, ἥν τινες καλοῦσι θαλάττιον οὖς—'the wild *lepas*, which some call the Sea-Ear'—of Aristotle, *Hist. An.*, lib. iv., c. 4) is common at Guernsey and Jersey, and has been found—that is, the shell—on the south coast of Devonshire, we agree with Mr. Sowerby in thinking that, on the present evidence, this species cannot with propriety be considered a native of our own coasts though the dead shells are sometimes thrown up on our southern shores after violent storms.

Habits.—The *Haliotides*, which are all marine and littoral, being without opercula, adhere, like the *Patellæ*, by applying their under parts to the surface of the rocks. They are generally found near the water's edge, and, according to Lamarck, go during the fine summer nights to feed on the herbage which grows near the shore.

Utility to Man.—As an article of food this genus is by no means to be despised. We have eaten *Haliotis tuberculata*, and when served by a good cook it is tender and sapid. The large fleshy foot, if not properly managed, is apt to be tough. The people of Guernsey and Jersey ornament their houses with the shells of this species, disposing them frequently in quincunx order, and placing them so that their bright interior may catch the rays of the sun. We have often thought that some of the large and splendid intertropical species, whose exterior, after removing the outer coat, take a polish almost equalling the natural brilliancy of the inside, might be converted into dishes for holding fruit: if mounted with good taste, their indescribable iridescence would materially add to the richness of an elegant table.

B. Species whose disk, besides the series of holes, is raised by a large parallel rib, hollowed interiorly, and whose anterior border is more or less irregular.

Padollus. (De Montfort.)



Padollus rubicundus?

M. De Blainville refers to *Haliotis canaliculata*, Lam. as the example. The figure in Knorr, referred to by Lamarck, is red externally, and has the elevated rib; but the shape of the shell is longer than that of *Padollus scalaris*, Leach, and of other *Padolli* which we have seen. The specimen recorded by Mr. Gray in the appendix to the 'Narrative of a Survey of the Intertropical and Western Coasts of Australia, performed between the years 1818 and 1822, by Captain Phillip Parker King, R.N., F.R.S., &c.,' vol. ii., and which Mr. Gray notices as the largest he ever saw, measured three inches and a half by two and a half. We have seen the shell, and never saw so large a specimen. Mr. Gray records it as *Padollus rubicundus* of De Montfort, with the synonyms of *Padollus scalaris*, Leach, and *Haliotis tricostalis*, Lamarck.

Locality.—Lamarck, on the authority of M. Leschenault, says that his *Haliotis tricostalis* inhabits the seas of Java. The fine specimen brought to England by Captain King was found upon Rottnest Island, on the west coast of New Holland, and is now in his cabinet. It has only three holes, the anterior ones, open. All, both those which are closed and those which are open, are very highly elevated, and so is the curved longitudinal rib. The left border externally is very much raised and nodulous, looking at first sight as if it had another row of holes which had been closed; but it was evidently always imperforate.

C. Species whose disk is not pierced, but hollowed longitudinally by a decurrent canal.

M. De Blainville gives as an example of his section C. *Haliotis dubia* of Lamarck. It will be clear to the observer that the animal protected by such shells as the two next, must exhibit some differences from that of a true *Haliotis*.

D. Species whose disk is not pierced, and which offer the two gutters together, but approximated, so as to leave externally a decurrent rib between them.

Stomatia. (Lamarck.)

Cuvier, who says that the animal of Stomatia is much less ornamented than that of *Haliotis*, is of opinion that this form connects the *Haliotides* with certain Turbines.

Mr. G. Sowerby (*Genera of Recent and Fossil Shells*, No. xix.) observes that Lamarck, in his observations upon *Stomatella*, tells us that in respect to their general form those shells appear to be nearly related to the *Stomatiæ*; and that they are principally distinguished by the transverse ridge and the elevated outer lip of the *Stomatiæ*.

Upon a careful examination however of ten species, Mr. Sowerby was unable to discover any difference in the outer lip; and he remarks that Lamarck places among his *Stomatellæ* one species, *S. rubra*, which has a nodular *keel* placed exactly in the same position as the transverse ridge, by which the latter characterizes *Stomatia;* so that Mr. Sowerby does not find any generic difference whatever, and has therefore united the two Lamarckian genera under the appellation *Stomatia*. He thus characterizes the genus thus reformed:—Shell pearly within, mostly coloured externally; suborbicular or long, generally ear-shaped and depressed. The spire, in most species, prominent, but not produced nor elongated; sometimes very small, marginal and inconspicuous. Aperture mostly longitudinal, in some species nearly orbicular, in others much elongated, always very largo; its edges entire, united at the upper part, and scarcely modified or altered in form by any portion of the last volution. Volutions from two to four. Muscular impressions two, seldom distinct, nearly marginal, and in the open part of the shell.

Mr. Sowerby goes on to state that Stomatia appears to be related to *Haliotis*, and is therefore rightly placed by Lamarck among his *Macrostomes*. One of its species is arranged by Linnæus, he adds, as a Haliotis, under the name of *Haliotis imperforata* (Gmel.). Mr. Sowerby does not pretend to discuss the question of their resemblance to Lamarck's *Turbinacées;* but only observes that in general form, some of them approach very nearly to some of Lamarck's *Monodontes*. The *Stomatiæ*, he states in conclusion, are marine, and he says that all the species he has seen were brought from the East Indies and New Holland.

Locality.—Stomatia has been found at a depth of seven fathoms, adhering to *Meleagrinæ* and corals.

Fossil Haliotidæ.

Mr. G. B. Sowerby, speaking of the true *Haliotides*, says that the existence of fossil species is very doubtful; the only approach to it that he had ever seen, were, he adds, some incrustations taken up from the sea near the Cape of Good Hope. He states that he never saw a fossil species of *Stomatia*, as modified by him. M. de Blainville remarks, at the end of his arrangement, that it would appear that no fossil species are known. Cuvier, speaking of tho true *Haliotides*, observes that the genus *Haliotis* certainly has, though the fact has been disputed, its analogue among the fossils; and he refers to the 'Ann. des Sc. Nat.,' t. xii., p. 45, f. A, for a species (*Hal. Philberti*) found in tho *calcaire* of Montpellier, described by M. Marcel Serres. M. Rang, speaking of the same genus, says, 'Nous en possédons une ou deux à l'état fossile.' M. Deshayes, in his tables, records one species, *H. tuberculata*, as both living and fossil (tertiary), from Sicily. (Pliocene Period of Lyell.) Of *Stomatia* M. Deshayes mentions no fossil species, but of *Stomatella* he records one fossil (tertiary) with an unknown locality.

HALISPO'NGIA. According to the structure and composition of the numerous species of sponges, they may be divided into genera. If, in accordance with the observations of Dr. R. Grant, we consider sponges in three groups, one having a horny tubular structure, another containing calcareous spiculæ, a third containing siliceous spiculæ, we may adopt the three generic types, Spongia, Calcispongia, and Halispongia, of Blainville.

Halispongia is thus characterized:—Mass more or less rigid or friable, of irregular figure, porous, traversed by winding canals, which end in openings scattered over the surface; substance subcartilaginous, supported by simple siliceous spiculæ.

Tho species exhibit various external forms, encrusting, branching, or foliaceous. Dr. Fleming includos them under the title Halichondria.

HALITHE'A, a genus of marino dorsibranchiate annelids belonging to the family *Aphroditidæ*. [Dorsibranchiata; Sea-Mouse.]

HALL, or HALLE, EDWARD, an English lawyer and historian, was the son of John Halle of Northall in Shropshire, and was descended from Sir Francis Van Halle, K.G., in the time of Edward III., who was the son of Frederic de Halle of the Tyrol, natural son of Albert king of the Romans and archduke of Austria. He was born, at the close of the fifteenth century, in the parish of St. Mildred, London, and received the first part of his education at Eton school. In 1514 he became scholar of King's College, Cambridge, and continued there till he became a junior fellow; afterwards, about 1518, when Cardinal Wolsey founded various lectures at Oxford, he removed to that university. Having entered at Gray's Inn, he was called to the bar, and became first one of the common serjeants, and subsequently under-sheriff of the city of London. In 1533 he was appointed summer-reader of Gray's Inn, and in 1540 double reader in Lent, and one of the judges of the Sheriff's Court. He died in 1547, and was buried in the church of St. Benet Sherehog, London.

Hall's Chronicle, entitled 'The Union of the two noble and illustrate Families of Lancaster and Yorke,' was first printed by Berthelette, in small fo o, in 1542. This edition is so very rare as to have been seen by scarcely any of our bibliographers. It was dedicated to King Henry VIII., and ended with his twenty-fourth year, 1532. Grafton, who reprinted it in 1548, continued the work from Hall's papers to the end of Henry VIII.'s reign. He again printed it in 1550. 'The boke commonly called Halle's Cronycles' is one of those which were forbidden by proclamation, 13th June, 1555, 1 and 2 Phil. and Mary. A fourth edition, but without any additions or improvements, was printed in 4to., London, 1809, by the booksellers, among the 'English Chronicles.' (Herbert's *Ames*, p. 527; Bliss's edit. of Wood's *Athenæ*, vol. i., p. 164; Warton, *Hist. Eng. Poet.*, 4to., vol. iii., p. 214; Nicolson's *Hist. Lib.*, edit. 1776, p. 58.)

HALL, JOSEPH, an eminent divine and prelate, was born July 1st, 1574, at Ashby-de-la-Zouch, in Leicestershire, and received his academical education at Emmanuel College, Cambridge, of which in due time he was elected Fellow. Having taken orders and received some minor benefices in succession, he was made dean of Worcester in 1617; sent as one of the English deputies to the synod of Dort in 1618, appointed bishop of Exeter in 1627, and translated to Norwich in 1641. His professional zeal and earnest piety involved him in those jealous timos in the charge of puritanism; and being harassed by frequent and vexatious attacks, he plainly told, to use his own words, archbishop Laud—'Under how dark a cloud I was hereupon I was so sensible, that I plainly told the lord archbishop of Canterbury (Laud) that rather than I would be obnoxious to those slanderous tongues of his misinformers I would cast up my rochet. I knew I went right ways, and would not endure to live under undeserved suspicions.' In truth he was well attached to the church of which he was a member, and wrote strongly in defence of episcopacy when the danger of the times became imminent. In November, 1641, having joined others of the bishops in a protest against all laws made during their forced absence from parliament, he was sent to the Tower, and only released in the following June on giving bail for 5000*l*. In the next year the revenues of his bishopric were sequestrated, and during the rest of his life he suffered much from poverty and harsh treatment, of which he has given an account in a piece called 'Hard Measure.' He removed in 1647 to Higham, near Norwich, and died there in 1656.

His numerous works fill several volumes in the old folio editions, and ten in the modern 8vo. They are chiefly controversial, as will appear from the catalogue in Watt, and therefore of ephemeral popularity. His 'Contemplations' are of more personal and lasting interest, and esteemed for their language, criticism, and piety; as also his 'Enochismus, or Treatise on the Mode of Walking with God,' a beautiful tract, translated into English in 1769. To tho student of English manners his Satires entitled 'Virgidemiarum,' in 6 books, are peculiarly valuable. They have been analyzed by Warton, in an unpublished portion of his 'Hist. of Poetry,' first printed in Chalmers's 'British Poets.' He says of them, 'The characters are delineated in strong and lively colouring, and their discriminations are touched with tho mastorly traces of genuine humour. The versification is equally energetic and elegant. His chief fault is obscurity, arising from a remote phraseology, constrained combinations, unfamiliar allusions, elliptical apostrophes, and abruptness of expression.'

HALL, a town in tho Innthal, in Tyrol, with 4500 inhabitants, having a mint and other public establishments, and salt-works which produce about 300,000 cwt. of salt annually; the rock-salt is brought from the Salzberg, 5088 feet high, which is ten miles distant.

Swabian Hall, in the circle of the Iaxt, and the kingdom of Würtemberg, has 6500 inhabitants, six churches, including the antient Gothic church of St. Michael, a handsome town-hall, and salt-works yielding 80,000 cwt. annually.

It was formerly a free Imperial city, and annexed to Würtemberg in 1802.

HALLE, in Saxony, on the Saale, a town in the district of Merseberg, and the province of Saxony, in Prussia, the chief town of the circle of the Saale. It is celebrated chiefly for its salt-works, for the Orphan Asylum founded by A. H. Francke [FRANCKE], and as the seat of the Frederick's university. It consists of three towns, viz. Halle itself with five suburbs, and Glaucha, and Neumarkt, which have magistrates of their own. The university was founded in 1694, and by a decree of the king of Prussia was united in 1817 with that of Wittenberg. It has always maintained a very high character, and has a number of scientific institutions connected with it, such as the botanic garden, the museum, theological and philological seminaries, a medical, chirurgical, and clinical institution for surgery, midwifery, &c., the anatomical theatre, the physical and chemical institution, the observatory, the mining institution, with a cabinet of minerals, &c. The university library consists of above 50,000 volumes. The first professors having been divines of what the Germans call the Pietist party, the theological faculty had from its origin a very local character, and Halle has been the chief seat of that party, which, notwithstanding its prejudices and peculiarities, has had a salutary influence on practical Christianity. A great change was however effected by Christian Von Wolff, who inspired the students with a love of mathematics and philosophy; and though by the influence of the Pietist divines he was for a time exiled from the Prussian states, he, with his whole school, triumphed in the end. The university had attained its highest lustre at the beginning of the nineteenth century, when Napoleon dissolved it after the battle of Jena. The Westphalian government indeed re-established it, but it had only from 300 to 400 students, and in 1813 Napoleon again decreed its dissolution. His overthrow restored it to Prussia, and after its union with that of Wittenberg it had in 1829 1300 students, of whom 944 studied divinity. The competition with the new university of Berlin however affected it, and the number of students now fluctuates between 800 and 900. There are above 40 professors and teachers, among whom are some highly eminent names. There are several remarkable buildings, such as St. Mary's church, built in the Gothic style in the sixteenth century; St. Ulrich's church, built in 1339; that of St. Maurice, of the middle of the twelfth century; the cathedral, built in 1520-23; and the town-hall. The antient castle, called the Moritzberg, formerly the residence of the archbishops of Magdeburg, was reduced to a ruinous condition in the Thirty Years' War, and only a wing now remains. Halle possesses many charitable institutions. There are numerous manufactories, but the most important are the salt-works, producing 462,000 bushels of salt annually. The workmen are called Halloren, and are a peculiar race, distinguished by their physiognomy, costume, and customs: they are supposed to be descended from the aboriginal inhabitants, and enjoy many privileges and immunities.

The 'Allgemeine Litteraturzeitung,' one of the very best in Germany, originally published at Leipzig, has appeared at Halle ever since 1804. The population of Halle itself is about 17,000, and with Glaucha, &c., 24,000.

HALLE, or HALLEIN, in the circle of Salzburg, in Austria, with 5000 inhabitants, has extensive salt-works, which produce annually 450,000 cwt. of salt.

HALLER, ALBERT VON, was born at Berne, October 16, 1708, of an antient and respectable family. His father, Nicholas Emmanuel von Haller, who was an advocate and had the reputation of being an able lawyer, died in 1721, but even at that time could foresee the distinction which his son would attain, from the superiority which he evinced over his fellow-pupils. In early life Haller was feeble and delicate, being affected with rickets, a circumstance which, as his friend and biographer Zimmermann observes, not unfrequently tends to foster and develop the talents of a youth. He is said, at the age of nine, to have been in the habit of writing down each day all the unusual words he met with. He composed also short lives of nearly two thousand distinguished persons, after the manner of Bayle's dictionary, and formed a Chaldee grammar. A satire in Latin verse upon his master was known to have been written by him when only ten years old, and two years later he first began to compose verses in his native language.

His father had intended him for the church, but his own inclinations leading him to the study of physic, he went in 1723 to the university of Tübingen, where he lived with Duvernoy, afterwards professor of anatomy at St. Petersburg. Being but little satisfied with his progress here, he resorted in 1725 to Leyden, where the zeal and talent of the professors afforded him an opportunity of pursuing his studies in a manner more accordant with his wishes. At this university Boerhaave was then in the height of his fame, attended by 120 pupils, whose instruction was his greatest delight; and Albinus was delivering the lectures on anatomy and surgery. Having enjoyed such advantages as these, it is not extraordinary that Haller should ever after speak with the greatest satisfaction of his residence at Leyden. About this time he visited Ruysch at Amsterdam, then in his eighty-ninth year, and saw a portion of his celebrated collection of anatomical preparations, the superiority of which, he tells us, depended rather upon skill in manipulation than on any secret process. At the end of the year 1726 he offered himself for his doctor's degree, and delivered his Thesis 'De ductu salivali Coschwiziano,' which he showed to be merely a blood-vessel. In 1727 he visited London, where he became acquainted with Sir Hans Sloane and Cheselden; thence he went to Oxford, and thence to Paris, whence having pursued his anatomical and surgical studies for some time under Winslow and Le Dran, he went to Basle to study mathematics under Bernouilli, and then returned to his native country and began to practice as a physician. In 1735 he was appointed physician to the hospital at Berne, and soon after principal librarian to the large public collection of books and medals; but these offices he did not hold long, for in the following year he was offered the professorship of medicine, anatomy, botany, and surgery, at Göttingen, by George II., which after some hesitation he accepted. Having declined practising, he devoted himself to the duties of his office with the greatest zeal, and especially exerted himself to increase the facilities for the study of anatomy. During eighteen years that he retained this appointment, while fully discharging all its laborious duties, he was a constant contributor to the different scientific Transactions. In 1747 he published the first edition of his 'Primæ Lineæ Physiologiæ,' which he had that year used as the ground-work of his lectures, having previously employed the 'Institutions' of Boerhaave. In 1751 the Royal Society of Göttingen was established, and Haller, at whose house the first meeting took place, was appointed perpetual president. To their Transactions, of which the first volume appeared shortly after under the title of 'Commentarii Societatis Regiæ Scientiarum Gottingensis,' he was a constant contributor, even after 1753, when, in consequence of the delicate state of his health, being obliged to leave Göttingen, he retired to Berne. Here he resided during the rest of life, constantly occupied in the publication of his most important and voluminous works, in the cultivation of the science of his profession and of general literature, and in the active and honourable discharge of various duties in the service of the republic, in which he at all times strenuously advocated the cause of the aristocracy. He died in October, 1777, in the enjoyment of the highest reputation, both as a citizen, a scholar, and a philosopher, his literary labours ceasing only with his life.

It would be difficult to determine how large a portion of the facts of medical science now most familiarly known we owe to the extraordinary labours of Haller. Some idea of the extent of his works may be formed from the fact that the titles of nearly two hundred treatises published by him from 1727 to 1777 are given by Senebier in his Eloge of Haller, and that this list does not profess to be complete. He is unanimously received as the father of modern physiology, whose history commences with his writings. He was the first to investigate independently the laws of the animal economy, which had before been studied only in connection with the prevailing mechanical and chemical or metaphysical theories of the day. Commencing with a sound knowledge of anatomy and of the structure of the organs in the dead body, he sought experimentally and systematically to discover the laws which governed their actions during life, proceeding from the most simple to the most complex phenomena. Excluding all the metaphysical explanations which Van Helmont and Stahl had invented, and all those deduced from mechanics and chemistry which were not clearly sufficient for the phenomena ascribed to them, he sought for powers peculiar to the living body, which he believed must govern the actions which he found occurring only in it. These he thought might be restricted to two—sensibility and irritability; the former seated in the brain and nerves, the latter in muscular fibre. In this he had indeed been partially anticipated by Glisson [GLISSON], who perceived the necessity of admitting an inherent property in muscular fibre, by which its contractions take place under the influence of certain stimuli, but the laws of this property, and the distinction between it and elasticity, had never been at all clearly determined. Haller thus illustrated these properties: the intestine removed from the abdomen, or a muscle separated from the body, is irritable, for when pricked or otherwise stimulated, it contracts—yet it is not sensible; the nerves on the other hand are sensible but not irritable, for when stimulated, though the muscles to which they are distributed are thrown into action, they themselves do not exhibit the slightest motion. Henco irritability, he said, cannot be derived from the nerves, for it is impossible they should communicate what they do not possess themselves; but he attributed a *nervous power* to some of the muscles as a necessary condition of their irritability, and supposed it to be convoyed to them during life from the brain through the nerves, and to govern their actions under the influence of certain undetermined laws. Proceeding to investigate further the laws of irritability, he found that it differed in intensity and permanency in different parts of the body. He found that it continued longest in the left ventricle of the heart, next in tho intestines and the diaphragm, and that it ceased soonest of all in the voluntary muscles, and by reforence to this superior degree of irritability he explained the constant action of tho heart and diaphragm even during sleep. He denied all irritability to tho iris, and believed that the action of light upon it takes place through the medium of the retina, a view since proved to be perfectly correct. He supposed the arteries to be supplied with muscular fibres, but that the cellular tissue around them prevented any motion from taking place in them, and he explained the accumulation of blood in an inflamed part, partly by the contraction of the veins and partly by the diminished contractility of the arteries. He endeavoured to prove by experiments that the tendons, the capsules of joints, the periosteum, and tho dura mater are entirely insensible, and that the pain which occurs in diseases of these parts ought to be referred to the affection of the nerves distributed to and around them; and in these and some other tissues which he held to be destitute of irritability he admitted a force analogous to elasticity, by which they contracted slowly and in a mannor altogether different from muscular tissue when divided or exposed to cold, &c.

Such is a sketch of the great doctrine of irritability and sensibility on which Haller based all the phenomena of lifo, and around which he arranged all the facts of physiology kuown at his time in his 'Elementa Physiologiæ.' It gave the first impulse to the study of the laws of life as a separate and exclusive science, and though in some parts erroneous, and in many insufficient, it still contained enough of truth to form a firm basis for the observations collected during many successive years. His doctrines were strongly opposed by Whytt and others, and in the controvorsies that followed numerous new facts were advanced and the most important additions to physiological knowledge rapidly made. It was soon shown that the restriction of the vital powers to the two, as defined by Haller, was much too exclusive, for that there were many parts which, though they gave no evidence of possessing either of them, were not the less alive, while others to which Haller refused these properties gave sufficient demonstration of possessing them when excited by othor and appropriato stimuli. Hence first originated the discovery of the fact that for the action of each organ a peculiar stimulus is required, and that each tissue has what Bichat, who illustrated it most completely, called a *vie propre*.

But even if Haller had not attempted to establish any such great generalization of vital phenomena as this, his learning and his admirable mode of studying physiology might have been sufficient to obtain for him a reputation nearly as high as that which he has always enjoyed. Possessed of a competent knowledgo of all the sciences which could throw any light on the actions occurring in the living body, he pointed out in numberless instances what part of them was to be attributed to the laws of inorganic matter and what to those peculiar to the state of life, whilo he carefully avoided admitting any of the former as sufficient by themselves to explain the whole of the latter, which had been the chief error of nearly all his predecessors. He rarely drew any conclusion respecting the mode of action of any organ or part in the human body, without previously investigating the analogous function in the bodies of animals by dissection or experiment; and he tells us that he often found that questions to which no sufficient answers could be obtained by observations on the human body, were at once solved by his examinations in the various classes of animals. Deeply read in all the works of those who preceded him and in all those of his cotemporaries in every nation, he did not attempt to decide anything till he had considered all their statements and compared them with his own investigations, and hence each of his works contains so perfect an epitome of the labours of all former writers on the same subject, and a mass of evidence so extensive, that whatever errors the conclusions he sometimes arrived at may contain, they can never fail to be records of the highest value. At the same time the elegant and lucid style in which they are written, the result of the combination, almost unique, of the poet with the anatomist, has rendered them attractive, notwithstanding their great extent, to his successors in every country.

Haller was fortunate in receiving the high honours which he deserved during his life-time. In 1739 he was appointed physician to the king of England. In 1743 he was elected a fellow of the Royal Society of London, and at different times subsequently of all the scientific societies of Europe. When George II. visited Göttingen in 1748 he was ennobled by the omperor: he was invited by Frederick the Great to settle in Berlin, with a handsome salary, to which no duties were attached, and was offered a professorship at Oxford and at Utrecht. He enjoyed throughout his life the friendship and esteem of the most eminent of his contemporaries throughout Europe; and, varied as his pursuits wore, he acquitted himself in all with the highest honour and success. It would be impossible here to give a complote list of his original writings and compilations; few writers have ever been so voluminous· and it is extraordinary that, amidst all his personal and laborious investigations, he should have had opportunity for the composition of so extensive a library as they alone would form. A large portion were probably formed from the accumulation of notes which he had made in following out his system of invariably recording everything which appeared to him worthy of notice; a plan which, commenced, as we have seen, in childhood, he continued without intermission to the last years of his life. The following are his principal works:—

His chief poetical production, 'Versuch Schweizerischer Gedichte,' was published anonymously at Berne; afterwards two more editions of it were printed there, and four at Göttingen. Three editions of a French translation were also published. From 1750 to 1760 he was engaged in publishing, in 19 vols. 4to., a number of the most select disputations and theses in anatomy, surgery, and medicine, and from 1757 to 1766 his 'Elementa Physiologiæ Corporis Humani,' undoubtedly the greatest work on medical science which the eighteenth century produced. It contains every fact and every doctrine of physiology at that time known, and is written in such a style of elegance and classical beauty that it is still a model for writers on the same subject. It appeared in eight 4to. volumes from 1757 to 1766, and a posthumous 'Auctarium' was published in 1782 in four 4to. fasciculi. From 1774 to the time of his death he was engaged in publishing part of his 'Bibliothecæ Anatomiæ, Chirurgiæ, Medicinæ Practicæ, Botanicæ, et Historiæ Naturalis,' which form together ten 4to. volumes, of which the publication was completed posthumously. They aro composed principally of abstracts of the writings of all the most esteemed authors on each subject, so as to form a complete history of the doctrines of each science. His 'Icones Anatomicæ,' which were published from 1743 to 1756, contain most accurate and well-engraved representations of the principal organs of the body, especially of the arteries. The greater part of his contributions to the various scientific transactions, and of his shorter works, were collected in his 'Opera Minora,' in 3 vols. 4to., from 1762 to 1768. The most valuablo of the papers contained in them are those on the Development of the Chick, on tho Formation of the Heart and the Bones, on the Circulation, and on the Eye. (*Das Leben des Herrn von Haller*, von J. G. Zimmermann, 1 vol. 8vo., 1755; Senebier, *Eloge de Haller*, Geneva, 1778; *Histoire de la Medicine*, par K. Sprengel.)

HALLEY, EDMUND. The materials for the personal life of Halley are principally in the Biographia Britannica, which makes considerable use of a manuscript furnished by Mr. Price, Halley's son-in-law Some years ago a manuscript belonging to the Bodleian library, purporting to be the life of Halley by some one acquainted with him, was read to the Royal Astronomical Society (see their Monthly Notice, December, 1834). We find some extracts from this manuscript agreeing almost word for word with passages in the Biog. Brit., and conclude that the document in the Bodleian library is the original, or perhaps an abridged copy, of that cited in the printed work. The éloge of Halley in the Memoirs of the Academy of Sciences is by Mairan, and is reprinted in the small collection of éloges by that writer, Paris, 1747.

Edmund Halley was born October 29th, 1656, at Haggerston, near London, at a country-house belonging to his father, who was a soap-boiler in Winchester Street, London. He was educated at St. Paul's school, under the care of Dr. Gale, and was placed at Queen's College, Oxford, in 1673, being then possessed of much erudition for his age, and a strong turn for observation, as appears by his having discovered for himself before he left school the alteration in the variation of the magnetic needle. At the university, being well supplied with instruments by his father, he began to apply himself to astronomy, and before he reached the age of twenty he had given (in the Phil. Trans.) a memoir on the problem of Kepler, had invented a method of constructing the phases of a solar eclipse, and had made many observations, particularly of Jupiter and Saturn, the results of which we shall presently see. Finding however that nothing could be done in planetary astronomy without more correct tables of the stars, and relying upon Flamsteed and Hevelius for the amelioration of the northern catalogues, he determined, with his father's consent and assistance, to appropriate to himself the task of forming a catalogue of the southern hemisphere. Furnished with a recommendation from Charles II. to the East India Company, he set sail for St. Helena in November, 1676, and remained there two years. His 'Catalogus Stellarum Australium,' published in 1679, was the result of this voyage, and contains, besides the positions of 350 stars, some other points of interest, particularly an observation of the transit of Mercury over the sun's disc, and a hint that such observations might be employed to determine the sun's parallax (afterwards so successfully carried into effect with the planet Venus). He also notices the increased curvature of the moon's orbit when in quadratures, which was afterwards explained by Newton. In his voyage out he had observed the fact that the oscillations of a pendulum increase in duration as the instrument approaches the equator.

At his return from St. Helena the king granted him a mandamus to the university of Oxford for the degree of Master of Arts, and he was elected a Fellow of the Royal Society. This body sent him to Danzig in 1679 to judge of the observations of Hevelius, who maintained the superior accuracy of instruments with simple sights, in opposition to Hook, who advocated the use of the telescope. Halley was a man of rapid movements: in November, 1678, he returned from St. Helena; in May, 1679, he set out for Danzig, having in the interval published his catalogue, and procured his Oxford degree, and admission to the Royal Society. He returned from Danzig in July, and remained at home till the end of 1680, at which time he set out on a continental tour, accompanied by his schoolfellow Mr. Nelson, since well known as the author of a work on the Feasts and Fasts. In December, being on the road to Paris, he saw the celebrated comet of 1680 in its return from perihelion, being the first who perceived it since it was lost in the preceding month. This body he observed with Cassini at Paris, and the observations thus made are remarkable as forming part of the foundation upon which Newton, in the Principia, verified his deduction of a comet's orbit from the theory of gravitation. He returned to England at the end of 1681, and in 1682 married the daughter of Mr. Tooke, auditor of the Exchequer, with whom he lived fifty-five years. He resided at Islington till 1696, and in 1683 published his theory of the variation of the magnet, followed by other papers in subsequent years, containing ingenious speculations, now forgotten. His astronomical occupations during this period consisted chiefly of lunar observations and comparisons. He was strongly of opinion that the moon would, when sufficiently known, furnish the means of finding the longitude, and at this period it seems that he had formed the idea of observing that body through a whole revolution of the nodes. His observations (1682-1684) are published in Street's 'Astronomia Carolina.' He was interrupted however by the state of his father's affairs, which had suffered by the great fire.

Among other objects of speculation he had considered the law of attraction, which he imagined must be as the inverse square of the distance. Having applied in vain to Hook and Wren for assistance in the mathematical part of the problem (himself being more of a mathematician than either), he heard of Newton, and paid him a visit at Cambridge. Finding all he wanted among the papers of his now friend, he never rested until he had persuaded Newton to publish the Principia, of which he superintended the printing, and supplied the well-known copy of Latin verses which stand at the beginning. In 1691 he was a candidate for the Savilian professorship, which he lost, according to Whiston, on account of his avowed unbelief of the Bible. This rests on the authority of Whiston, and of an anecdote to be found in Sir David Brewster's Life of Newton, and yet it is certain that he afterwards was appointed to the same professorship, and as he then obtained the degree of doctor of laws, which required no subscription to articles, it may be presumed his opinions, if known, were not considered to be a disqualification. Flamsteed, if we remember rightly, speaks of his opinions on this matter as things of common notoriety. In 1696 he was appointed comptroller of the mint at Chester, where he resided two years.

In 1698 king William, who had heard of his magnetic theory, gave him the commission of captain in the navy, with the command of a small vessel, and instructions to observe the variation of the magnet, and the longitude and latitude of places in the American settlements, and to attempt the discovery of land south of the Western Ocean. He set out in November, but was compelled to return by the insubordination of his first lieutenant. Having tried this officer by a court-martial, he set out again in September, with the same ship and another, observed in many parts of the Atlantic as far as the ice would permit, touched at the Canaries, Madeira, Cape de Verd Islands, St. Helena, Brazil, Barbadoes, and returned September, 1700, having not lost a man by sickness during the whole voyage. He published in 1701 a chart of the variation of the magnet in all seas of the known world, and immediately afterwards sailed to survey the coasts of the Channel, of which he also published a chart. He was then twice successively ordered to the coast of the Adriatic, to assist in the formation and repairs of harbours in the emperor's dominions, and returned to England in November, 1703, just in time to succeed Dr. Wallis, who had died a few weeks before, in the Savilian chair of geometry at Oxford.

If Halley was active and energetic, he was no less universal. The captain-professor found an unfinished translation by Dr. Bernard of a tract of Apollonius, and, though he did not understand Arabic, undertook to complete the work. [Apollonius Pergæus.] The Oxford MS. says, 'This he did with such success, through his being so great a master of the subject, that I remember the learned Dr. Sykes (our Hebrew professor at Cambridge, and the greatest naturalist of his time when I was at that university) told me that Mr. Halley, talking with him upon the subject, showed him two or three passages which wanted emendation, telling him what the author said, and what he should have said, and which Dr. Sykes found he might with great ease be made to say, by small corrections he was by this means enabled to make in the text. Thus, I remember Dr. Sykes expressed himself, Mr. Halley made emendations to the text of an author he could not so much as read the language of.' It is not necessary (after the article last cited) to say more of the splendid edition of the whole of Apollonius, published in 1710.

The Miscellanea Curiosa, a collection of pieces, mostly from the Philosophical Transactions, many of them by himself, was superintended by him, and published in 1708.

Halley resided at Oxford for some years after his appointment to the Savilian chair, nor do we know when he again became a permanent resident in London: it was however not later than 1713, for in that year he became secretary to the Royal Society. He had been assistant-secretary before, as far back as 1685, and the Transactions from 1686 to 1692 were superintended by him. From the manner in which his name is mixed up with the affair of Flamsteed, he must have resided in town for some years previous to 1713. [FLAMSTEED.] In the article cited we have called Flamsteed's work the Principia of practical astronomy; and it were to be wished the connexion of Halley with the printing of this one had been as creditable as that which links his name with the Principia of Newton. It is difficult to say to what extent Halley was involved in originating any of the unworthy proceedings to which we allude; and we must protest against his being made a scapegoat for Newton, in which position even Flamsteed seemed inclined to place him, as well as several more recent writers on the controversy. Neither the position nor the character of Halley renders it likely that he would prefer making a tool of Newton to any direct mode of aggression. The committee appointed by Prince George of Denmark must bear the blame of all the formal proceedings; and in that committee the name of Halley is not found, though it is on the list of those who published the Commercium Epistolicum, a position which we cannot defend. [COMMERCIUM EPISTOLICUM; FLUXIONS.]

At the beginning of 1720, after the death of Flamsteed, Halley was appointed astronomer-royal. In the previous years he had been employed in completing his lunar and planetary tables, which were then ready to be published. But upon his appointment to Greenwich he revived his old idea of observing the moon through a revolution of her nodes. It was doubtful that at the age of sixty-four he should live to complete an undertaking which required nineteen years of health; but he did undertake it, and did live to finish it. The result is the comparison of nearly 2000 observed lunar places with his previously formed tables. [GREENWICH OBSERVATORY.] He died January 14, 1741-42, in the 86th year of his age.

The remarks on the personal character of Halley which appear in the éloge of Mairan were furnished (it is asserted) by his friend Mr. Folkes, and their justice must be allowed so far as they speak of his prodigious information and activity. His disinterestedness in money matters is supposed to be attested by his request to Queen Caroline not to increase the salary of the astronomer-royal on his appointment to that office, lest it should afterwards become an object of ambition to incompetent persons; but, though allowing that Halley was not greedy of gain, we see but little to commend in this act of a man of independent fortune. The social qualifications of Halley were such as endeared him to his friends; and he could, when no partiality stood in the way, be fair and just to others. Thus Mairan remarks on his not having treated either Des Cartes or Vieta with the injustice which their memory received from several English writers. It were to be wished that he had been as free from personal as from national prepossessions, and that Leibnitz and Flamsteed had received their due from the friend of Newton. In his edition of the observations of the latter [FLAMSTEED] he inserted a preface containing culpable misrepresentations, an account of which is to be found in Mr. Baily's work. We shall also cite the following suppression, which is a parallel to that of Newton mentioned in the article FLUXIONS, since any presumption which can be afforded of the frequency of the practice may be some palliation for the particular cases. In all the editions of the Synopsis Cometica published during Halley's life a numerical deduction from observations is given, to which the following is appended: 'At the *moment* of the first example the comet was observed at London to be close to the second star of Aries, of which it was nine minutes north, and three minutes east; the observer being *Robert Hook*.' But in the augmented edition left by Halley to be published with his tables, the comet, at the same *hour* as in the preceding, is nine or ten minutes north of the star of Aries, and nearly in the same longitude; the observer being no longer Robert Hook, but Auzout and another. Doubtless Halley had quarrelled with Hook (as almost everybody was obliged to do) in the interval; and though the example was evidently worked for comparison with Hook's observation, at the same *moment*, we find it struck out in favour of one by Auzout in the same *hour*.

But though the scientific fame of a philosopher be no excuse for that suppression of his faults to which biographers are prone, still less should the latter be allowed to colour our views of the former. Among the Englishmen of his day Halley stands second only to Newton, and probably for many years after the publication of the Principia he was the only one who both could and would rightly appreciate the character and coming utility of that memorable work. His own attention was too much divided to permit of his being the mathematician which he might have been; but nevertheless his papers on pure mathematics show a genius of the same order of power, though of much less fertility, than that of John Bernoulli. We shall close this article with a brief account of his printed writings, and of the most remarkable points in them.

The separate works of Halley consist of the 'Catalogus Stellarum Australium,' &c., London, 1679, translated into French by M. Royer in the same year; the work of Apollonius 'De Sectione Rationis,' Oxford, 1706; the Conic Sections of Apollonius, Oxford, 1710; the unfortunate edition of Flamsteed's 'Historia Cœlestis,' London, 1712; and the planetary tables published in 1749, though printed for the most part in 1717-19. The superintendence of this work is attributed to Bradley, though it is evident that he did not write the preface. Besides the preceding there are from eighty to a hundred memoirs, including many of small importance, in the Philosophical Transactions.

In astronomy we owe to Halley, 1. The discovery and the detection of the amount of what is called the *long inequality* of Jupiter and Saturn, which he confidently expected would be shown to be a consequence of the law of gravitation, as was afterwards done. 2. The detection, by comparison of antient and modern observations of eclipses, of the slow acceleration of the moon's mean motion. 3. The first prediction of the return of a comet. [HALLEY'S COMET.] 4. The explanation of the appearance of Venus in the daytime at particular seasons, arising out of the now well-known method of estimating the brilliancy of the planet. 5. The recommendation to observe the transit of Venus for the determination of the sun's parallax.

The following list of the most remarkable labours of Halley out of astronomy, arranged in the order of publication, will instruct the reader to what articles to look for further information:—1. On the variation of the compass. 2. The law according to which the mercury falls in the barometer while the instrument ascends, being the first application of this instrument to the measurement of heights. 3. Theory of the trade-winds. 4. Construction of equations of the third and fourth degree. 5. Estimation of the quantity of vapour raised from the sea. 6. Inquiry into the point at which Julius Cæsar made his entry into Britain. 7. Tables of mortality, from observations made at Breslau, the first of the kind constructed. 8. Application of algebra to the problem of lenses. 9. Method of constructing logarithms, a celebrated paper, reprinted in Sherwin's 'Logarithms.' 10. Improvements in the diving-bell. Those papers only have been cited which refer to points on which Halley's name is inseparably connected with the history of the progress of science.

HALLEY'S COMET, the first of the comets which was proved to be a constituent part of the solar system, and to revolve regularly round the sun, deriving its name from HALLEY, the astronomer who first discovered that it had made several revolutions within the æra of correct astronomical observation, and predicted the year of its return. For the other periodic comets now known, see COMET OF BIELA, and ENCKE'S COMET. See also the general article COMET.

We cannot here attempt to give an account of this body in detail proportioned to the interest which its recent appearance excited; but such detail is rendered unnecessary by the number of publications which then appeared. Exclusively of articles scattered through the 'Astronomische Nachrichten,' the notices of the Astronomical Society, and other astronomical periodicals, and also of communications to the daily papers, the editors of which, as might be supposed, were not always able to detect the difference between sound and superficial knowledge, we may refer the reader to the following articles: 'Some account of Halley's Astronomiæ Cometicæ Synopsis,' Oxford, 1835, by Professor Rigaud: 'Des Comètes en Général,' by M. Arago, Paris, 3rd edition, 1834; 'Notice sur la Comète de Halley,' by M. Pontécoulant, Paris, 1835; and for the general history, to an article in the 'Companion to the Almanac' for 1835; and for the history of mathematical methods, to the address of the Astronomer-royal to the Astronomical Society, on delivering their medal to M. Rosenberger, in their 'Monthly Notices,' vol. iv., p. 50.

The 'Astronomiæ Cometicæ Synopsis' o Halley was published in the Philosophical Transactions for 1705, and again at the University press in Oxford, and also in an English translation published in London in 1705, which was reprinted in 1706, in the Miscellanea Curiosa. It was again reprinted in the second edition of Gregory's Astronomy, in an English edition of the same work, 1715, in Lemonnier's Theory of Comets, and was finally left for publication, in an augmented form, hy Halley himself, and was published with his tables in 1749. This work was a consequenee of the Principia of Newton, in which the method of applying Kepler's laws to the computation of the parabolic orbit of comets, the idea of the possibility of a periodic comet, and even an implied assertion that sueh things would be discovered, is to be found in book iii., prop. xli., first edition, 1687) · 'I leave their axes and times of revolution to be determined from the comparison of comets which return in the same orbits after long periods.' Halley, acting upon this hint, collected the observations of all such comets as had been observed with any degree of accuraey, up to the year 1700. These were 24 in number, and had appeared in the following years:—

1337	1580	1652	1680
1472	1585	1661	1682
1531	1590	1664	1683
1532	1596	1665	1684
1556	1607	1672	1686
1577	1618	1677	1698

On looking over the list, it needed only a glanee to see that three of these comets exhibited very nearly the same orbit, and that the intervals of the appearances were very nearly the same. The following extract from Halley's table will show this:—

In the years	1531	1607	1682
Comets appeared having	° ′	° ′	° ′
Long. of asc. node	49 25	50 21	51 16
Incl. of orbit	17 56	17 2	17 56
Long. of perih.	301 39	302 16	302 52
Perih. distanee, that of earth being 1.	56700	58680	58328
Perih. passage	Aug. 24.	Oet. 16.	Sept. 4.
Distanee from perih. to asc. nodo	° ′ 107 46	° ′ 108 5	° ′ 108 23
Motion	Retrog.	Retrog.	Retrog.

The interval hetween the perihelion passages of the first and second comet is fifteen months longer than that between the second and third, which might have puzzled a person not acquainted with the Principia. But the disturbing action of the planets, wbich has since heen so successfully computed that the motion of this hody is now much better known than was that of the moon in the time of Halley, immediately suggested itself. He announced accordingly the return of the comet about the year 1758.

It may seem perhaps that we have lessened the éclat of Halley's announeement by attributing the hint to Newton, and making his part of the work seem to be mere calculation. But it must he remembered that though at this time an expert computer in the Nautical Almanae Office would perform the same work in half a year, yet Halley had all the difficulties of a less advaneed state of pure mathematics. He had his method to organize, if not to invent; and so rare were those who had a competent understanding of the Principia, that, after a little hesitation, we agree perfectly with the astronomer-royal in saying that Halley was in all probability the only man in Europe who was competent to perform this labour.

In the latest edition of the Synopsis Halley examined the elements of the eomet's orbit further, and repeated his predietion still more eonfidently, desiring that all would remember that its author was an Englishman, 'Quoeirca si secundum prædicta nostra redierit iterum circa annum 1758, hoc primum ab homine Anglo inventum fuisse non inficiabitur æqua posteritas.' Among the years preceding 1531, in which the same eomet probably did become visible, 399, 1305, and 1456 are years of well attested eomets. But there is less evidence for the years A.C. 130, and A.D. 323, 550, 930, 1005, 1230, and 1380, all of which are described as years in which comets appeared in the collection of Lubienietski, upon various authorities.

The prediction of Halley caused various astronomers to eompute orbits of the coming comet, but none of these took into account the perturbations eaused by the planets. In 1757 Clairaut and Lalando (see these names) undertook the enormous labour of computing the effect of the perturbations of the principal planets through a period of 150 years. Assisted by Madame Lepaute, wife of a well-known watchmaker of that name, Lalande performed the drudgery of the process, while Clairaut, the first who extended Newton's application of his theory, applied the results. The consequence was, that in November, 1758, when the comet was already expected, the announcement was made that it would arrive at its perihelion within a month, one way or the other, of April 13, 1759. The announcement of Clairaut was just in time, for on December 25, 1758, George Palitzch, a farmer and amateur astrouomer in the neighbourhood of Dresden, detected the comet. It was afterwards repeatedly observed in various parts of Europe, bnt it is not on record that any one saw it with the naked eye, nor was its position at all favourable for that purpose. Various orbits were computed, but no one seemed inclined to undertake the task of applying the corrections for perturbation, so as to prediet the perihelion place for 1835. The comet slept in peace therefore until the improvement of methods of computing the perturbations, and the approaeh of a new appearanee, induced first the Academy of Turin, and next that of Paris, to offer prizes on the subject. The first was gained by M. Damoiseau, the second by M. de Pontécoulant (1817 and 1833). And M. Rosenberger at various times (*Astron. Nachr.*, Nos. 196, 180, 250, 276, 288), computed the elements of the orbit for 1682 and 1759, and the whole of the perturbations from 1682 to 1835. This enormous labour has been duly appreciated, and has placed M. Rosenberger in a very honourable position among living astronomers.

The following list of elements (extraeted from the Nautical Almanac for 1835) were given, the first by M. Pontécoulant from his own computation of perturbations, the second hy M. Damoiseau, the third by Mr. Lubhock, who applied the perturhations of M. Pontécoulant to elements for the year 1759, computed by himself. The fourth column contains the elements approximately corrected, during the reappearanee of the comet, by the superintendant of the Nautieal Almanac, from 56 roughly reduced right ascensions and deelinations.

Perih. passage 1835.	November. 7·2 Paris Mean time from noon.	November. 4·32 Paris Mean time from midn.	October.* 20·2 Paris Mean time from midn.	November. 15·93546 Greenwich mean astron. time,
Place of perih. on the orbit	304° 31′ 43″	304° 27′ 24″	304° 23′ 39″	304° 32′ 9″·2*
Long. asc. node	55° 30′ 0″	55° 9′ 7″	55° 3′ 59″	55° 8′ 21″·2*
Incl. of orb.	17° 44′ 24″	17° 41′ 5″	17° 42′ 50″	17° 45′ 56″·7
Excentricity	·9675212	·9673055	·967348	·9675509
Semi-ax. maj.	17·98705	17·9852	17·98355	18·0779386

The comet was first seen at Rome, on the fifth of August, by M. Dumouchel, director of the observatory of the Roman college. From that time it continued to be observed till the end of the year in Europe, and through a great part of the ensning spring in the southern hemisphere. During a part of the time it was distinctly visible to the naked eye. The number of good observations which were procured greatly exceeded, as might be supposed, those made on any previous occasion. And in full proportion to the increase of observers and instruments has been the means afforded to the astronomieal public of turning their ohservations to useful aecount. We allude to the Appendix to the Nautical Almanae for 1839, in whieh will he found the result of the most eomplete preparation for the treatment of observations which has ever been furnished for any heavenly body. Taking the elements above given as a basis, it contains the perturbations of the comet by all the planets from the beginning of August, 1835, to the end of March, 1836, the deduction of the variations of the elements during every four days, the computation of an ephemeris for the whole period, and finally the equations of eondition by the help of which an observer may deduee the corrections of the elements of the orbit which his own observations should indieate. These last are given as often as eight times a-day, for the period of the comet's most rapid motion. Every thing therefore which could be done previous to the observation being made, is effected: and the praise due to Lieut. Stratford and his assistants for this voluntary addition to their already arduous labours has heen awarded hy judges more competent than ourselves.

The history of the last appearance of Halley's comet is not yet completed, nor ean it be until the reduction and comparison of all the observations are made to produce a new

* From mean Equinox of November 15, 1835.

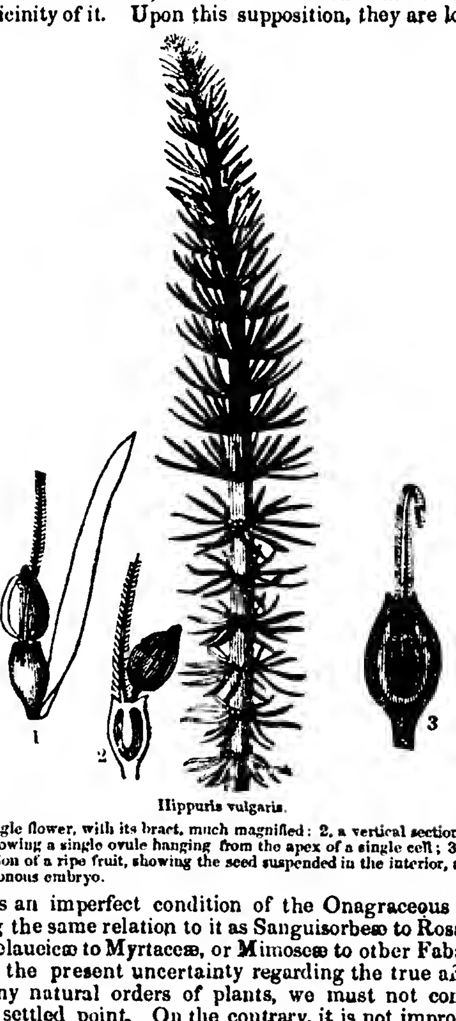
determination of the elements of 1835. Those who have collected the materials, both theoretical and practical to which we have alluded, have been working for posterity; and it is the year 1911 which must show the progress of astronomy between 1759 and 1835, just as the year 1835 was evidence of the change which took place between 1682 and 1759.

HALLI'RHOA, the name proposed by Lamouroux for a group of fossil Polyparia, referred by many writers to Alcyonia. The spheroidal figure, contracted base, deep central pit, and pores on the surface, appear the characters most relied on by Lamouroux. Goldfuss gives characters for the genus Siphonia of Parkinson, which may include the two species mentioned by Lamouroux from the vicinity of Caen and the Vaches Noires. Hallirhoa costata of Lamouroux is found in the greensand of Normandy and England.

HALMATU'RUS. [KANGAROOS.]

HALO'DROMA. Illiger's name for a genus of sea-birds allied to the Petrels and Albatrosses. [LARIDÆ.]

HALORA'GEÆ, a small group of Exogenous plants, many of which inhabit watery places, and all of which have minute inconspicuous flowers. In consequence of the calyx being superior, the embryo without much albumen, and some of them having four petals, they are often considered to form a peculiar section of Onagraceæ, or if separated from that order, are at least stationed in the immediate vicinity of it. Upon this supposition, they are looked



Hippuris vulgaris.

1, a single flower, with its bract, much magnified: 2, a vertical section of the ovary, showing a single ovule hanging from the apex of a single cell; 3, a vertical section of a ripe fruit, showing the seed suspended in the interior, and the dicotyledonous embryo.

upon as an imperfect condition of the Onagraceous type, bearing the same relation to it as Sanguisorbeæ to Rosaceæ, Chamælaucieæ to Myrtaceæ, or Mimoseæ to other Fabaceæ. But in the present uncertainty regarding the true affinity of many natural orders of plants, we must not consider this a settled point. On the contrary, it is not improbable that Halorageæ constitute an imperfect form of the great Epigynous group of Exogens, of which Onagraceæ are only one of the members. What renders it peculiarly difficult to determine the real affinity of this little group is, that as it is now constituted, it offers striking modifications of development both in the organs of vegetation and those of fructification. While Haloragis has a stem with a complete vascular organization, and regularly constructed leaves, Myriophyllum has its vascular system reduced to a rudimentary condition, and in some of the species the leaves themselves appear only in the form of filiform ramifications; and in Hippuris, the development of the vascular system of both stem and leaves is still further reduced. In like manner in the flowers, Haloragis has four petals, eight stamens, four stigmas, and four cells to the ovary; Proserpinaca has no petals, three stamens, three stigmas, and three cells to the ovary; and Hippuris has no petals, one stamen, one stigma, and but one cell to the ovary. This latter genus is a common plant in the marshes and meadows of this country, where it is vulgarly called Mare's-tail.

HALS, FRANCIS, an eminent portrait-painter, born at Mechlin, 1584, died in 1666. No artist of that time was superior to him except Vandyck, and very few could be compared with him. With the first merit of a portrait, that of strong resemblance, his pictures were executed with remarkable freedom and boldness: his colouring was extremely good, and the effect very striking.

HALSTED. [ESSEX.]

HALYATTES. [ALYATTES.]

HALYMENITES. Under this generic name Sternberg (*Flora der Vorwelt*) and Bronn (*Lethæa Geognostica*) include several species of fossil fucoid plants, found in the slaty oolitic rocks of Stonesfield and Solenhofen.

HALYS. [KIZIL ERMAK.] We have referred to this head, because some further information on this river may be soon expected.

HALYSITES, the name given by Fischer to a genus of fossil corals, synonymous with Catenipora of Goldfuss. As having priority, it is adopted by Bronn in his 'Lethæa Geognostica.'

HAM, EAST and WEST. [ESSEX.]

HAMADAN. [ECBATANA.]

HAMAMELA'CEÆ, or HAMAMELI'DEÆ, a very small group of woody Exogenous plants, characterized by having a superior calyx, a definite number of stamens, half of which are usually sterile, a two-celled ovary, and an embryo in the midst of horny albumen. There are only three genera in the gardens of this country, Hamamelis, Trichocladus, and Fothergilla. It is at present uncertain to what order Hamamelaceæ are most nearly allied, and until some further discoveries shall have been made, the question is not likely to be settled. Some of the species are large forest trees, affording good timber, but nothing is known of any other useful property in the order.

HAMBURG, the largest city in Germany after Vienna and Berlin, and by far the most important emporium of commerce, is situated in 53° 33′ N. lat., 9° 58′ 35″ E. long. The origin of this city is attributed to Charlemagne. The founder chose for its site the most elevated spot on the north bank of the Elbe and the east bank of the Alster, about 75 miles from the German Ocean. Though at first merely the resort of fishermen, its advantageous position could not fail to make it in time a place of trade. It was several times destroyed by the neighbouring barbarians, yet it always recovered, and had attained considerable commercial importance at the beginning of the twelfth century. In the thirteenth century it concurred in the formation of the Hanseatic League. [HANSE TOWNS.] Till 1500 it was confined to the space between the Elbe and the east bank of the Alster; but the west bank was gradually built upon, especially by refugees from the Netherlands, who fled from the tyranny of the Duke of Alba. Hence arose the new town, which increased so rapidly that it was thought advisable to extend the walls so as to enclose it within the city. The actual fortifications of the city were not further enlarged after this time, though some outworks were made and a fortified line was formed enclosing the suburb of St. George. Its rights as an estate of the empire were contested by the Danes, and though it was recognised as such in 1618, it did not obtain a seat or vote in the Diet. The kings of Denmark claiming the sovereignty as counts of Holstein, Hamburg was obliged at different times to avert a threatened attack by the payment of large sums, till a convention with the house of Holstein in 1768 removed all difficulties; and in 1770 it was confirmed by the emperor in its rights as a free city of the empire. The possession of the cathedral had been always claimed by the archbishops of Bremen, but it was assigned by the treaty of Westphalia in 1648 to Sweden, and afterwards passed to Hanover with the duchy of Bremen. The general effect of the repeated wars in Germany to the close of the eighteenth century was favourable to Hamburg, by causing a great addition to its population and its wealth, and extending its commerce. In

1802 the cathedral and all the property hitherto belonging to Hanover in the city and territory were finally assigned to Hamburg, and its independence still further secured. Thus Hamburg at the commencement of the nineteenth century was one of the most flourishing, happy, and opulent cities of the Continent. Its misfortunes commenced with the occupation of Hanover, in 1803, by the French, who seized Ritzebüttel, at the mouth of the Elbe, to prevent English ships from entering the river. Upon this the English instituted a most rigorous blockade, so that the commerce of Hamburg was paralyzed, and its direct maritime trade interrupted. It was compelled by French threats to advance two millions and a half of Banco marks (about 200,000*l.* sterling) to the estates of Hanover. After the pillage of Lübeck in 1806 Marshal Mortier with his corps occupied Hamburg, and made the city pay sixteen millions of francs as a ransom for the English goods in the warehouses. Though the French troops were withdrawn after the treaty of Tilsit, and the city had for a short time a shadow of independence, it was still subject to numerous extortions from the French generals. The decrees of Berlin and Milan ruined the little remaining trade of Hamburg, and the English goods which it had been forced to ransom were now confiscated and consigned to the flames. At the end of 1810 it was incorporated with the French empire as the capital of the department of the Mouths of the Elbe. In 1813 the citizens hailed with rapture the entrance of a Russian corps, at the approach of which the French had evacuated the city. The old constitution was restored; a burgher guard of 7000 men was formed, and two thousand of the inhabitants volunteered to join the allies, and the Russians repaired the fortifications, which had been partly razed. But the French soon returned and attacked the city on the Elbe side. The Russians, being too weak, withdrew, and Marshal Davoust and General Vandamme entered Hamburg, which they treated with a degree of wanton severity that excited in the highest degree the sympathy and indignation of Europe. They imposed a contribution of two millions sterling; and being afterwards besieged, drove out 40,000 inhabitants in the depth of winter, and even seized the treasure deposited in the bank, amounting to about 700,000*l.* sterling. An unhappy combination of circumstances enabled them to retain possession of it till May, 1814. On the 26th of that month the old constitution was restored, and on the 8th of June, 1815, Hamburg joined the German Confederation as a free Hanseatic city. For all its severe sufferings, including the robbery of the bank, a very inadequate indemnity was obtained from France at the peace. But the public spirit of the inhabitants, its internal resources, and its favourable situation, have gradually restored its former prosperity.

The territory of Hamburg, including the area of the city (which is nearly an oval four English miles in circumference), is about 150 square miles, bounded on the south by the Elbe, and on the other sides by the Danish territories. It has likewise some islands in the Elbe, some parcels of land on the Hanoverian side of the river, and the bailiwick of Ritzebüttel at the mouth of the Elbe, in which is the harbour of Cuxhaven. Conjointly with Lübeck it has the bailiwick of Bergedorff, and the districts called the Vierländen, 16 miles from Hamburg, with 10,000 inhabitants. The population of Hamburg and its suburbs is 100,000; and that of the territory, including Bergedorff, between 25,000 and 30,000. The great majority are Lutherans. The Roman Catholics may be from 5000 to 6000, the Calvinists 1500 to 2000, and the English may fluctuate between 1000 and 1500; the number of Jews is stated in some late works at 14,000, which we believe to be more than double the real number. In 1824 it appeared from the bills of mortality that they could not exceed 4000.

The constitution is a mixture of aristocracy and democracy. The senate, consisting of four burgomasters and twenty-four senators, with four syndics and four secretaries, has the executive power, and the sole right of proposing laws; but no laws can be made and no taxes imposed without the consent of the citizens in common hall. The citizens are divided into five parishes, each of which chooses 36 members to the council of 180, consisting—1, of 15 elders, who are the guardians of the laws, and have the affairs of the churches and the poor under them; 2, of 45 deacons, 9 from each parish, who with the elders form the council of 60; and 3, of 24 subdeacons from each parish: all these are obliged to appear in the common hall, where at least 200 citizens must be present. From this council is chosen the board of 60, and out of that the 15 elders or aldermen. Only the senators and the elders receive salaries. For the administration of justice there are various tribunals. In the last resort the decision is with the High Court of Appeal for all the free cities, sitting at Lübeck. In the German Diet Hamburg has one vote in the deliberations, but in the select council it has a vote only in common with Lübeck, Bremen, and Frankfort. Its contingent to the army of the Confederation is 1298 men, and its contribution to the general fund 500 florins per annum. It has also an admirably organized burgher guard of 9000 infantry, cavalry, and artillery.

The interior of the city by no means corresponds with its commercial importance and its wealth. As in most of the old fortified towns of Germany, the streets are in general narrow, irregular, and dark; the houses old-fashioned and awkward, and yet not interesting to the lovers of antiquity. In modern times handsome houses have certainly been erected in some streets, but they are exceptions. Some streets in the New Town are indeed broader and more regular, but that is all. Nor can Hamburg boast of its public buildings, either ecclesiastical or civil. The number of churches has been reduced of late years: the antient cathedral was pulled down almost as soon as it was ceded to Hamburg, and since the peace four smaller churches have been demolished. There are now five principal and six smaller churches or chapels: the former, having been shamefully profaned by the French, who used them as stables for their horses, and committed the most wanton mischief, have been much beautified inside since 1814. The most worthy of notice is the great church of St. Michael, which was saved from French desecration. It was begun in 1751, and completed in 1762, except the spire, which was not erected till 1778. This church, built by Sonnin, is the pride of Hamburg; it is capable of accommodating 2000 persons: the height of the steeple is said to be 456 feet. These churches are all Lutheran. The Roman Catholics had formerly no places of worship, except the chapels of the ambassadors of that religion; but the French seized for their use the small church of St. Michael, which has since been granted them by the city. Of the public edifices, the most distinguished for their style of architecture are the new bank, the new observatory, and the new theatre, built after a design of the celebrated Schinkel of Berlin. But if the public edifices have so little to recommend them, Hamburg may well be proud of the number and variety of its charitable institutions, the bare enumeration of which would exceed our limits, but of which it may be affirmed that they are on the most liberal plan, and managed in the most exemplary manner. There are only two learned institutions supported by the state—the Johanneum, designed to qualify young men for the university, and the gymnasium. Hamburg has been the birth-place of many learned men and the chosen residence of many others. Its numerous literary institutions, its private collections of paintings, the general taste for music, the fondness for the study of foreign languages, prove that the whole attention of the inhabitants is not absorbed by thirst of gain. The principal public library, called the City Library, contains nearly 200,000 volumes, besides 3000 volumes of MSS.

The arm of the Elbe, next the town, is narrow, but the two harbours are capable of receiving a considerable number of ships. The old town is so intersected with canals as to resemble a Dutch city: the canals are filled chiefly by the Elbe, but partly by the Alster, and almost all the warehouses are close to them. The Alster forms on the north side of the town a fine basin, chiefly used for parties of pleasure. On the south side of this basin is the finest line of houses in the city, with a spacious walk planted with trees, and called the Jungfernsteig, or Ladies' Walk. Since the peace, this favourite promenade has been continued along the west side of the basin, so as to join the ramparts, the whole of which are beautifully laid as a public garden and promenade (the carriage-way is broad enough for three carriages), all round the city, affording a most agreeable place of recreation to the inhabitants. North of this Inner Alster is the Outer Alster, a very large basin, on the banks of which are numerous fine country-seats, which however are not equal to those possessed by some of the wealthy merchants in the Danish territory, at Blankenese, on the banks of the Elbe, six miles west of Hamburg.

To give an account of the vast commerce of Hamburg would fill a volume. Every thing that can be bought and sold, however costly or however mean, is an object of trade, which is as free as can be desired. The import duties are extremely low, and no transit duties are levied. This city is consequently the great receptacle for English goods imported into Germany, and of the ships (about 2000 in number) which annually enter the port, at least one-third are English. Within these few years there has been a regular communication by steam-boats with London, Hull, Leith, Amsterdam, and Hâvre. (J. L. v. Hess, *Hamburg, Topog. Polit. Histor.;* K. J. H. Hutte, *Ansichten der Stadt Hamburg;* H. E. Lloyd, *Hamburg*, &c.)

HAMEL, JEAN BAPTISTE DU, was born in 1624, and died August 6, 1706. In 1632 he published a very perspicuous treatise on the Sphærics of Theodosius, which was followed by several other works on natural philosophy and astronomy. Upon the foundation of the Royal Academy of Sciences by Louis XIV. in 1666, Du Hamel was appointed secretary, which office he continued to hold till 1697, when he was succeeded by Fontenelle. His philosophical and astronomical works were collected and published at Nürnberg, 1681, in 4 vols. 4to., and in 1698 appeared his history of the Royal Academy and its transactions, from its foundation to the year 1700. This latter work, entitled 'Regiæ Scientiarum Academiæ Historia,' is the only one which possesses any value at the present day.

HAMELN, a considerable town in the Hanoverian principality of Calenberg, at the confluence of the Hamel with the Weser, over which there is a bridge of boats. It has above 5000 inhabitants.

HAMILCAR, BARCAS, the leader of the popular party at Carthage, was appointed in the eighteenth year of the first Punic war (B.C. 247) to the command of the Carthaginian forces. We possess no particulars respecting his early life or the time of his birth; but we learn from Nepos (*Hamil.*, c. 1) that he was very young when he obtained the command. He ravaged with his fleet the coasts of the Bruttii and the Epizephyrian Locrians, and afterwards seized upon a strong fortress in Sicily, which was situated between Eryx and Panormus. In this place he continued for some years, with very little support from the Carthaginian government; and although the Romans were masters of almost the whole of the island, they were unable to dislodge him. He frequently ravaged the southern coasts of Italy as far as Cumæ, and defeated the Roman troops in Sicily. On one occasion he took Eryx, which he held till the conclusion of the war. The Romans at length fitted out a fleet to cut off all communication between Hamilcar and Carthage; the Carthaginian fleet sent to his assistance was defeated by the Roman consul Lutatius Catulus (B.C. 241), and the Carthaginians were obliged to sue for peace. This was granted by the Romans; and Hamilcar led his troops from Eryx to Lilybœum, whence they were conveyed to Africa. But a new danger awaited Carthage. The Carthaginian treasury was exhausted; and it was proposed to the troops that they should relinquish a part of the pay which was due to them. The soldiers rejected the proposal, appointed two of their number, Spendius and Matho, commanders, and proceeded to enforce their demands. Being joined by many of the native tribes of Africa, they defeated Hanno, the Carthaginian general sent against them, and brought Carthage to the brink of ruin. In these desperate circumstances Hamilcar was appointed to the command, and at length succeeded in subduing them after the war had lasted three years and four months.

After the end of this war Hamilcar was sent into Spain (B.C. 238). He remained in Spain nearly nine years, during which time he extended the dominion of Carthage over the southern and eastern parts of that country. He fell in a battle against the natives, B.C. 229.

The abilities of Hamilcar were of the highest order; and he directed all the energies of his mind to diminish the power of Rome. Polybius states his belief (b. iii., p. 165-6, *Casaubon*), that his administration would soon have produced another war with the Romans, if he had not been prevented by the disorders in which his country was involved through the war of the mercenaries.

Hamilcar was succeeded in his command in Spain by his son-in-law Hasdrubal, who must not be confounded with Hasdrubal the brother of Hannibal. He carried on the conquests of Hamilcar, and reduced almost the whole of the country south of the Iberus (Ebro), which river was fixed by a treaty between the Carthaginians and the Romans, B.C. 226, as the frontier of the Carthaginian dominions. Hasdrubal was murdered in his tent by a Gaul, B.C. 221, after holding the command eight years. (Polybius, b. i. ii.; Appian; Nepos.)

HAMILTON [LANARKSHIRE.]

HAMILTON, A. [GRAMMONT.]

HAMILTON, GAVIN, descended from a noble family of Scotland, spent the greater part of his life at Rome. Though not perhaps gifted with eminent genius for invention as an artist, yet a liberal education and refined taste enabled him at least to equal his most distinguished contemporaries. This is manifest in several subjects which he painted from the 'Iliad.' It is probable that he would have attained greater eminence had he devoted more time to the practice of his profession; but a considerable part of the latter period of his life was dedicated, perhaps more advantageously for the cause of the arts, to the discovery of antient monuments. He opened scavos in many parts of the Roman territory, especially at Tivoli, in Hadrian's villa. In the Museo Clementino, the statues, busts, and bas-reliefs contributed by him form the most important portion, next to the treasures of the Belvedere; and many great collections in Russia, Germany, and England are indebted to him for their chief ornaments. The 'Townley Gallery,' published under the superintendence of the Society for the Diffusion of Useful Knowledge, contains a list of the marbles procured by him for the collection of Mr. Townley. Neither the date of his birth nor death is certainly known; he died however between 1790 and 1800. However eminent his talents, they were excelled, says Fuseli, by the liberality, benevolence, and humanity of his character.

HAMILTON, WILLIAM, of Scotch descent, but probably born in London, studied at a very early age under Zucchi, the painter of ornaments, at Rome. After his return he soon obtained general employment. He was engaged in all the public works, such as the Shakspeare Gallery, Macklin's Bible, &c. He excelled in ornament, to which he gave propriety, richness, and a classic appearance. He died in 1801, at the age of fifty.

HAMILTON, SIR WILLIAM, a well-known diplomatist and lover of art, was born in Scotland in 1730. He began life, he says, 'with an antient name and 1000*l*.;' but removed the discrepance between his name and his fortunes by marrying in 1755 a lady of very large property, as well as amiable and agreeable character. It is said in the French biographies that he was foster-brother to George III., which may account for his appointment in 1764 to be English ambassador at Naples, whence he was not recalled till 1800. His connexion with the stirring events born of the French revolution, more especially with the brilliant exploits of Nelson in the Mediterranean, belong to the history of the period. The master-spirit in that troubled time was his second wife (married to him in 1791), the fascinating, mischievous, and wretched Lady Hamilton. [NELSON.] Sir William appears however to have maintained an unblemished character, except in his weak indulgence of his licentious wife. He was made a Knight of the Bath in 1771, and a privy-councillor in 1791. He died, much impoverished, in England, April 6, 1803.

Immediately after his arrival at Naples he applied himself diligently to observe and record the volcanic phenomena of the neighbourhood; and the continued activity of Vesuvius from 1766 to 1771 gave him excellent opportunity for these researches, of which his great work, the 'Campi Phlegræi,' Naples, 1776-7, 2 vols. fol., is a noble monument. It consists of a series of coloured plates, exhibiting the most remarkable volcanic phenomena and the scenery of the most remarkable spots with great vividness, accompanied by explanations in French and English. Sir W. Hamilton published a Supplement to it in 1779, containing similar representations of the great eruption of Vesuvius in August of that year.

His collection of Greek and Etruscan vases (now in the British Museum) was very valuable; the foundation of them was laid by the purchase of the Porcinari collection at Naples in 1765. They gave rise to that splendid work 'Antiquités Etrusques, Grecques, et Romaines, tirées du Cabinet de M. Hamilton,' 4 vols fol., published at Naples, the two first vols. in 1766, the others at a later date. The profit of the work was assigned to the editor D'Hancarville. Many of the marbles now in the Townley Gallery of the British Museum came from the collection of Sir W. Hamilton. (See *Library of Entertaining Knowledge, Townley Gallery*, vol. ii., index.)

Mr. Hamilton took a lively interest in all subjects connected with art or with antiquity, especially in the progress of the excavations at Herculaneum and Pompeii, and the formation of the museum of Portici. He was earnest in recommending to the Neapolitan government the great work of unrolling the Herculaneum manuscripts, but produced little effect on that most supine court. He himself bestowed a part of his income upon this object. Ten papers of his composition, upon matters observed during his abode in Italy, are printed in the 'Phil. Trans.' for the years 1767 to 1795 inclusive. His other works are, 'Observations on Mount Vesuvius, Mount Etna,' &c., Lond. 1772; and 'Lettera sul Monte Volture,' Naples, 1780. (Chalmers' *Biog. Dict.*; *Biog. Univ.*; Watt, *Bibl. Br.*)

HAMILTON, ELIZABETH, born at Belfast in Ireland, but probably of Scottish parentage, is deservedly remembered as an early advocate of an enlarged and intellectual system of female education, and as one of the leaders of that useful class of novelists who have placed the interest of their fictions, not in rare adventure and glowing description, but in the accurate portraiture of the daily workings of domestic life. We find little to tell of her personal history. It appears that she filled the office of governess to the daughters of a Scottish nobleman, for the eldest of whom her 'Letters on the Formation of the Religious and Moral Principle' were written. She died July 25, 1816, regretted and beloved. Her warm and sincere piety was untinctured by severity, and her natural cheerfulness and lively talents rendered her delightful in society, and, in old age, a universal favourite with the young.

The following are her chief works:—'Letters of a Hindoo Rajah,' 1796; 'Modern Philosophers,' 1800, a clever, popular, and effective satire, intended to throw discredit on the sceptical and republican doctrines taught by some disciples of the French Revolution; 'Letters on the Elementary Principles of Education,' 1801-2; 'Life of Agrippina,' 1804, an attempt to make history interesting, by expanding it into something bearing the resemblance of a novel; 'Letters on the Formation of the Religious and Moral Principle,' 1806; 'Cottagers of Glenburnie,' 1808; 'Exercises in Religious Knowledge,' 1809; 'Popular Essays,' 1813. Of these the 'Letters on Education' is the most sterling and important. She has here applied the principles of metaphysics to the subject of education, and shown (we quote words ascribed to a female writer of still higher note) 'how the doctrine of the association of ideas may be applied in early education to the formation of the habits, of temper, and to the principles of taste and morals; she has considered how all that metaphysicians know of secretion, abstraction, &c., can be applied to the cultivation of the judgment and the imaginations of children. No matter how little is actually ascertained on these subjects; she has done much in wakening the attention of parents, and of mothers especially, to future inquiry; she has done much by directing their inquiries rightly; much by exciting them to reflect upon their own minds, and to observe what passes in the minds of their children.' As a novelist, she will be best recollected by the 'Cottagers of Glenburnie,' 'a lively and humorous picture of the slovenly habits, the indolent temper, the baneful content, which prevail among some of the lower class of people in Scotland.' This piece, though only the picture of humble life in a remote and obscure district, can never lose its interest, for the characters are true to nature, essentially, not locally true; and the pathos, the humour, the admirable moral lessons, are of all time, and independent of the national peculiarities under which they are conveyed. (Notice ascribed to Miss Edgeworth, in the *Monthly Mag.* for September, 1816.)

HAMITES, a genus of Cephalopodous Mollusca proposed by Mr. James Sowerby. (*Min. Conchology of Great Britain.*) It includes only fossil species, and is yet incompletely understood. According to the original views of Mr. Sowerby, only those chambered shells belong to hamites which have the form of a hook or siphon bent in one plane with parallel but unequal limbs, and sinuous septa. But the specimens having these characters appear always imperfect; and when Professor Phillips found in Yorkshire many fossils, in other respects perfectly resembling hamites described by Mr. Sowerby, rolled in a plane spiral, the volutions in some species touching, in others free, and in a few terminating in a straight elongation (like spirula), he extended the use of the term. Dr. Buckland has adopted this view in his 'Bridgewater Treatise.'

In the 'Transactions of the Geographical Society of France,' June 11, 1837, M. Leveillé gives descriptions and figures of species of fossil Cephalopoda, which might be considered as the spiral part of hamites (Phillips), and names them *Crioceratites*. Bronn adopts this genus. Mr. Sowerby has recently been led to very similar results, and has proposed to call the same group *Tropæum*. Now as certain forms of ammonites in the lias and oolitic rocks (A. fimbriatus) have no very obvious difference from Tropæum, Crioceratites, or the spiral parts of Scaphites (*e.g.* Scaphites Yoannii in the British Museum), it is evident that the whole question of the true relations of these remarkable fossil genera to ammonites remains to be further examined. We shall therefore reserve till the article TROPÆUM a general view of these relations.

Hamites of the typical forms occur at Folkstone, Hamsey, and other situations in the gault, greensand, and other cretaceous beds. Crioceratites and Tropæum belong chiefly to the same groups of rocks in England, France, Switzerland, &c. [TROPÆUM.]

HAMMERFEST. [NORWAY.]

HAMMERSMITH. [MIDDLESEX.]

HAMMOND, HENRY, a learned and excellent divine of the church of England, was born at Chertsey, August 18, 1605. Having been educated at Eton, and Magdalen College, Oxford, of which he became Fellow, he was presented to the rectory of Penshurst in Kent, in 1633, ten years after which he was appointed archdeacon of Chichester. By birth and education a confirmed royalist, he retired to Oxford soon after the civil war broke out, continued to reside there while that city was held by the king, and attended the king's commissioners to Uxbridge, where he disputed with Vines, a Presbyterian minister. He was appointed canon of Christchurch and public orator in 1645, and attended Charles I. as his chaplain from the time when he fell into the hands of the army until the end of 1647, when the king's attendants were parted from him. Hammond then returned to Oxford, and was chosen sub-dean of Christchurch, from which situation he was expelled in March, 1648, by the parliamentary visitors, and placed for some time in confinement. On his release he repaired to Westwood in Worcestershire, the seat of Sir John Packwood, where the remainder of his life was spent in literary labour, 'doing much good to the day of his death, in which time he had the disposal of great charities reposed in his hands, as being the most zealous promoter of almsgiving that lived in England since the change of religion. . . . Great were his natural abilities, greater his acquired; and in the whole circle of the arts ho was most accurate. He was also eloquent in the tongues, exact in antient and modern writers, well versed in philosophy, and better in philology, most learned in school divinity, and a great master in church antiquity.' He died after long suffering from a complication of disorders, April 25, 1660. It is said that Charles II. intended for him the bishopric of Worcester. Of his numerous works, chiefly controversial, the following are some of the most remarkable: 'Practical Catechism,' 1644; 'Humble Address to the Right Hon. the Lord Fairfax and his Council of War,' 1649, concerning the impending trial of Charles I.; 'Paraphrase and Annotations on the New Testament,' 1653, best edition 1702. He began a similar paraphrase of the Old Testament; but advanced no farther than the Psalms, 1659, and one chapter of Proverbs. His works, in 4 vols. folio, were collected by his amanuensis Fulman, 4 vols. folio, 1674-84. (*Life*, by Bishop Fell; Wood, *Athen. Oxon.*)

HAMMOND, JAMES, was the second son of Anthony Hammond, Esq., of Somersham Place, in Huntingdonshire. He was born in 1710, and educated at Westminster; he sat in parliament for Truro, on the interest of the Prince of Wales, whose equerry he was. He died in 1742.

His verses are mostly elegiac, and addressed in the vapid style of pastoral sentiment, then in fashion, to a fictitious object, whom he names Delia. He is said to have been in love with a Miss Dashwood, who refused him—if she read his poems it is hard to say how she could do otherwise—and to have lost his intellects in consequence of her cruelty.

An attempt has been made to defend his poetry, but we think there will be few in this age to differ from Dr. Johnson in his somowhat oracular opinion that 'these elegies have neither passion, nature, nor manners.' (Johnson's *Lives*; Chalmers' *Biog. Dict.*; Aikin's *Brit. Poets*.)

HAMOAZE. [PLYMOUTH.]

HAMPDEN, JOHN, the eldest son of William Hampden, of Hampden, in Buckinghamshire, and his wife Elizabeth, second daughter of Sir Henry Cromwell, of Hinchinbrooke, in Huntingdonshire, and aunt of the Protector, was born in London in 1594, and succeeded in his infancy to the estates of his antient and respectable family. He was educated first at a grammar-school at Thame, afterwards at Magdalen College, Oxford, and in 1613 was admitted a student in the Inner Temple, where he made considerable progress in the common law. In 1619 he married at Pyrton, in Oxfordshire, Elizabeth, only daughter of Edmund Symeon, and for some years continued to lead a country life, entering freely into field sports and other amusements of his age. His attention however was not thus wholly occupied, but was likewise attracted by the political struggles of the day; so that when the king was by necessity compelled to summon a parliament, Hampden became anxious for a seat in the lower house. The borough of Grampound first returned him to parliament; the borough of Wendover next elected him three successive times. He was then chosen by the county of Buckingham, and being doubly returned to the Long Parliament by the constituencies of Wendover and Buckinghamshire, he made his election for the county. In 1634 his wife, to whom he was tenderly attached, died, leaving nine children,—three sons and six daughters: Elizabeth, the eldest, married Richard Knightley, of Fawsley, in Northamptonshire; the second, Anne, became the wife of Sir Robert Pye, of Faringdon. Mrs. Knightley, Hampden's favourite daughter, died during the first year of the civil war. He married, for his second wife, Lætitia, daughter of Mr. Vachell, of Coley, near Reading: by this lady, who survived him, it does not appear that he had issue.

In the first short parliament to which he was elected Hampden took no very forward part in the business of the house; but his opinions coincided with those of Pym, Selden, and others of the popular party, who were determined to resist the unwarrantable encroachments of the crown upon the privileges of the parliament and the rights of the people. Gradually his influence increased both in and out of parliament, and especially in his native county of Buckingham. At length his reputation became general. At the close of Charles I.'s second parliament, the king, in pursuance of his threat to resort to new modes of raising supplies, required a general loan; to this loan Hampden resolutely refused to contribute, denying the king's right to demand it. In consequence of this refusal he was imprisoned in the Gate-house, removed thence in custody to Hampshire, but was afterwards, with seventy-six others, unconditionally liberated by an order of council. He now became one of the most industrious members in the house, both in its general business and the superintendence and conduct of committees. His resistance to the arbitrary imposition of ship-money (1636) induced many other residents in Buckinghamshire to follow his example. Proceedings were instituted against him on the part of the crown. The case was argued in the Exchequer Chamber (1637) during twelve days before all the twelve judges, who, two excepted, gave a decision in favour of the crown. It is remarkable that there is no appearance of an assessment of ship-money having been made upon the county of Buckingham after Hampden's trial. The judgment however which was then given strengthened the claim which the king had made to the power of taxing in any manner and to any extent, and the fear of oppression began to operate as an inducement to emigration. Many, especially among the puritans, had already left the kingdom, and more were preparing to do so, when an order from the king, dated April, 1638, prohibited all ships from sailing with passengers unless with a special licence. Eight ships were then lying in the Thames for the reception of emigrants; in one of which had engaged their passage across the Atlantic two no less considerable persons, it is said, than Oliver Cromwell and his kinsman Hampden: to this ship a licence was refused. (Lord Nugent's *Memorials of Hampden*, vol. i., p. 254.)

For an account of Hampden's conduct generally in the Long Parliament we must refer to Lord Nugent's 'Memorials of Hampden,' to Clarendon, Whitelock, and the general histories. His resistance to the undue influence of the king so irritated Charles I., that the king accused him, with three other members of the Commons and one of the Lords, of having traitorously endeavoured to subvert the fundamental laws and government of the kingdom, and even made an attempt in person to seize them in the House. The House protected them from seizure, but violent debates and tumults arose, which were shortly after followed by the civil war. Hampden now raised and commanded a troop, with which he joined the parliamentary army, acting chiefly in Berkshire and the counties of Oxford, Northampton, Warwick, Middlesex, and Buckingham. Being a member of the Committee of Public Safety, as well as a military leader, he was incessantly and variously occupied in all the affairs of the war. His counsel was for vigorous and resolute attack; he considered that Essex, the parliamentary general, should have acted more on the offensive. In an engagement with Prince Rupert upon Chalgrove Field, June 18, 1643, Hampden placed himself at the head of the attack, but in the first charge received his death-wound. Two carabine balls struck him in the shoulder, and, breaking the bone, entered his body: he left the field, and obtained surgical aid at Thame, but the wound was incurable, and after six days' severe suffering he expired.

Historians of the most opposite parties unite in unanimous praise of this great man: all bear testimony to his affability in conversation; his temper, art, and eloquence in debate; his penetration in counsel; his industry, vigilance, and enterprise in action; and his courage in war. His last words were a touching and beautiful prayer for the welfare of his country. (Lord Nugent's *Memorials of Hampden*; Clarendon, *Hist. Rebel.*; Hume, *Hist of England*.)

HAMPSHIRE, a southern maritime county of England, lying between 50° 34′ and 51° 22′ N. lat., and 0° 43′ and 1° 54′ W. long. It is principally on the mainland of England, but includes the Isle of Wight. [WIGHT, ISLE OF.] The portion on the mainland approximates in form to a parallelogram, except at the south-west corner, where a portion juts out to the westward: the sides of the parallelogram face the four cardinal points. Hampshire is bounded on the north by Berkshire, on the east by Surrey and Sussex, on the south by the English Channel, and on the west by Wiltshire and Dorsetshire. The length of the county (mainland part) from north to south varies from 37 to 46 miles; the breadth varies from 28 to 41 miles. The Isle of Wight is in the form of a lozenge, having its longer diagonal from east to west 23 miles, and its shorter diagonal from north to south 14 miles. It is separated from the main part of the county by an arm of the sea averaging about 3 miles over; but in the narrowest part not more than one mile. There is a small detached part of the county 9 miles long, and for the most part less than half a mile wide, extending from near Haslemere in Surrey to Midhurst in Sussex. The area of the county, including the Isle, is 1625 square miles; in size it is the eighth of the English counties, being a little smaller than Somerset and a little larger than Kent. The population in 1831 was 314,280, or 193 to a square mile. In absolute population it is the fifteenth, in relative population the twenty-fourth of the English counties. Winchester, the county town, is on the Itchin, 62 or 63 miles in a direct line south-west of St. Paul's, London; 65 miles from Hyde Park Corner by the road through Staines, Farnham, and Alton, or 62½ miles by Basingstoke: but Southampton, from which the county derives its name, is 71 miles south-west of St. Paul's, London, in a direct line, or 77 miles from Hyde Park Corner by the road through Alton and Winchester.

Coast-line, Surface, Hydrography, Communications.—The coast of Hampshire (not including the Isle of Wight) is low towards the east side of the county, where there is a wide but not very deep bay or inlet, divided by Hayling Island and Portsea Island into three parts; Chichester harbour on the east, Langston harbour in the middle, and Portsmouth harbour on the west. These harbours, when the tide is up, present broad sheets of water; and Portsmouth harbour especially, with its shipping, has, when viewed from the top of Portsdown, a striking appearance; but when the tide is out, little is seen but an assemblage of sand or mud banks, with channels of deeper water running between them. Hayling Island is about 4 miles long from north to south, and nearly as much broad at the widest part, which is next the open sea. It contains the two villages of North and South Hayling, with a population of 882. Portsea Island, 4 miles long from north to south, and about 3 broad, contains the antient borough of Portsmouth and the town of Portsea, with their extensive suburbs. The principal naval dockyard in England, or indeed in the world, is at Portsea. The two towns have a population of 50,389. [PORTSMOUTH.] There are salt-works on both these islands.

From the entrance of Portsmouth harbour the coast runs north-west to the entrance of the inlet or æstuary called Southampton Water. In this part are some low cliffs. Southampton Water penetrates about 7 miles inland to the town of Southampton, at the junction of the Test and the Itchin: its breadth, when the tide is up, is from 1½ to 2 miles; at low water, about half a mile. From the entrance of Southampton Water a low coast runs south-west until opposite to the western extremity of the Isle of Wight. Along this low coast are extensive salt-works, and at its extremity, upon the point of a long sandy neck, stands Hurst Castle. From Hurst Castle the coast runs west, forming the shallow bay of Christchurch, terminated at its western point by Hengistbury Head, from which the coast still runs west to the border of Dorsetshire. From the neighbourhood of Hurst Castle the coast is generally high and abrupt.

The surface of this county is rather irregular. The South Downs enter the county from Sussex on the south-east, near Petersfield, and cross it in a north-west direction into Wiltshire: Butser hill, between Petersfield and Horndean, on the Portsmouth road, one of the highest points in this range, is 917 feet high. The North Downs enter the county from Surrey near Farnham, and extend across the county, by Odiham, Basingstoke, and Kingsclere, into Wiltshire. Highclere Beacon, one of the points of this range, in the north-western part of the county, near the border of Wilts and Berks, is 900 feet high. The Alton hills form a connection on the east side of the county between the South and North Downs, and run from Petersfield northwards past Alton. Portsdown is an isolated eminence extending east and west just above Portsmouth and Langston harbours; its height is about 447 feet; its length 7 miles, and its breadth one. All these hills are in the chalk formation.

A large part of Hampshire is within the basin of the Southampton Water; a small portion on the north and north-east sides of the county is in the basin of the Thames; a small portion on the south-east side is in the basin of the Arun, and a small portion of the west side is in the Wiltshire and Dorsetshire basin.

The principal streams which drain the Southampton basin are the Anton or Test, the Itchin, and the Hamble. One branch of the Test rises near Hurstbourne Tarrant (between Newbury, Berks, and Andover), and another near Whitchurch; their united stream flows by Stockbridge and Romsey to Southampton. The Itchin rises in the hills around Alresford and flows past Winchester to Southampton. The Hamble rises near Bishop's Waltham, and joins the Southampton river some miles below Southampton. A stream, to which the maps assign no name, flows by the village of Titchfield into the sea, near the mouth of the Southampton Water. The length of these rivers is as follows:—the Anton or Test to Southampton, 35 miles; the Itchin 25 miles (of which 13, viz. up to Winchester, are navigable); the Hamble 10, and the Titchfield river 20 miles; the length of the Southampton Water has been already given. The Itchin navigation does not coincide with the natural bed of the river.

The New Forest occupies nearly all that part of the county which has been represented as projecting at the south-west corner. It is drained by two small streams, the Ex or Beaulieu river and the Boldro Water, besides some smaller streams. The Ex and the Boldre flow south-east into the sea, the first at Exbury, the second at Lymington: the length of the Ex is about 13 miles, that of the Boldre Water about 15 miles.

The basin of the Thames is separated from the rest of the county by the North Downs, and drained by the Wey, the source of which is in Hampshire and by the Auborne and the Loddon, which have their course along the border.

The basin of the Arun is separated from the rest of the county by the Alton and Petersfield hills and the South Downs. It is drained by the Rother, which rises in this county and flows past Midhurst into the Arun.

The Wiltshire and Dorsetshire basin comprehends a narrow strip of the county to the west of the New Forest. It is drained by the Avon, which, entering the county just below Downton, Wilts, about six miles from Salisbury, runs south past Fordingbridge, Ringwood, and Christchurch, into the sea. That part of the river which is in the county is about 20 to 22 miles long. A small portion of the Dorsetshire Stour, and of the Great Leonards Water, a tributary of the Stour, are in the county or upon its boundary; the Stour joins the Avon below Christchurch: their æstuary forms Christchurch haven.

The county has two principal canals. The Andover Canal commences at Andover, and is carried along the valley of a small feeder of the Anton or Test, till the junction of this feeder with the main stream. The canal then crosses the Anton and follows the valley of that river on the eastern side of the stream to Redbridge, three or four miles above Southampton, where it enters the Anton. Its whole length is 22½ miles: its total fall is above 176 feet. It has a branch to Salisbury. It is chiefly used for the import of coal and other fuel, and of general goods from the coast, and for the export of agricultural produce. The Basingstoke Canal commences at Basingstoke, and is carried in a very winding course 22 miles east on one level to the Loddon, which it crosses into the county of Surrey, its farther course through which to the navigable part of the river Wey (near its junction with the Thames) is 15 miles, with a considerable fall. That part of the canal which is in Hampshire is the summit level, and is 38 feet wide and 5½ feet deep. About four miles east of Basingstoke the canal is carried by a tunnel above a mile long through a chalk hill; from this chalk, which yields a great quantity of water, the chief supply is obtained for lockage at that part of the canal which is in Surrey. Not far from the border of the county this canal is carried by an aqueduct across a valley three quarters of a mile broad. This canal serves for the conveyance of coal, deals, groceries, bale goods, &c., from London, and for the export of timber, flour, malt, bark, and earthenware. Part of the canal from Arundel by Chichester to Portsmouth is in this county.

Three principal mail-roads cross the county, viz. the road from London to Portsmouth, that to Southampton and Poole, and the great western road through Salisbury. The Portsmouth road enters the county between Godalming and Petersfield, but again quits it to pass through a projecting corner of the county of Sussex: it re-enters Hampshire not far from Petersfield, and runs through that town and through the villages of Horndean and Cosham to Portsmouth. The Poole and Southampton road first enters the county and crosses a portion of it between Bagshot and Farnham, both in Surrey; beyond Farnham it again enters it and runs by Alton, Alresford, and Winchester to Southampton. From Southampton it runs by Ringwood into Dorsetshire. The great western road, travelled by the Penzance, Falmouth, and Exeter mail, and by the Exeter mail, enters the county between Bagshot (just beyond which it branches off from the Southampton road) and Basingstoke, and passes through Basingstoke, Whitchurch, and Andover to Salisbury in Wiltshire. At Andover a road, travelled by the Falmouth, Devonport, and Exeter mail, branches off from this to Amesbury, in Wiltshire. Beside these principal roads there are many other roads of less importance. A road parallel to the coast coming from Chichester passes through Havant, Cosham, near Portsmouth, and Fareham to Southampton; a road from Southampton leads by Lymington and Christchurch to Poole; a road from Newbury (Berks) runs by Andover, Stockbridge, and Romsey to Southampton; a road from Salisbury leads by Fordingbridge and Ringwood to Christchurch; and several roads from Winchester communicate with different parts of the county.

Geological Character.—That vast district of chalk which overspreads so large a portion of Wiltshire, and of which Salisbury Plain forms a part, extends into Hampshire and occupies a considerable part of it. It is bounded on the north by a line drawn from Inkpen Beacon, near Great Bedwin, Wiltshire (the highest point in all the chalk formation of England), by Kingsclere and Basingstoke to Odiham; on the east by a line drawn from Odiham by Alton, and along the Farnham road to the neighbourhood of Bishop's Waltham; and on the south by a line drawn from the neighbourhood of Bishop's Waltham and north of Bishopstoke into Wiltshire. The extent of this chalk district from north to south is about 20 or 22 miles; from east to west its Hampshire extent varies from 22 to 32 miles, but its whole extent through Hampshire and Wiltshire together is much greater. The breadth of the North Down range is about two or threo miles, that of the South Downs about four miles. Portsdown hill is an outlying mass of chalk.

The country to the north of the great chalk district and of the North Downs belongs to the London basin; the country to the south of the great chalk district and of the South Downs belongs to the Isle of Wight basin; and theso are almost entirely occupied by the strata above the chalk.

The country to the east of the great chalk district and embraced between the North and South Downs is occupied by the strata which underlie the chalk, and which extend into Surrey and Sussex, and form the district of the Weald of the south-east of England. In the London basin the Bagshot sand, belonging to the upper marine formation, is found at Frimley Heath, on the border of Surrey, and is surrounded by a belt of the London clay; but these two formations are found only in the north-east of the county, and are of small extent: the rest of this basin in Hampshire is occupied by tho plastic clay, except near Kingsclere, where, for a short distance the chalk marl, and greensand crop out from beneath the chalk. In the Isle of Wight basin that part of tho New Forest which extends from the Boldre Water to the Southampton Water is for the most part occupied by a sand probably agreeing in its principal characteristics with the Bagshot sand; this district is peculiarly adapted to the growth of oak. The remaining part of the New Forest, the country around the Southampton Water, and the whole line of tho coast eastward from the Avon, and including Portsea and Hayling Islands, aro occupied by the London clay; the country west of the Avon and a belt varying from three to seven miles south of the chalk, are occupied by tho plastic clay. The Weald district east of the chalk is occupied by the chalk marl and greensand; and the small detached part of the county included in Sussex, partly by these formations and partly by the Weald clay.

No minerals are procured from this county to any extent, except near Petersfield, where grey chalk is quarried and sent to Portsmouth dockyard to be burnt for limo.

Forests.—There are several forests in this county, namely, the New Forest in the south-west, Alice Holt and Woolmer Forest in the east, and the forest of Bere in the south-east. The New Forest, the most important of these, appears to have heen, at tho time of the Conquest, a wooded tract thinly peopled. William the Conqueror or his immediate successors afforested the tract extending from Godshill, near Fordingbridge, to the sea, and from Ringwood to Hardley, near Southampton Water, and comprehending 92,365 acres. The bounds were so far enlarged between the commencement of Henry II.'s reign and the reign of Edward I., that they comprehended all tho country hetween the Southampton Water and the Avon for several miles inland. These additions were disafforested in the reign of Edward I., in pursuanco of the Charta de Foresta, and the original hounds retained till the perambulation in tho time of Charles II. The forest at present comprehends nearly 64,000 acres, and is the property of tho crown, subject to rights of common and other antient claims. The crown has also manorial rights over some, and the absolute property of other plots of ground included in the former, but not in the present bounds of the forest. For local purposes the forest is divided into nine bailiwicks, which are subdivided into fifteen walks. The forest is under a purveyor for the navy attached to the dockyard at Portsmouth, and under the surveyor-general of woods and forests. The chief value of the New Forest is for the raising of oak and beech timber for the use of the navy; but for many years this was much neglected, and the management of the forest was very bad. Within the present century many reforms have been made, from which considerable benefit may be expected. There aro many deer kept in the forest: rabbits, which formerly abounded, are now scarce: a diminutive breed of horses, and a peculiar breed of swine, bearing considerable resemblance to the wild boar, are found in a half-wild state in the forest. The oaks seldom riso into lofty stems; their branches aro commonly twisted into the most picturesque forms; and tho scenery of the forest is vory beautiful. Many of the trees are antient and of great bulk. Various encroachments have been made on the forest, and many rudo cottages crected by the poor who live round the borders of tho forest, and who are in general an indolent race, poor and wretched in the extreme, and depending for a subsistence on casual pilfering from the forest.

Tho forest of Bere extends northward from Portsdown-hill, and its bounds, according to a perambulation made in 1688, and still observed, comprehend about 16,000 acres, of which one-third is enclosed. It is divided into two larger divisions, the East and West Walks, with some smaller portions dependent on these, and is under the control of a warden and other officers. The quantity of timber grown in this forest is trifling compared with what it once yielded. Some deer are kept.

Alice Holt and Woolmer Forest lies between the Portsmouth and Southampton roads. It is divided into two parts by intervening private property, namely, Alice Holt, near the Southampton road, a little beyond Farnham, and Woolmer, nearer the Portsmouth road, between Liphook and Petersfield. It contains altogether nearly 15,500 acres, more than half of which belongs to the crown. Tho growing timber in Alice Holt is of considerable value. Like tho other forests of tho county it had during the last century been much neglected. In the marshy bottoms of Woolmer Forest many trees have been found and dug up with the peat, and many hundreds of Roman coins, several of them those of Marcus Aurelius and the Empress Faustina, were dug up in the bed of Woolmer pond, when dried up in 1741 by the heat.

Waltham Chace, a waste of 2000 acres, belonging to the bishop of Winchester, is on the north-west side of the forest of Bere, near Bishop's Waltham. It is connected in our criminal annals with the atrocities of the deer-stealers, called the 'Waltham Blacks;' and the statute known as 'the Black Act,' passed for their suppression.

Agriculture.—The climate of Hampshire is generally mild and favourablo to vegetation. The southern part of the Isle of Wight is considered to have the mildest climate in Great Britain, and is resorted to on that account by invalids during tho winter. But a great part of Hampshire consists of poor sands and gravelly soils or chalky hills, having between them low bottoms, with no ready outlet for the water, which has produced marshes and peat-bogs. In such places the nature of the soil has a greater effect on the climate than the difference of several degrees of latitude would have under other circumstances.

The northern part of the county, where it borders on Berkshire and Surrey, consists chiefly of the poor, dark sand, mixed with an ochery loam, which is well known as the Bagshot-heath soil. This extends to Basingstoke. The whole of this part of the county is naturally very unproductive, and till within a few years was almost entirely covered with a brown heath, on which some hardy forest sheep and a few miserable cattle were reared, and contrived to pick up a scanty living. There were however some spots between the hills which contained a few farm buildings and somo green fields, forming a striking contrast with the surrounding waste. Within the last thirty years much of this hoath, which lay in common, has been enclosed and divided. Some of it has been brought into cultivation at a great expense, and a considerable portion has been planted with fir-trees, which have thriven wherever the proprietor was at tho expense of trenching and draining the land before planting.

The great roads which traverse this part of the county, and the numerous places in which horses are kept for posting, stage-coaches, and waggons, have caused a supply of manure, by which the poor soils immediately around them have been much improved. The very poverty of the soil has set ingenuity to work to produce the most improved practices and implements. Most of the drilling-machines which are used within a certain distance in the counties of Surrey and Berks, as well as in Hampshire, are manufactured in the neighbourhood of Basingstoke.

South of this district, as far as Winchester and a few miles beyond it, the chalk prevails. The soil which lies over this chalk varies in depth, and, where it is sufficiently deep, produces good crops of barley, wheat, and oats. In many places it lies very near the chalk, and is intermixed with flints and pebbles. Although the appearance of it is not very promising, it is tolerably productive in good seasons; the pebbles and flints reflect the sun's beams, while the young plant is sheltered by them from the cold easterly winds which, in spring, sweep over the hills, where few trees break their force.

Where tho soil is thin and very near the chalk, it is scarcely fitted for the plough, but remains in the state of down; and the natural grasses which grow there, when kept closely cropped by sheep, aro sweet, and make the best sheep-pastures. If these downs are not sufficiently stocked, or if they are reserved for cows, the furze and brambles are apt to overrun them, and the coarse grasses get the upper hand.

In the valleys and along the lower slopes of the chalk-hills the soil is of a tough, tenacious nature, being a mixture of chalk washed down the hills by the rains and stiff clay. This is a soil very difficult to cultivate. In spring it is extremely heavy, and retains moisture a long time, and when dried it becomes so hard, that unless it has been worked at the exact moment when it is dry on the surface, and the clods are still friable, there are no means of reducing it to a proper tilth. But when it is carefully managed and well manured, it produces very good crops of beans, wheat, and oats. This land can scarcely be cultivated and kept clean without occasional fallows, and the most profitable rotation is wheat, beans, oats, fallow. It is much too heavy for turnips. In some spots which are not quite so heavy the Suffolk rotation of barley, after a long fallow, clover, wheat, beans, and oats, might be introduced with advantage. It is not at all adapted to the Scotch convertible system; for although grass-seeds might grow well, the land could seldom be depastured with cattle, either in spring or autumn, and after a dry summer it would be almost impossible to plough it up in good time to sow it with wheat. On the eastern side of the county, bordering on Surrey and Sussex, is a small tract of land, which is provincially called malmy land, forming the vale of Petersfield. It has a groy, tender, sandy soil of some depth, lying on a soft sandstone, which is almost impervious to water. This circumstance counteracts the advantages of a light soil, unless the water be artificially carried off. On the higher grounds the poor sandy soil is only fit for plantations of firs.

The land in the New Forest, and on the opposite side of the river, or æstuary, below Southampton, is mostly of a light nature, intermixed here and there with heavier loams and clays. Where it is sound and free from springs it is of a good quality; and that which is not so may be materially improved by judicious under-draining. Some spots in the New Forest were effectually drained many years ago by Mr. Elkington, and have amply repaid the expense incurred, both by the improvement of the land and the greater salubrity of the neighbourhood; for where the land has not been drained, low bogs and marshy places are formed, which are the cause of frequent fevers and agues.

Various kinds of marl are found in many places; some of these are very useful on poor gravelly soils, which they greatly improve when a sufficient quantity is carried on. The value of marl depends on the union of carbonate of lime and clay, and is readily discovered by its effervescing strongly when any acid is poured upon it. When the quantity of carbonate of lime is small, very good white or red bricks are made of it. The white colour is caused by the calcareous matter, the red by the presence of the oxide of iron.

The Isle of Wight consists principally of chalk, over which are found various soils, such as gravel, sand, and very stiff clay. The mildness of the climate is favourable to vegetation, and there are some neat farms, in which the land is well cultivated.

In traversing the whole country it will be observed that the poorer soils predominate, and a great part of the land will scarcely repay the expense of cultivation. There are a few fertile spots, and some very valuable water-meadows along the principal rivers, especially the Avon, which runs through the western part of the county bordering on Dorsetshire. Where a farm has a portion of water-meadow and a run for sheep on the downs, the occupier generally thrives; but the greatest agricultural skill is displayed in the cultivation of the poorer soils, where manure must be made on the spot, and the cattle and sheep kept on the produce of the arable land.

Hampshire, although it cannot be compared with some eastern and northern counties for agricultural improvements, is not far behind them; and there are some farms as well managed as any in England. The great fault lies in the want of economy of labour; too many horses are used; the threshing-machine is not sufficiently common; the stock is not fed so economically as it might be; the manure is not so carefully collected, nor so well prepared, before it is put on the land; and there is a great waste of the liquid part of it on the best managed farms.

The old clumsy plough, once in general use, is now replaced by a lighter and more durable plough, of which the parts that wear out most are made of cast-iron. Two horses now plough land which formerly was thought to require four. The seed is put in by a drilling-machine instead of being scattered by the hand. The corn is put into neat stacks, raised on stone pillars, and well thatched, instead of being exposed to the depredation of rats in a huge barn. The farm buildings, as well as the house of the farmer, are more commodiously arranged, and there is a general spirit of improvement. The correction of the abuses of the old poor-laws, and the commutation of the tithes for a fixed annual payment, will much encourage the improvement of poor lands; and in half a century the general face of the county will be very different from what it is at present.

There are no breeds of cattle, horses, or sheep, peculiar to Hampshire, unless we consider the small New Forest ponies in that light. The cows are of various breeds. The oxen are chiefly Sussex and Devon. The horses used in husbandry are mostly bred in other counties. The sheep are—the common small forest breed, or heath-sheep, which, when tolerably fat, give the high-flavoured mutton formerly known by the name of Bagshot mutton; the Dorset and Leicester sheep, in the richer meadows; and the South Down, on the chalky hills. The last are most numerous, and preferred for folding on the land.

Hampshire has long been famous for the curing of bacon; and a Hampshire hog is a very common sign for a public-house; yet the native breed of pigs in this county is by no means remarkable for its qualities. The native hogs, which live on the acorns and beech-mast of the New Forest, although the flavour of their flesh may be good, are coarse, raw-boned, flat-sided animals, and are now seldom met with. The improved breeds produced by crosses of the Berkshire, the Suffolk, Essex, and Chinese pigs, are so much better and more profitable, that the only difference to be noticed in the pigs bred on different farms is that which arises from the predominant character of any one of the above-mentioned breeds.

The reputation of the Hampshire bacon is owing entirely to the care with which it is cured. The hogs being fatted on peas and barleymeal, are kept fasting for twenty-four hours, at least, before they are killed; they are used as gently as possible in the act of killing, which is done by inserting a long pointed knife into the main artery which comes from the heart. The hair is burnt off with lighted straw, and the cuticle of the skin scraped off. The carcass is hung up after the entrails have been removed, and the next day, when it is quite cold, it is cut up into flitches. The spare ribs are taken out, and the bloody veins carefully removed: the whole is then covered with salt with a small quantity of saltpetre mixed with it. Sometimes a little brown sugar is added, which gives a pleasant sweetness to the bacon.

The flitches are laid on a low wooden table, which has a small raised border all round it. The table slants a little so as to let the brine run off into a vessel placed under it, by a small opening in the border at the lower end. The flitches are turned and re-salted every day; those which were uppermost are put under, and in three weeks they are ready to be hung up to dry. Smoking the bacon is no longer so common as it used to be, as simply drying it is found sufficient to make it keep. Those who, from early association, like the flavour given by the smoke of wood, burn sawdust and shavings in a smothered fire for some time under the flitches. When they are quite dry, they are either placed on a bacon-rack for the use of the family, or are packed with wheat-chaff into chests till they are sold.

The practice of cutting the hogs into pieces and pickling them in a vat, being attended with less trouble, is very generally preferred when there is only a sufficient number of hogs killed to serve the farmer's family; but flitches of bacon, well cured, are more profitable for sale.

The fatting of hogs is profitable when a pound of green bacon, when it is first dried, is worth more than the tenth part of the price of a bushel of barley, for a bushel of barley is supposed, with good management and a good breed of hogs, to produce 10 lb. of bacon. The risk and attendance are fully compensated by the value of the dung made by the hogs, which is of the richest nature. Hogs may be made fat with less expensive food, such as boiled roots mixed with meal; but in this case the bacon is much less valuable, and is not superior to the Irish bacon, which is mostly fatted on potatoes.

The following are the principal fairs in Hampshire:—Alresford, last Thursday in July, October 17; Alton, Saturday before May 1, September 29; Andover, May 13, November 17 and 18; Basingstoke, Easter Tuesday, September 23, October 11; Botley, July 23, August 20, November 13; Christchurch, June 13, October 17; Hambleton, February 13, October 2; Kingsclere, April 2, October 15; Lymington, May 12, October 2; Magdalen Hill, near Winchester, August 2; Newport, Isle of Wight, Whit-Monday, Tuesday, and Wednesday; Overton, May 4, July 18, October 22; Petersfield, March 5, July 10, December 11; Portsmouth, July 10, lasts 14 days; Rumsey, Easter Monday, August 26, November 8; Southampton, February 17, May 6, December 15; Stockbridge, Holy Thursday, July 10, October 7; Weyhill, October 11, 12, 13, 14, 15, 16 (this is one of the greatest fairs in England, for cattle, sheep, wool, and hops); Whitchurch, April 23, June 17, July 7, October 19; Wickham, May 20; Winchester, first Monday in Lent, October 24.

Divisions, Towns, &c.—The most antient division of the county is into hundreds, of which there were fifty at the time of the Domesday survey. There are now thirty-nine hundreds, beside the city of Winchester with the liberty of Soke, the borough of Portsmouth with the district of Portsea and Portsea Guildable, the town and county of Southampton, and eleven liberties, including the liberties of East and West Medina in the Isle of Wight. From the great number of the hundreds and liberties they have been arranged in 'divisions' for administrative purposes. At the time of the census in 1831, these divisions, with their situation in the county, included subdivisions, area, and population, were as follows:—

Division.	Situation.	Hundreds.	Area.	Population in 1831.
I. Alton, North Division.	East.	Alton, Bishop's Sutton, and Selborne, and the liberty of Alresford.	74,320 acres.	14,968
II. Alton, South Division.	South-east.	East Meon and Finchdean.	44,160 „	7,483
III. Andover Division.	West.	Andover, Barton Stacey, King's Sombourn, Thorngate, and Wherwell.	130,210 „	27,465
IV. Basingstoke Division.	North-east.	Basingstoke, Bermondspit, Crondall, Holdshott, Mitcheldever, and Odiham, and the liberty of Bentley.	144,800 „	29,592
V. Fawley Division.	Central.	Bountisborough, Buddlesgate, Fawley, Mainsborough, and Mansbridge.	129,690 „	24,020
VI. Kingclere Division.	North.	Chutely, Evingar, Kingsclere, Overton, and Pastrow.	102,500 „	18,070
VII. New Forest, East Division.	South.	New Forest (East), New Forest (North), Redbridge, Bishop's Waltham (part of), Ringwood (part of), and the liberties of Beaulieu, Dibdin, and Lymington.	62,360 „	18,346
VIII. New Forest, West Division.	South-west.	Christchurch, Fordingbridge, and Ringwood (the greater part of), with the liberties of Breamore and Westover, and that part of the New Forest which is not included in any parish.	133,870 „	19,127
IX. Portsdown Division.	South-east.	Bishop's Waltham (the greater part of), Bosmere, Fareham, Hambledon, Meon-Stoke, Portsdown, and Titchfield, and the liberties of Alverstoke and Gosport, and Havant	100,520 „	41,298
X. Isle of Wight Division.	South.	Liberties of East and West Medina.	86,810 „	35,431
Separate Jurisdictions		City of Winchester and liberty of Soke.	2,250 „	8,767
		Borough of Portsmouth, with Portsea and Portsea Guidable.*	5,090 „	50,389
		Town and county of Southampton.	1,970 „	19,324
			1,018,550	314,280

By a subsequent arrangement made under the direction of the magistrates of the county, the divisions of the county have been increased to thirteen, not including the Isle of Wight. They are as follows:—Alton, Andover, Basingstoke, Droxford, Fareham, Kingsclere, Lymington, Odiham, Petersfield, Ringwood, Romsey, Southampton, and Winchester. Hampshire, not including the Isle of Wight, contains one city, Winchester; six parliamentary boroughs, Andover, Christchurch, Lymington, Petersfield, Portsmouth, and Southampton; and thirteen other market-towns, Alresford, Alton, Basingstoke, Bishop's Waltham, Fareham, Fordingbridge, Gosport, Havant, Kingsclere, Odiham, Romsey, Stockbridge, and Whitchurch, which last two were disfranchised by the Reform Act. Of these some are described elsewhere. [ALRESFORD; ALTON; ANDOVER; BASINGSTOKE; BISHOP'S WALTHAM; CHRISTCHURCH; LYMINGTON; PETERSFIELD; PORTSMOUTH; SOUTHAMPTON; WINCHESTER.] Of the others an account is subjoined.

Fareham is in the hundred of Fareham, at the head of the north-west branch of Portsmouth harbour, 73 miles from London, at the intersection of the road from London to Gosport and that from Chichester to Southampton. The parish is extensive, containing 6670 acres: it constitutes the whole of the hundred, and had in 1831 a population of 4402. Fareham was in Leland's time a fishing village: it is now a tolerably thriving town, depending for its prosperity chiefly on its neighbourhood to Portsmouth. Several persons connected with the naval establishments at Portsmouth reside here. Some small vessels are built at Fareham; and cordage, sacking, and coarse pottery are made. Vessels of 300 tons can get up to the port; and considerable trade in corn and coal is carried on. The market is on Wednesday, and there is one yearly fair. Petty sessions are held here. The architecture of the church is of various dates and styles; the chancel is early English. The living is a rectory in the peculiar jurisdiction of the bishop of Winchester, in whose gift it is; the annual value is 671*l.* There were in 1833 twenty-two day and four boarding-schools, with nearly 700 children: of these schools, one with 27 boys was an endowed free-school, another with 130 children, a national school, and a third with 62 children, a subscription infant school. There were also three Sunday-schools, containing above 400 children. There are congregations of Independents and Methodists.

Fordingbridge is in the hundred of Fordingbridge, on the right or west bank of the Avon, 92 miles from London on the road to Christchurch. The parish is large, containing 5720 acres, and had in 1831 a population of 2822, more than half agricultural. Fordingbridge was formerly a place of greater extent than now, and has suffered several times from fire. There is a stone bridge of seven arches over the river. There are some manufactures of sail-cloth and bed-ticking. The market is on Saturday, and there is one yearly fair. The living is a vicarage, united with the parochial chapelry of Ibsby, or Ibsley, in the diocese and archdeaconry of Winchester, and in the gift of King's College, Cambridge: the annual value is 601*l.*, with a glebe-house. There is an Independent congregation. There were in the parish in 1833 one infant-school with

* Portsea Guildable is a part of the parish of Portsea, not within the jurisdiction of the borough of Portsmouth, but comprehended in the hundred of Portsdown.

45 children, eight day and boarding-schools with 153 children, one day and Sunday-school with 231 children daily and 113 on Sundays, partly supported by endowment, and one Sunday-school with 292 children.

Two miles from the town, on a hill called Godshill, overgrown with oaks, are the remains of an antient camp, perhaps of Saxon origin, secured on one side by a double trench, and on the other by the steep slope of the hill.

Havant is in the liberty of Havant (which comprehends only this parish), near the head of Langston harbour, 66½ miles from London by Petersfield and Horndean. The parish comprehends 2560 acres, and had in 1831 a population of 2083, about one-fourth agricultural. The church is in the centre of the town, in the form of a cross, with a tower rising from the intersection: some parts of it are of Norman architecture. The living is a rectory, in the peculiar jurisdiction of the bishop of Winchester, who has the presentation: it is of the yearly value of 489*l.*, with a glebe-house. There is an Independent congregation. Havant has little trade: some parchment is made, and some of the inhabitants are engaged in fishing and fowling. The market is on Saturday, and there are two yearly fairs. There were in the parish in 1833 two national-schools with about 200 children, one boarding and day-school and four day-schools with 115 children, and one Sunday-school with 130 children.

Kingsclere is in Kingsclere hundred, 55 miles from London through Basingstoke. The parish is large, containing 17,240 acres, and had in 1831 a population of 3151, three-fourths agricultural: the parish extends into the hundred of Evingar. Kingsclere is a small town of mean appearance. There is some trade in malt carried on: the market is on Tuesday, and there are two fairs in the year. The living is a vicarage, with the chapelries of Ecchinwell and Sidmonton annexed, in the diocese and archdeaconry of Winchester; of the yearly value of 400*l.* There were in the parish in 1833 seven day-schools with 124 children, one of which (with 27 boys) is endowed; and one day and Sunday-school with 50 children daily and 60 on Sundays. At Kingsclere was antiently a residence of the West Saxon kings, and there was a royal residence in the neighbourhood as late as the time of King John.

Odiham is in Odiham hundred, a little to the left of the great western (Salisbury and Exeter) road, 40 miles from London. The parish is large, comprehending 7550 acres, and had in 1831 a population of 2647, about half agricultural. The market is on Friday, and there are two yearly fairs. Odiham was formerly a free borough, belonging to the bishop of Winchester: it had a royal residence and park: the remains of the residence have been converted into a farm-house, still called Palace Gate, or Place Gate. There is an old almshouse near the church, which latter is a large, antient brick building. The living is a vicarage, with the parochial chapelry of Grewell annexed, in the diocese and archdeaconry of Winchester; of the yearly value of 537*l.*, with a glebe-house. There is an Independent congregation at Odiham. There were in the parish in 1833 ten day or boarding and day-schools with about 250 children: one of these schools, with 41 children, was partially supported by endowment: there was also one Sunday-school with 187 children.

Near Odiham are the remains of an old castle, which, in the civil wars at the close of King John's reign, was bravely but unsuccessfully defended by a garrison of thirteen against the Dauphin, Louis of France. In this castle David Bruce, king of Scotland, was confined for eleven years after his capture at Neville's Cross.

Romsey is a corporate town, locally situated in the hundred of King's Sombourn, upon the left bank of the Anton or Test, over which is a bridge, and close to the Andover Canal. It is 73 miles from London, on a road leading by Winchester to Ringwood and Poole. The whole parish is very extensive, comprehending 9310 acres, with a population of 5432, about one-fourth agricultural; but the borough comprehends only that part of the parish known as 'Romsey Infra,' having an extent of 380 acres, and a population of 2046. The church formerly belonged to an abbey founded in the reign of Edward the Elder, and occupied by Benedictine nuns: the abbey was valued at the dissolution at 528*l.* 8*s.* 10*d.* per annum gross, or 393*l.* 10*s.* 10*d.* clear. The church is a cross church, having its exterior for the most part of Norman architecture, much enriched in some portions with zigzag and other ornaments: the central portion of the interior, the transepts, and the sides of the chancel, are also Norman: the west end of the church is in the early English style, very plain outside, but rich within. There are various windows of later date inserted, especially some fine ones at the east end. On the roof of the church grows an apple-tree, which for many years has borne fruit. There are dissenting meeting-houses, a town-hall, an 'audit-house,' supported on piers, with an open space below for the market people, a small borough gaol, and some almshouses. There were formerly considerable manufactures carried on at Romsey of sacking and shalloon, but these have much declined: there are in or about the town several paper and flour-mills and tan-yards. The market is on Thursday, formerly on Saturday, and there are three yearly fairs. By the Municipal Reform Act, the council of the borough consists of a mayor, four aldermen and twelve councillors. The living is a vicarage, in the diocese and archdeaconry of Winchester, of the yearly value of 365*l.* There were in the parish in 1835 twelve infant or dame-schools with 136 children, twenty day-schools with about 650 children, and seven Sunday-schools with about 700 children. Of the day-schools one is a free-school, another is a national-school, united with an old endowed free-school, and a third is wholly supported by Lord Palmerston and family. Sir William Petty was a native of Romsey, and lies buried in the church.

Stockbridge is a borough in the hundred of King's Sombourn, on the left bank of the Anton or Test, and near the Andover canal; it is 66½ miles from London on a road leading from Basingstoke to Salisbury. The parish and borough limits coincide and comprehend 1220 acres; the population in 1831 was 851, about one-third agricultural. The town consists of one street, in which are seven bridges: it has little trade, but is chiefly supported by being a considerable thoroughfare. There are races in the neighbourhood. The market is on Thursday, and there is a yearly fair (there were formerly three fairs), one of the largest in the county for lambs. Stockbridge returned two members to parliament up to the passing of the Reform Act, by which it was disfranchised: it is a borough by prescription; the town-hall is a neat building. The living is a chapelry, in the diocese and archdeaconry of Winchester, annexed to the vicarage of King's Sombourn, to which the chapelry of Little Sombourn is also annexed; their joint yearly value is 696*l.* with a glebe-house. There were in Stockbridge in 1833 five day-schools with 99 children, and two Sunday-schools with 60 children.

Whitchurch is a borough in the hundred of Evingar, 56½ miles from London on the great Western road, between Basingstoke and Andover, near the head of the river Anton. The parish comprehends 7330 acres, with a population in 1831 of 1673, about half agricultural. Shalloons and serges are manufactured; also paper for the exclusive use of the Bank of England. The market, held on Friday, is said in some of our authorities to be now disused. Whitchurch is a borough by prescription, and returned two members to parliament until disfranchised by the Reform Act. The living is a rectory, in the peculiar jurisdiction of the bishop of Winchester; of the yearly value of 140*l.* There were in 1833 seven day or boarding and day-schools, with about 230 children, and three Sunday-schools with above 300 children.

Emsworth, a hamlet of the parish of Warblington, at the head of a channel which forms a branch of Chichester harbour, is a place of some trade as a port; ship-building and rope-making are carried on. Hayling Island is becoming a place of considerable resort for bathers, and numerous new buildings have been recently erected. Titchfield, about two miles from Fareham, on the road to Southampton, is a place of some trade: it is on a small river, by which small vessels get up to the town. A customary market is held.

Divisions for Ecclesiastical and Legal purposes.—Hampshire is included in the diocese of Winchester and the ecclesiastical province of Canterbury, and constitutes (inclusive of the Isle of Wight), the archdeaconry of Winchester. This archdeaconry is subdivided into ten deaneries, viz., Alresford, Alton, Andover, Basingstoke, Dorkinsford, or Droxford, Fordingbridge, Sombourn, Southampton, Winchester, and the Isle of Wight. The number of churches and chapels is given in Warner's 'Collections for the History of Hampshire' at 277. In Lewis's 'Topographical Dictionary' the number of benefices is given at 305, viz. 154 rectories, 72 vicarages, and the rest perpetual curacies.

This county is in the Western circuit: the assizes and quarter-sessions are held at Winchester. For the election of members of parliament, the county was by the Reform Act divided into two parts. The Northern division comprebends Alton, Andover, Basingstoke, Droxford, Kingsclere. Odiham, Petersfield, and Winchester divisions; the chief place of election is Winchester, and the polling stations are Winchester, Alton, Andover, Basingstoke, Kingsclere, Odiham, Petersfield, and Bishop's Waltham. The Southern division comprebends Fareham, Lymington, Ringwood, Romsey, and Soutbampton divisions; the chief place of election is Southampton, and the polling stations are Southampton, Fareham, Lymington, Portsmouth, Ringwood and Romsey. Tbe 'divisions' are those made by the county magistrates, subsequently to the census of 1831. Tbo Isle of Wight was by tbe same act severed from tbe county for parliamentary purposes, and allowed to return one member: tho chief place of election is Newport, and the polling stations are Newport and West Cowes. Formerly, two members each were returned from the city of Winchester, the boroughs of Christchurch, Lymington, Portsmouth, Southampton, Andover, Petersfield, Stockbridge, and Whitchurch, and for the boroughs of Newport, Newtown, and Yarmouth, in the Isle of Wight. By tbe Reform Act, Stockbridge, Wbitcburch, Newtown, and Yarmouth were disfranchised, and Christchurch and Petersfield reduced to one member each. The act, by regulating the franchise, opeued the city of Winchester, and the boroughs of Portsmouth, Christchurch, Lymington, Petersfield, Andover, and Newport, wbich were all previously very close.

History, Antiquities, &c.—Before the Roman invasion, this county was iuhabited by three tribes: the Regni (Ῥηγνοι, Ptol.), wbo occupied the coast, as well as tbe counties of Sussex and Surrey; tbe Belgæ (Βελγαι, Ptol.), who inhabited tbe middle portion, and extended into Wiltshire; and the Atrebates, or Atrebatii (Ατρεβατιοι, Ptol.), who occupied, it is likely, the northern part on the confines of Berkshire. Winchester appears to bave been a British town antecedently to its being occupied as a Roman station, and Silchester also, if it may be identified with Calleva Atrebatum. This part of tbe island was reduced by the Romans, probably under Vespasian, who is distinctly recorded by Suetonius (*Vespas.*, c. iv.) as having subjugated the Isle of Wigbt, called by the Romans Vectis (Οὐηκτις, Ptolemy). It was comprehended in Britannia Prima, and was crossed by several Roman roads, and contained several Roman stations. It was Camden's opinion that the Trisanton river mentioned by Ptolemy (Τρισάντωνος ποτάμου ἐκβολαί) was the Anton or Test; perhaps it was the Southampton Water, with all the streams that flow into it. Others however identify the Trisanton with the Arun of Sussex. If Trisanton be a representation of tbe British Traeth Anton, 'tbe æstuary or frith of Anton,' it is a designation peculiarly suitable to Southampton Water. The Roman station Clausentum, mentioned in the Iter VII. of Antoninus, is generally admitted to have been near Southampton. At Bittern Farm abundance of Roman remains are found, and modern antiquaries seem to agree in fixing the station at tbis spot, which is on the east side of the Itchin, by a bend in which it is nearly surrounded. There are remains of the Roman works, a ditch and part of a rampart on the land side, composed of earth, flints, and large flat bricks, and faced roughly with small square stones. A quantity of Roman coins and of fine red pottery, a glass urn, and sculptured and other stones have been dug up. The area of the station is about half a mile in circumference; Southampton probably arose from its ruins. In tbe latter part of the name Claus-entum we probably discern the same root which may be traced in Tris-anton, South-hampton, and Hampton- (now shertened into Hamp-) shire. Another station mentioned by Antoninus is Venta (a Roman modification of the more antient British name Caer Gwent, 'the white city'), distinguished from some other places of the same name, as 'Venta Belgarum.' Ptolemy mentions Venta, or as he writes it Οὐέντα, as one of the towns of the Belgæ. It is the modern Winchester, the first part of which name is a corruption of the British Gwent, or the Roman Venta. This was an important station: the walls with which the Romans enclosed it yet form the cbief part, though frequently repaired and much altered, of the town walls. Roman tombs containing human bones, sepulchral urns, and some other antiquities, have been discovered just outside the town walls. An entrenchment on St. Catherine's Hill, south of the city, is perhaps tbe Roman castra æstiva, or summer camp.

P. C., No. 728.

But the most remarkable remains of a Roman station are at Silchester, a village on the border of the county, due north from Basingstoke. It was certainly a station of importance, though it is difficult to determine whether it was the Calleva Atrebatum or the Vindomis of the Itinerary. Camden identifies it with the latter, and assigns to it the British name of Caer Segont, which is said to have been destroyed in the invasion by Ella, who founded the kingdom of the South Saxons. The remains of this station are among the most entire in the kingdom. The walls form an irregular octagon and are about a mile and a half in compass; they enclose a space of about 100 acres, divided into seven fields, together with the parish cburch and church-yard, a farm-house and its offices. The enclosure contains several springs, and slopes to the south: the foundations of the streets may yet be traced running across it in parallel lines, and in the centre is an open space supposed to have been the forum, where tbe foundations of a large building and other remains have been dug up. The walls are generally from fifteen to eighteen feet high; on the south side, where they are most perfect, they are twenty feet. There are four gates, facing the four cardinal points: some other openings have been made since tbe ruin of the town. The walls are formed by layers of flat stones of variable dimensions, and of rubble-stone consolidated by cement: the whole is surrounded by a ditch wbioh has in many parts been filled up by tbe ruins of the wall. Coins, inscribed stones, and other antiquities have been dug up. At a short distance north-east of the walls are the remains of an amphitbeatre.

The remains of a Roman station, supposed to have been the Brige of Antoninus, were observed by Mr. Gale at Broughton, not far from Stockbridge. The walls of Porchester Castle contain some portions of Roman architecture, and are probably on the site of one of the stations denominated Portus, either Portus Magnus, or more probably Portus Adurni, mentioned in the Notitia Imperii. Roman roads may be traced leadiug from Venta to Sorbiodunum (Old Sarum); to Silchester and to Porchester; and from Silchester in various directions.

This county appears to have been the scene of contest in the Saxon invasion. The invasion of Ella has been noticed. Cerdic, who founded the kingdom of Wessex, is said to have defeated and slain in tbe New Forest a British chieftain who bore the name of Natanleod: and Porta, an ally of Cerdic, is said to have landed at Portsmoutb. Portsmouth obviously derives its name from its situation; and the landing of Porta may have been fixed here by the ignorance of some who sought to give to the name an historical rather tban a topographical origin. Hampshire was included in the kingdom of Wessex, and Venta, called by the Saxons Wintanceaster, became the seat of government. Here Cerdio was buried, and here, on tbe conversion of the West Saxons to Christianity, a bishop's see was established. In the contests of the Saxon princes the Isle of Wight was taken by Wulfhere, king of Mercia, and annexed by him to the kingdom of Sussex: it was however soon after reconquered by Ceadwalla, king of Wessex. Upon the predominance of the West Saxon kings over the other Saxon potentates being permanently established by Egbert, Winchester became the metropolis of England.

When the Northmen attacked the island, Hampshire was exposed to their ravages. In tbe reign of Ethelbert, grandson of Egbert (A.D. 860—866), a body of them landed at Soutbampton, and advanced to Winchester, which they partially laid waste: they were routed however as they returned to their ships and much of the booty recovered. At Basing, near Basingstoke, Ethelred I., king of Wessex, and his brother Alfred, were defeated by the Danes, A.D. 870. A year or two after, viz. in 871 or 873, in the reign of Alfred, tbe invaders made another attack on Winchester, damaged the cathedral and murdered the ecclesiatics belonging to it. From the timo of Alfred's restoration the county experienced scarcely any hostility till the time of Ethelred II., in whose reign, about the close of the tenth century, the Danes ravaged the Isle of Wight. In the civil dissensions of the reign of Edward the Confessor, the same island was infested by Godwin, earl of Kent, and his son Harold, then in rebellion: and in the subsequent reign, of Harold II., it was laid under contribution by Tostig, the king's rebellious brother. Winchester continued to be the principal seat of royalty in the reign of William tbe Conqueror.

The extension or formation of the New Forest by William has been already noticed; it became the scene of several disasters which befel his family, and which were regarded as judgments on him for his arbitrary and cruel behaviour in the transaction, which however has been much exaggerated. His son Richard lost his life here by what Camden describes as 'a pestilential blast:' his grandson Henry, son of Robert, was entangled among the branches and killed while hunting; and his successor William Rufus was shot by a random arrow by Walter Tyrrel, A.D. 1100. Upon Rufus's death, Henry, his brother, hastened to Winchester, where he possessed himself of the royal treasure, and afterwards succeeded to the crown. Robert, his elder brother, to whom the succession rightfully belonged, landed at Portsmouth with an army the next year (A.D. 1101) to enforce his claim; but finding his rival too strong, came to an accommodation with him, and retired.

In the civil war between the supporters of King Stephen (then a prisoner) and the Empress Maud, Winchester was the scene of conflict. The cathedral and Wolvesey Castle, the residence of Henry of Blois, bishop of Winchester and brother of Stephen, were in the hands of the king's party, and Winchester Castle and other parts of the city in the hands of the empress. The empress's friends were gradually dispossessed of all they held, except the castle; and, when this was hard pressed, it is said that the empress escaped by being carried through the opposing army, wrapped in a sheet of lead, like a corpse for interment. Her natural brother and chief supporter, the earl of Gloucester, was taken soon after at Stockbridge and exchanged for the captive king. In the civil war which marked the close of the reign of John, Odiham Castle was gallantly but vainly defended for that prince against the revolted barons and the Dauphin, Louis of France.

At the commencement of the French war of Edward III., A.D. 1338, the town of Southampton was attacked by the French with their allies the Genoese and Spaniards. Their fleet was of fifty galleys. They took the town, burned the greater part of it, and slaughtered many of the inhabitants. About the close of the reign of Edward III., or the commencement of that of Richard II., another attack was made on this town, but failed. About the same period the Isle of Wight was attacked by the French, and Newtown and Yarmouth burned, and Carisbrook Castle vainly besieged. In A.D. 1415, when Henry V. was about to embark at Southampton for France, a conspiracy against his life was detected; for which the Earl of Cambridge and others were executed in that town. In the reign of the same monarch the Isle of Wight was once attacked and a second time threatened by the French. About the close of the reign of Henry VIII. another attack was made by the same people, but repulsed. It was at Winchester that Mary I. was married to Philip of Spain, A.D. 1554.

Of these early times the county contains several relics. [BISHOP'S WALTHAM; CHRISTCHURCH; SOUTHAMPTON.] Porchester Castle, at the head of Portsmouth harbour, is of great antiquity and doubtful origin. It is probable that the site has been occupied by a fortress from a period anterior to the Roman conquest; and the present structure exhibits traces of Roman, Saxon, and Norman architecture. It is a quadrangle enclosing an area of four or five acres, and is still in sufficient preservation to be used occasionally as a place of confinement for prisoners of war. The walls are from eight to twelve feet thick and eighteen feet high, having in many places a passage round them, defended by a parapet. It is enclosed by a ditch (double on the east side), and has eighteen towers including those of the keep, which are four. The keep forms the north-west angle of the castle, and encloses a quadrangle of one hundred and fifteen feet by sixty-five. The remains of Roman workmanship are chiefly observable in the outer walls. Many Roman coins and medals have been dug up at different times. The parish church of Porchester is within the outer court of the castle: it is a large Norman cross church, of which the south transept has been destroyed. All the doors and windows of the more antient part have semicircular arches. Calshot and Hurst castles are of the time of Henry VIII., and though still occupied as garrisons are of little strength. Both are on small headlands jutting into the sea: Calshot, at the entrance of Southampton Water; and Hurst, near Lymington. Netley Castle, near Netley Abbey, built about the same time, is now a ruin.

The chief monastic remains beside those mentioned elsewhere [CHRISTCHURCH; WINCHESTER] are Netley and Beaulieu abbeys, and the Priory of St. Dionysius, near Southampton, beside the church of Romsey, mentioned above as having formerly been conventual. Netley Abbey is a short distance from the bank of the Southampton Water, about three miles east of the town of Southampton. It appears to have been founded in the thirteenth century, though probably not by Henry III., to whom its origin is commonly attributed. It was of the Cistertian order. At the time of the dissolution its possessions were valued at 160*l.* 2*s.* 9*d.* gross, or 100*l.* 1*s.* 8*d.* clear yearly value. The ruins stand on the declivity of a hill gently rising from the water, and are so environed by wood as to be scarcely observable, except on a near approach. The principal remains are the chapel, a crypt popularly called 'the Abbot's Kitchen,' the chapter-house, and the refectory. The chapel was in the form of a cross; the southern transept and the choir are the most perfect portions; the northern transept has been destroyed, and many parts are much mutilated. The roof of the whole has fallen in, and most of the windows have lost their tracery. Many parts of the ruins are finely mantled with ivy. The length of the chapel when entire was about 200 feet: the breadth 60 feet, and at the transepts 120 feet. The crypt is a curious vaulted apartment, 48 feet long by 18 broad. Beaulieu Abbey, also Cistertian, was founded, A.D. 1204, by King John: its yearly revenue at the dissolution was 428*l.* 6*s.* 8*d.* gross, or 326*l.* 13*s.* 2*d.* clear. The stone wall which surrounded the precincts of the abbey is in several places nearly entire and is finely mantled with ivy. The abbot's apartments, converted after the dissolution into a family seat, having a well-proportioned vaulted hall; a long building, supposed, from the extent and height of the apartments, to have been the dormitory; the antient kitchen and the refectory are still standing. There are some traces of the cloisters; a gateway leading to the area enclosed by them is standing; the church is entirely destroyed. The refectory, a plain stone building, with strong buttresses, and a curiously raftered oak roof, forms the parish church of the village of Beaulieu. This abbey possessed the privilege of sanctuary, and as such afforded shelter to Margaret of Anjou and her son Prince Edward, on their landing in England at the time of the battle of Barnet, and to Perkin Warbeck, after the failure of his attempts in the West of England. St. Dionysius's (commonly called St. Denis's) Priory, is on the bank of the Itchin above Southampton. It was founded by Henry I. for Augustinian or Black Canons. It yearly revenues at the dissolution were valued at 91*l.* 9*s.* gross, or 80*l.* 11*s.* 6*d.* clear. The ruins are of small extent, and appear to have formed the west end of the Priory church.

In the beginning of the reign of Charles I. the duke of Buckingham was stabbed at Portsmouth, and in the civil war of that reign this county was the scene of partial hostilities. The strong posts of the Isle of Wight were early in the contest secured for the parliament, and the island was thus preserved from subsequent disturbance. In December, 1643, the Royalists were defeated at Alton by Sir William Waller. But the most remarkable event in the contest that occurred in this county was the defence of Basing House, near Basingstoke, by its possessor, John Paulet, marquis of Winchester. The marquis was a Royalist, and fortified his mansion for the king with works, which inclosed a space of above fourteen acres. The outline of the works was irregular, but the ditches were deep (in some parts thirty-six feet perpendicular), and the ramparts, of which there are yet some remains, very high and strong. The investment commenced in August, 1643, and Sir William Waller, who made the first serious assaults, after being repelled in three attempts to storm the place in nine days, was obliged to retreat to Farnham. The investment continued, probably at intervals, for two years. In 1644 the garrison, when much pressed by hunger, was twice relieved by a detachment from the Royalist quarters at Oxford, under Colonel Gage. The final investment was by Cromwell, who, in Oct., 1645, took the house by storm, and burned it to the ground. The plunder in cash, jewels, and rich furniture, is said to have been immense. In A.D. 1647, Charles I., after his escape from Hampton Court, remained concealed at Titchfield House till he gave himself up to Colonel Hammond, governor of the Isle of Wight. He was imprisoned for some time at Carisbrook, and afterwards at Hurst Castle.

Statistics.

Population.—Hampshire is an agricultural county, few of its inhabitants being engaged in manufactures. Of 74,711 males twenty years of age and upwards living in the county in 1831 there were 28,683 employed in agricultural pursuits, and only 292 in manufactures or in manufacturing machinery; 10,348 were employed as labourers not agricultural.

Hampshire ranks the 22nd in the list of agricultural counties.

The population of this county at each of the four enumeratious made in the present century was—

	Males.	Females.	Total.	Increase per cent.
1801	105,667	113,989	219,656	..
1811	118,855	126,225	245,080	11·57
1821	138,373	144,925	283,298	15·59
1831	152,082	162,198	314,280	10·94

showing an increase between the first and last periods of 94,624, or rather more than 43 per cent., which is 14 per cent. below the whole rate of increase throughout England.

The following table contains a summary of the population, &c., of every division, as taken in 1831:—

Summary of the County of Southampton (otherwise Hampshire, or Hants).

DIVISIONS, BOROUGH, CITY, TOWNS, &c.	HOUSES.				OCCUPATIONS.			PERSONS.			
	Inhabited.	Families.	Building.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.	Males, twenty years of age.
Alton, North Division	2,401	2,883	11	52	1,523	742	618	7,553	7,415	14,968	3,763
Alton, South Division	1,238	1,455	8	25	847	319	289	3,739	3,744	7,483	1,854
Andover	5,283	5,925	72	167	3,007	1,734	1,184	13,862	13,603	27,465	7,082
Basingstoke	5,232	5,980	30	113	3,568	1,438	974	15,029	14,563	29.592	7,558
Fawley	4,158	4,733	21	93	2,867	1,047	819	12,260	11,760	24 020	6,279
Kingsclere	3,442	3,796	23	65	2,454	785	557	9,196	8,874	18,070	4,561
New Forest, East	3,528	3,788	32	110	1,297	1,134	1,357	9,031	9,315	18,346	4,465
New Forest, West	3,894	4,097	40	165	2,078	988	1,031	9,473	9,654	19,127	4,697
Portsdown	7,525	8,175	48	372	2,558	3,253	2,364	19,902	21,396	41,298	10,031
Isle of Wight	5,811	6,684	44	254	2,229	2,220	2,235	17,205	18,226	35,431	8,059
Winchester, City, and Soke Liberty	1,415	1,683	12	39	71	820	792	4,285	4,482	8,767	2,138
Portsmouth, Borough, and Portsea, Town	9,410	11,394	63	367	245	4,765	6,384	21,902	28,487	50,389	9,808
Southampton, Town & County	3,189	4,059	118	195	17	1,738	2,304	8,645	10,679	19,324	4,416
Totals	56,526	64,652	522	2017	22,761	20,983	20,908	152,082	162,198	314,280	74,711

County Expenses, Crime, &c.—The sums expended for the relief of the poor at the four dates of—

		£.		s.	d.	
1801	were	124,019,	being	11	3	for each inhabitant.
1811	„	225,601	„	18	4	„
1821	„	193,294	„	13	7	„
1831	„	215,229	„	13	8	„

The sum expended for the same purpose for the year ending March, 1837, was 123,840*l.*; and assuming that the population had increased at the same rate of progression as in the ten preceding years, the above sum gives an average of 7*s.* 6*d.* for each inhabitant. These averages are all above those for the whole of England and Wales.

The sum raised in Hampshire for poor-rate, county-rate, and other local purposes, in the year ending the 25th of March, 1833, was 248,176*l.* 3*s.*, and was levied upon the various descriptions of property as follows:—

On land	£180,534	4
Dwelling-houses	58,680	3
Mill, factories, &c.	4,112	7
Manorial profits, navigation, &c.	4,849	9

The amount expended was—

For the relief of the poor	£211,075	18
In suits of law, removal of paupers, &c.	5,467	2
For other purposes	35,980	7
	252,523	7

In the returns made up for subsequent years, the descriptions of property assessed are not specified. In the years 1834, 1835, 1836, and 1837, there were raised 243,525*l.* 15*s.*, 211,826*l.* 17*s.*, 177,547*l.* 2*s.*, and 151,240*l.* respectively; and the expenditure of each year was as follows:—

	1834. £.	s.	1835. £.	s.	1836. £.	s.	1837. £.
For the relief of the poor	203,466	4	174.418	2	141,933	11	123,840
In suits of law, removals, &c.	6,545	11	4,324	12	3,504	9	2,105
Payment towards the county-rate	33,934	17	5,799	2	14,061	12	15,507
For all other purposes			22,251	5	18,485	7	13.297
Total money expended	£243,946	12	216,793	1	177,984	19	154,839

The saving effected on the whole sum expended in 1837, as compared with that expended in 1834, was therefore about 36½ per cent.; and the saving effected on the sum expended for the relief of the poor was rather more than 39 per cent. in 1837, as compared with the expenditure in 1834.

The number of turnpike trusts in Hampshire, as ascertained in 1835, is 36; the number of miles of road under their charge is 810; the annual income in 1835, arising from the tolls and parish composition, was 30,321*l.* 13*s.* 6*d.*; and the annual expenditure, 29,894*l.* 11*s.* 7*d.*

The county expenditure in 1834, exclusive of that for the relief of the poor, was 19,618*l.* 3*s.* 5*d.*, disbursed as follows:—

	£.	s.	d.
Bridges, building, and repairs, &c.	1,247	3	5
Gaols, houses of correction, &c., and maintaining prisoners, &c.	3,909	18	3
Shire-halls and courts of justice, building, repairing, &c.	898	19	8
Prosecutions	2,999	8	5
Clerk of the peace	732	2	8
Conveyance of prisoners before trial	791	15	5
„ transports	91	0	0
Constables, high and special	71	1	0
Coroner	298	12	0
Debt, payment of, principal and interest	6,165	10	0
Miscellaneous	2,412	12	7

The number of persons charged with criminal offences in the three septennial periods ending with 1820, 1827, and 1834, were 2085, 2190, and 3187 respectively; making an average of 298 annually in the first period, of 313 in the second period, and of 455 in the third period. The number of persons tried at quarter-sessions, in each of the years 1831, 1832, and 1833, in respect to which any costs were paid out of the county rates, were 109, 156, and 202 respectively. Among the persons charged with offences, there were committed for—

	1831.	1832.	1833.
Felonies	82	129	144
Misdemeanors	9	6	16

The total number of committals in each of the same years was 151, 227, 249 respectively.

	1831.	1832.	1833.
The number convicted was .	98	167	163
„ acquitted .	18	23	43
Discharged by proclamation .	35	37	43

In 1837, at the assizes and sessions, 622 persons were charged with crime in Hampshire. Of these, 42 were charged with offences against the person, 15 of which were for common assaults; there were 24 offences against property, committed with violence; 512 offences against property, committed without violence; 2 for setting fire to crops, &c.; 4 for maiming cattle; 13 for forging and coining; 16 for poaching; 5 for riot; 4 for other misdemeanors. Of the whole number of offenders, 437 were convicted, 138 were acquitted, no bill was found against 36, and 11 others were not prosecuted. Of those convicted, 8 were condemned to death, none of whom were executed, but the sentence of 6 was commuted to transportation for life; and of 2 to imprisonment for six months or under. Besides the above six, 19 were transported for life, 3 for 14 years, and 45 for 7 years; 3 were sentenced to imprisonment for 2 years and above one, 49 for one year and above 6 months, and 308 for 6 months and under; 2 were fined. Of the whole number of offenders, 509 were males, and 113 were females; 225 could neither read nor write; 344 could read and write imperfectly; 47 could read and write well; 2 had a superior instruction, and the degree of instruction of 4 could not be ascertained.

The number of persons qualified to vote for the county members of Hampshire is 8983, being about 1 in 35 of the whole population, and above 1 in 8 of the male population twenty years and upwards, as taken in 1831. The expenses of the last election of county members to parliament were to the inhabitants of the county 233*l.* 17*s.* 2*d.*, and were paid out of the general county-rate.

There are 11 savings' banks in this county. The number of depositors and amount of deposits on the 26th of November in each of the following years were—

	1832.	1833.	1834.	1835.	1836.
Number of depositors	7,700	8,581	9,237	9,898	10,408
Amount of deposits	£279,299	£301,906	£322,493	£341,155	£356,456

The various sums placed in the savings' banks in 1835 and 1836 were distributed as under:—

	1835.		1836.	
	Depositors.	Deposits.	Depositors.	Deposits.
Not exceeding £20	4,805	£35,629	5,018	£36,067
„ 50	2,885	89,323	3,056	95,660
„ 100	1,381	92,851	1,473	95,838
„ 150	487	58,629	501	60,758
„ 200	260	43,922	282	47,298
Above 200	80	20,801	78	20,835
	9898	341,155	10,408	356,456

Education.—The following summary is taken from the Parliamentary Returns on Education, made in the session of 1835:—

	Schools.	Scholars.	Total.
Infant schools	99		
Number of infants at such schools; ages from 2 to 7 years:—			
Males		627	
Females . . .		634	
Sex not specified .		805	
			2,066
Daily schools	1197		
Number of children at such schools; ages from 4 to 14 years:—			
Males . . .		15,911	
Females . . .		13,577	
Sex not specified .		7,179	
			36,667
Schools .	1,296		
Total of children under daily instruction			38,733
Sunday-schools	440		
Number of children at such schools; ages from 4 to 15 years:—			
Males		12,088	
Females . . .		12,714	
Sex not specified .		7,610	
			32,412

Assuming that the population between the ages of 2 and 15 has increased in the same proportion with the whole population since 1821, when the relative population at different ages was last taken, and likewise assuming that the whole population has increased since 1831 in the same ratio as it did the ten years preceding that date, we find by approximation that there were 108,217 children between the ages of two and fifteen in the county of Hampshire in 1834, the time the educational inquiry was made. Sixteen Sunday-schools are returned from places where no other school exists, and the children, 441 in number, who are instructed therein, cannot be supposed to attend any other school; at all other places Sunday-school children have opportunity of resorting to other schools also; but in what number or in what proportion duplicate entry of the same children is thus produced must remain uncertain. Ninety schools, containing 6215 children, which are both daily and Sunday-schools, are returned from various places, and duplicate entry is therefore known to have been thus far created. Making allowance from this cause for a number of children having been entered twice as under instruction, we may perhaps fairly conclude that not two-thirds of the children between the ages of 2 and 15 are receiving instruction in this county.

Maintenance of Schools.

Description of Schools.	By endowment.		By subscription.		By payments from scholars.		Subscrip. and payment from scholars.	
	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.
Infant Schools	2	125	7	139	77	1103	13	699
Daily Schools	93	2143	128	8,362	865	19,438	111	6454
Sunday Schools	15	733	392	29,072	..	..	33	2607
Total...	110	3271	527	37,573	942	20,541	157	9760

The schools established by dissenters, included in the above statement, are:—

	Schools.		Scholars.
Infant school . .	1,	containing	69
Daily schools . .	29,	„	1,499
Sunday-schools .	125,	„	12,888

The schools established since 1818 are:—

			Scholars.
Infant and other daily schools	794,	containing	22,399
Sunday-schools	334	„	23,706

One hundred boarding-schools are included in the number of daily schools given above. No school in this county appears to be confined to the children of the Established Church, or of any other religious denomination, such exclusion being disclaimed in almost every instance, especially in schools established by Dissenters, with whom are here included Wesleyan Methodists and Roman Catholics. Lending-libraries of books are attached to 92 schools in this county.

HAMPSHIRE, NEW. [New Hampshire.]

HAMPSTEAD. [Middlesex.]

HAMPTON. [Polybius.]

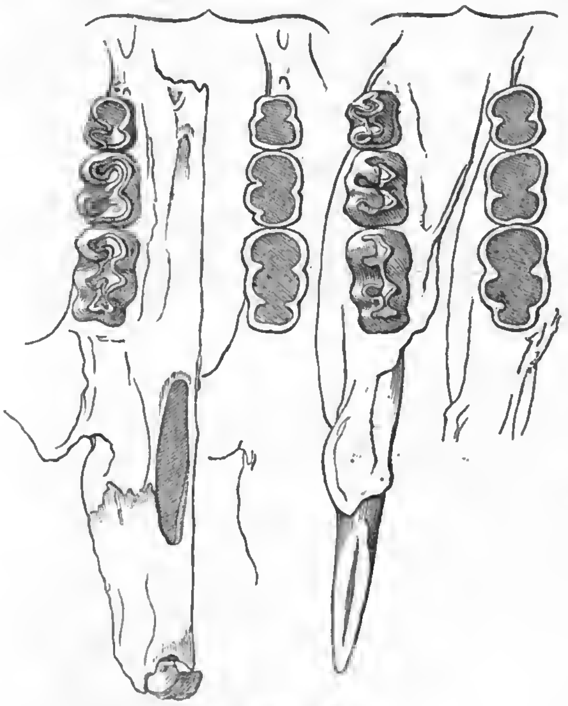
HAMSTER, *Cricetus*, the name of a genus of Rodents, whose economy makes them one of the most interesting of the great Linnæan genus *Mus*, or the family of *Muridæ* in its most extensive sense.

Generic Character—Molar *teeth* simple; their crown furnished with blunt tubercles. Four *toes* and the vestige of a thumb on the fore-feet; five toes on the hind feet; nails robust. *Tail* short and hairy.

Dental Formula.—Incisors $\frac{2}{2}$; molars $\frac{3-3}{3-3} = 16$.

Geographical Distribution of the Genus.—All the north of Europe and of Asia, the temperate countries of Persia, and the deserts of Astrakan. If the *Canada pouched* rat (*Hamster du Canada—Cricetus bursarius* of Desmarest, *Mus bursarius* of Shaw) is to be considered a hamster, Canada and the borders of Lake Superior must be added; and it must be remembered that the *Tucan* of Hernandez, an inhabitant of New Spain, is considered by some to be identical with this 'Canada Rat' (Dr. Richardson thinks on insufficient grounds). But the last-mentioned zoologist places Desmarest's *Canada Hamster* under the genus *Geomys*, with a note of interrogation; and Say has given it a generic distinction under the name of *Pseudostoma*.

There are five or six species of the genus; but we shall select as our example the *Common Hamster, Cricetus vulgaris, Mus Cricetus* of Pallas, Le *Hamster* of Buffon and the French authors.



Teeth of Hamster. (F. Cuvier.)

Description.—Reddish brown above; black below, with three great whitish spots on the sides. Feet white; a white spot on the throat, and another on the breast. Length about 9 inches; tail 3. Males bigger than females. Weight of some males from 12 to 16 ounces; weight of females seldom exceeding from 4 to 6.

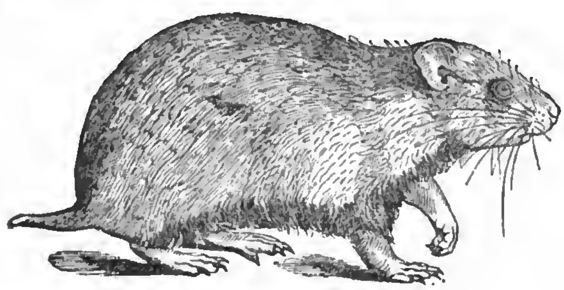
Varieties.—Variations in colour are not uncommon. There is one variety entirely black. Pennant figures one which is entirely black, with the exception of the edge of the ear, the muzzle, the under-jaw and feet.

Localities.—All the north of Europe and Asia (Lesson), Austria, Silesia, and many parts of Germany, Poland, and the Ukraine; all the southern and temperate parts of Russia and Siberia; and even about the river Yenesei, but not farther to the east. In the Tartarian deserts, in sandy soil: they dislike moist places. Swarming in Gotha (Pennant).

Food, Habits, Reproduction.—The *Common Hamsters* are ill friends to the farmer. The quantity of grain which they consume is very great, nor does the destruction stop with mere satiety of appetite; the animal never forgets its hoard, and fills its two cheek-pouches till they seem bursting with the booty. They are also said to be very fond of the seeds of liquorice. Their dwellings are under the earth; their mode of forming them, and the purposes to which they apply them, have been thus described:—They first form an entrance, burrowing down obliquely. At the end of this passage one perpendicular hole is sunk by the male; the female sinks several. At the end of these they excavate various vaults, some as lodges for themselves and young, some as storehouses for their food. Every young one is said to have its separate apartment; each sort of grain its different vault. The 'living apartments,' as they may be called, are lined with straw or grass. The vaults are said to be of different depths, according to the age of the constructor: a young hamster, it is stated, makes them scarcely a foot deep, an old one sinks to the depth of four or five; and the whole 'curtilage,' so to speak, is sometimes eight or ten feet in diameter. From the mode of proceeding in their work, the reader will be prepared for the statement that the male and female live in separate apartments; and indeed it appears that, excepting at the short season of courtship, they have very little or no intercourse. Pennant gives them a very unamiable character. 'The whole race,' writes that zoologist, 'is so malevolent as to constantly reject all society with one another. They will fight, kill, and devour their own species, as well as other lesser animals; so may be said to be carnivorous as well as granivorous. If it happens that two males meet in search of a female, a battle ensues; the female makes a short attachment to the conqueror, after which the connection ceases. She brings forth two or three times in a year, and brings from sixteen to eighteen at a birth: their growth is very quick, and at about the age of three weeks the old one forces them out of the burrows to take care of themselves; she shows little affection for them; for if any one digs into the hole, she attempts to save herself by burrowing deeper into the earth, and totally neglects the safety of her brood; on the contrary, if she is attacked in the season of courtship, she defends the male with the utmost fury.'

The harvest of these animals commences in August. Grains of corn, ears of corn, peas and beans in the pods, all find their way into their cheek-pouches, which will hold a quarter of a pint English. This forage is carefully cleaned in their burrows, and the husks and chaff carried out. When all is in order, they stop up the entrance and prepare for their hybernation, which lasts during the whole of the severe season; the provision they have made having been collected for the purpose of their support before their torpidity actually commences, and also in the spring and summer before the season has produced a supply for them in the fields. If all tales be true, they are a bold generation, and will jump at a horse if he tread near them, and hang by its nose so as to be disengaged with difficulty. Their voice is said to be like the barking of a dog. Fierce as they are, they quail before their deadly enemy the polecat, which, chasing them into their holes, destroys them unrelentingly. Notwithstanding this check, they are said to be so numerous in some seasons as to occasion a dearth of corn.

Utility to Man.—The fur of the animal is said to be valuable; and the peasant, when he 'goes a *Hamster-nesting*' in the winter, not only possesses himself of the skin of the plunderer, but of the plunder, which is said commonly to amount to two bushels of good grain in each magazine. Buffon, quoting Sulzer, says that in Gotha, where these animals were proscribed on account of their vast devastations among the corn, 11,564 of their skins were delivered at the Hôtel de Ville of the capital in one year; 54,429 in another, and 80,139 in a third.



Hamster; Cricetus vulgaris. (F. Cuvier.)

FOSSIL HAMSTER.

Professor Kaup records *Cricetus vulgaris fossilis*, from the Epplesheim sand.

HANAPER OFFICE, one of the offices belonging to the Court of Chancery. Writs relating to the business of the subject, and their returns, were, according to the simplicity of antient times, originally kept in a hamper, *in hanaperio;* and the others, relating to matters wherein the Crown was immediately or mediately concerned, were preserved in a little sack or bag, *in parvâ bagâ;* whence the distinction of the Hanaper Office and Petty Bag Office, both belonging to the Common-Law Court in Chancery.

The business of the clerk of the Hanaper is to receive all money due to the king for the seals of charters, patents, commissions, and writs, as well as all fees due to the officers for enrolling and examining them.

HANAU-MÜNZENBERG is a county in the electorate of Hesse Cassel, on the north bank of the Main, a very fertile and well-cultivated district, containing about 490 square miles, with a population of above 90,000 inhabitants. The county had formerly its own count, but the family was subsequently divided into two branches, that of Münzenberg and that of Lichtenberg. Both branches becoming extinct in the male line, Hanau-Münzenberg came, in 1736, to the electorate of Hesse Cassel, with which it has ever since been united (except from 1806, when the French took possession of it, to 1814, when the elector recovered it). It is contains some mountainous tracts, extensive forests, and rich mines of copper, silver, cobalt, and salt. The inhabitants are Protestants, with the exception of between 400 and 500 Roman Catholics and 800 Jews. In 1818 the Lutherans and Calvinists agreed to unite together as an evangelical church. There are some manufactures, chiefly in Hanau, the capital.

Hanau-Lichtenberg was formerly nearly equal in extent to Hanau-Münzenberg, but the larger portion, lying in Alsace, is now part of France; and the remainder, which occupies about 100 square miles, with 20,000 inhabitants, belongs to Baden.

HANAU, the capital of Hanau-Münzenberg, situated in an extensive plain on the river Kinzig, near its junction with the Main, consists of the old and the new town. In the former is the magnificent castle, the gymnasium, the theatre, the hospital, and the synagogue. The new town has straight broad streets, and in the middle of it a large market-place, forming an oblong parallelogram, with handsome fountains in the four corners, and the large town-hall at one end. The cathedral has a leaning tower, like that at Pisa. The inhabitants are 13,000, among whom are some descendants of the Walloons and Flemings who fled from the tyranny of Philip II.; likewise some of the French Calvinists expelled by the revocation of the edict of Nantes. Hanau is the most manufacturing place in Hesse Cassel, and has a considerable trade. In the vicinity are the electoral palace of Philipsruhe and the baths of Wilhelmsbad. On October 30, 1813, a dreadful battle was fought near Hanau, when an army of Bavarians and Austrians, commanded by Prince Wrede, endeavoured to stop Napoleon on his retreat to France. The loss was very great on both sides, especially on that of the French, who were stated to have had 15,000 killed and wounded and 10,000 prisoners, but Napoleon made good his passage.

HAND. [MAN.]

HANDEL, GEORGE FREDERICK, who, from having passed nearly the whole of his life in this country, and produced in it all his great works, the English feel some right to claim as their own, was born at Halle, in Saxony, on the 24th of February, 1684. He was the issue of a second marriage, which his father, an eminent physician and surgeon, contracted after he had reached his grand climacteric. This son of his rather advanced age he destined for the profession of the civil law, but the child's passion for music, his sacrifice of play-hours, often of his meals, to its pursuit, and the determined manner in which he evaded or resisted all attempts to divert him from a purpose nature seems to have prompted, at length softened the obduracy of his father, who, by the earnest advice of the duke of Saxe-Weissenfels, placed him under Friedrich Zachau, organist of the cathedral of Halle, an excellent musician. This professor soon made so willing a pupil acquainted with the principles of the science and the laws of harmony; he then placed in his hands the best works of the greatest composers, without directing his attention to any one in particular, thus leaving him to form a style of his own out of an acquaintance with numerous models of acknowledged superiority. So successful was this plan of education, that the youthful student composed a set of sonatas when only ten years of age, which was in the possession of George III., and most probably still forms a part of the Queen's library.

Handel continued his attendance on the same master till he attained his fourteenth year, when he was taken to Berlin, where the Italian opera was flourishing under the direction of Bononcini and Ariosti, afterwards his rivals in London. He there attracted the notice of the elector, who proposed to send him to Italy, which offer, for some reason unknown, was declined by his father, who shortly after died; and from this period we lose all trace of the young Handel till the year 1703, when he reached Hamburg, in which city he may be said to have commenced his professional life. He there found Reinhard Keiser in the office of director of the opera, a composer of the highest celebrity, but whose expensive and somewhat dissipated habits led him frequently to absent himself from his post, on which occasions Handel was appointed to fill his situation, a preference so irritating to Mattheson, an able musician and a voluminous writer on the art, that he violently assailed his favoured rival. A duel ensued, and nothing but a *score*, buttoned under Handel's coat, on which his antagonist's weapon broke, saved a life that soon proved of such inestimable value. Shortly after this he was employed to set a drama entitled *Almeria*, the success of which was remarkable; it ran thirty nights uninterruptedly. Next year he produced *Florinda*, and *Nerone* in the year following, both of which were as favourably received as his former work. He now found himself possessed of the means of visiting Italy, then the land of song. At Florence he was welcomed in the most flattering manner by the grand-duke, and there, in 1709, produced the opera of *Rodrigo*, for which he was rewarded with a hundred sequins (50*l.*), and a service of plate, presents which now seem quite disproportioned to each other. He then proceeded to Venice, and brought out his *Agrippina*, which was performed twenty-seven nights successively. In this, we are told, horns and other wind instruments were first used in Italy, as accompaniments to the voice. 'Here the charms of his music made an impression on the famous beauty and singer, Signora Vittoria, a lady particularly distinguished by the grand-duke; but in this, as in every instance of a similar kind, Handel showed no disposition to avail himself of any partialities exhibited in his favour. His thoughts were nearly all absorbed by his art; and it is but just to conclude that he was also influenced by those sentiments of moral propriety which so distinctly marked his conduct through life. (*Gallery of Portraits*, vol. ii., p. 41.)

Quitting Venice, Handel went to Rome, where he was hospitably entertained by the Cardinal Ottoboni, who had in his service a band of excellent performers, under the direction of the famous Corelli [CORELLI], with whom, as well as with Domenico Scarlatti, the young Saxon speedily formed an acquaintance. There he produced *Il Trionfo del Tempo*, the text written for him by the Cardinal Pamphilii, and a sacred opera, a kind of mystery, *La Resurrezione*. The former altered and enlarged, with English words by Dr. Morell, he afterwards brought out in London, as an oratorio, under the name of *The Triumph of Time and Truth*. From Rome he advanced to Naples; but being anxious to return to Germany he declined many proffered engagements, and in 1710 reached Hanover, finding there a generous patron in the Elector, afterwards George I., who soon appointed him his *Maestro di Capella*, with a salary of 1500 crowns, on condition that he would, on the termination of his travels, return to perform the duties of his office.

In 1710 this great musician first arrived in London, and was soon honoured by the notice of Queen Anne. Aaron Hill, then manager of the opera, having formed a drama from Tasso's *Gerusalemme Liberata*, which Rolli worked into an opera under the title of *Rinaldo*, Handel set music to it, and it was produced in March, 1711. He then returned to Hanover; but the attractions of London brought him back the following year to this metropolis, which thenceforward became his home. At the peace of Utrecht he, by the queen's command, composed a *Te Deum* and *Jubilate*, for the rejoicings on that event. A pension of two hundred pounds was the reward of this service. His promise to return to Hanover was now either forgotten or its fulfilment delayed; when, in 1741, the demise of Queen Anne placed the elector of Hanover on the British throne. Handel, taken by surprise, and conscious of having offended his patron, did not dare present himself at court; but his friend Baron Kilmansegge having contrived that he should meet the king, during a royal excursion on the Thames, with a band of wind-instruments, playing the charming *Water-Music*, written for the occasion, the composer was again received into favour, and never after lost the royal protection. His pension was immediately doubled; and many years after, when appointed to teach the princesses, Queen Caroline, consort of George II., added another 200*l.* to the former grants; making altogether 600*l.* per annum, no small income a century ago. From 1715 to 1718 Handel was an inmate in the house of the Earl of Burlington, where he constantly met Pope, whose regard for the German composer is manifest from all he said and wrote concerning him. During the same period he produced three operas, *Amadis*, *Tesco*, and *Il Pastor Fido*, besides several detached pieces. In 1718 he undertook the direction of the Duke of Chandos's chapel at Cannons, for which he composed many fine anthems. He there also produced most of his concertos, sonatas, lessons, and organ fugues, his *Acis and Galatea*, for which Gay furnished him with the poetry, and the oratorio of *Esther*.

The busiest, but not the most fortunate, period of Handel's life now arrived. The English nobility formed a project for converting the Italian theatre into an Academy of Music, a title borrowed from the French, and engaged the subject of this biographical notice as manager, with a condition that he should supply a certain number of operas. In consequence, he went to Dresden to engage singers, among whom was Senesino. His first opera was *Radamisto*, the success of which was unparalleled. But Bononcini and Ariosti, before alluded to, had been attached in some measure to the theatre, and having powerful friends, opposed themselves to the German intruder, as they very insolently called the great composer. Hence those feuds, among the weak people of fashion, the remembrance whereof is propetuated by Swift's well-known epigram. To calm these it was proposed that an opera in three acts should be produced, and that each of the contending composers should set one act. The drama chosen was *Muzio Scevola*. Handel's portion was declared the best; 'but, strange to say, though each, no doubt, strained his ability to the utmost in this struggle, not a single piece in the whole opera is known in the present day!' Handel now, master of the field, produced about fifteen new operas; 'but the genius of discord,' says the work from which we have before quoted, 'must always have a seat in the temple of harmony,' and that spirit of cabal often caused and always encouraged by the weak, that is the larger, part of the ranks of fashion, compelled the great composer and able manager to retire from the theatre in 1726, with the loss of 10,000*l*., and a constitution much damaged by incessant labour and constant turmoil. A slight paralytic affection was the consequence, which however the baths of Aix-la-Chapelle removed. He then made an attempt to give operas at Covent Garden Theatre, but this proved equally mortifying and unprofitable. But the vexations and losses he encountered at the Italian Theatre ultimately led to the advancement of his fame and the repair of his fortune. He now announced performances during the Lent season, in imitation of the *Concerto Spirituale*, which he called oratorios, and at Covent Garden gave several, most of them composed for the occasion. But the receipts at these did not indemnify him for the expenses he incurred: even his sublimest work, *The Messiah*, was as ill-attended as received in the capital of the empire, when first produced in 1741.

These failures were imputed, and justly, to the hostility of the nobility, who, notwithstanding the unvaried patronage of the Royal Family, still pursued him with unabated rigour. From such persecution he determined to seek refuge in Ireland, then noted for the gaiety and splendour of its court. Pope alludes to this circumstance in the well-known appeal to the Goddess of Dullness:—

> 'But soon, ah! soon rebellion will commence,
> If music meanly borrows aid from sense.
> Strong in new arms, lo! giant Handel stands,
> Like bold Briareus, with a hundred hands:
> To stir, to rouse, to shake the world he comes,
> And Jove's own thunders follow Mars's drums.
> Arrest him, empress, or you sleep no more—
> She heard,—and drove him to th' Hibernian shore.'

'On his arrival in Dublin,' says Dr. Burney, in his *Commemoration of Handel*, 'he, with equal judgment and humanity, began by performing *The Messiah* for the benefit of the city prison.' He remained in Ireland about nine months, and had every reason to be satisfied with his visit. Returning to London in 1742, he renewed his oratorios at Covent Garden Theatre, beginning with *Samson*. From this time success attended all his undertakings. His last work drew crowds to the house, and *The Messiah* was equally attractive. The latter was, during a long period, performed annually at the Foundling Hospital, and alone added 10,300*l*. to the funds of that institution. It is next to impossible to calculate what it has produced to other charities; the amount must be prodigious. He continued his oratorios to nearly the last day of his life, deriving considerable pecuniary advantage from them; for though still opposed by most of the nobility, the king (George II.) and the people actively supported him.

Late in life Handel was afflicted with blindness; he nevertheless continued to conduct his oratorios, and, as usual, performed concertos and other organ pieces between the acts. He even composed, employing as his amanuensis Mr. John Christian Smith, and assisted at one of his oratorios a week only before his decease, which took place on a Good Friday (according to his wish, it is said), April 13th, 1759. He was buried in Poet's Corner, Westminster Abbey, where a monument by Roubilliac—a work which never fails to arrest attention and excite admiration—is erected to his memory. 'But,' says the biographer before quoted, 'a still more honourable tribute to his memory was paid in the year 1784, by the performances which took place under the roof which covers his dust. A century having elapsed from the time of his birth, it was resolved that a *Commemoration of Handel* should take place.' The management was entrusted to the directors of the Antient Concerts, and eight of the most distinguished members of the musical profession. The king, George III., zealously patronized the undertaking, and nearly all the upper classes of the kingdom seconded the royal views. The receipts at five performances amounted to the sum of 12,736*l*., the disbursements to rather more than 6000*l*.; of the profits 1000*l*. was given to the Westminster Hospital, and the remainder to the Society for Decayed Musicians.

Handel was great in every style. In sacred music, especially of the choral kind, he not only throws at an immeasurable distance all who preceded and followed him, but reaches that sublimity which, it is now almost universally admitted, the art is so capable of attaining. Till within the last few years his works were unknown out of the British Isles; now they are heard with admiration in every part of Germany—the true land of harmony, in France and in Russia. The United States we should also name, but that we consider them as morally a part of the country from which they were peopled. But Italy, who now scarcely knows her own Dante, is shocked by the energetic strains of a Handel.

It is worthy of remark, and encouraging to those who are unwilling to believe that the intellectual powers decay in proportion to the diminution of bodily activity, to know that most of Handel's greatest works were composed when he was between fifty-four and sixty-seven years of age. *Jephthah* was produced at the latest moment of that period. And here we may, in passing, observe that the finest offsprings of Haydn's genius had their birth after he had become a sexagenarian.

In the Queen's library are the original MSS. of nearly all Handel's works, filling eighty-two large folio volumes. These include 32 Italian operas, 23 oratorios, 8 volumes of anthems, 4 of cantatas, 3 of Te Deums and a Jubilate, together with concertos, sonatas, &c. Not in the royal collection are 11 operas, harpsichord lessons, fugues, organ concertos, water-music, &c. &c. Of the oratorios *Deborah* was first performed in 1733; *Israel in Egypt* in 1738; *Saul* in 1740; *Messiah* in 1741; *Samson* in 1742; *Judas Maccabæus* in 1746; *Joshua* in 1747; *Solomon* in 1749 and *Jephthah* in 1751.

HAND-FASTING. [BETROTHMENT.]

HANDGLASS is a name given by gardeners to a portable glazed cover which they place over certain plants for one of two purposes; either to screen them from the effects of cold and wet without depriving them of much light, or to maintain around them an atmosphere of uniform humidity. Bell-glasses differ from handglasses in no respect with regard to the purpose they are intended to serve, but are blown from a single piece of glass instead of being composed of many pieces fastened together. Glasses of this description are principally used to assist cuttings of plants in the process of striking root, or newly-planted individuals in establishing themselves in the soil. The rationale of the action of handglasses seems to be this:—when cuttings or newly-planted individuals are exposed freely to the atmosphere, they part readily with the moisture they contain, in consequence of the specific power possessed by light, especially direct solar light, of causing perspiration. Under ordinary circumstances the moisture they part with is lost in space, so that it cannot be re-absorbed; and as the atmosphere of the plants or cuttings remains dry, perspiration will go on till the plant is exhausted or dead. The effect of a handglass is to invert this state of things: the moisture raised from the soil by evaporation, or produced by vegetable perspiration, necessarily accumulates beneath the handglass, the air enclosed by which gradually becomes more and more moist, and at last is saturated; this circumambient humidity is re-absorbed by the leaves, or branches, or soil, and thus restored to the plant which had lost it; in addition to which, perspiration itself necessarily goes on the more slowly in proportion as the air itself is charged with humidity. It may also be presumed that a handglass, or any such transparent cover, keeps the temperature in which the plant breathes higher than the external air, and thus stimulates the languid powers of vegetation.

HA'NNIBAL, the son of Hamilcar Barcas, was born B.C. 247. At the age of nine he accompanied his father to Spain, who, provious to his departure, took his son to the altar, and placing his hand on the victim, made him swear that he would never be a friend to the Romans. It does not appear how long Hannibal remained in Spain, but he was at a very early age associated with Hasdrubal, who succeeded his father in the command of the Cathaginian army in that country. On the death of Hasdrubal, B.C. 221, he obtained the undivided command of the army, and quickly conquered the Olcades, Vaccæans, Carpesians, and the other Spanish tribes that had not been subdued by Hasdrubal. The inhabitants of Saguntum, alarmed at his success, sent messengers to Rome to inform the Romans of their danger. A Roman embassy was accordingly sent to Hannibal, who was passing the winter at New Carthage, to announce to him that the independence of Saguntum was guaranteed by a treaty between the Carthaginians and Romans (concluded B.C. 226), and that they should consider any injury done to the Saguntines as a declaration of war against themselves. Hannibal however paid no regard to this remonstrance.

More than twenty years had elapsed since the termination of the first Punic war, during which period the Carthaginians had recovered their strength, and had obtained possession of the greater part of Spain; and the favourable opportunity had arrived for renewing the war with the Romans.

In B.C. 219 Hannibal took Saguntum, after a siege of eight months, and employed the winter in making preparations for the invasion of Italy. He first provided for the security of Africa and Spain by leaving an army of about 16,000 men in each country; the army in Africa consisted principally of Spanish troops, and that in Spain of Africans, under the command of his brother Hasdrubal. He had already received promise of support from the Gauls who inhabited the north of Italy, and who were anxious to deliver themselves from the Roman dominion.

Having thus made every necessary preparation he set out from New Carthage late in the spring of B.C. 218, with an army of 80,000 foot and 12,000 horse. In his march from the Ebro to the Pyrenees he was opposed by a great number of the native tribes, but they were quickly defeated though with loss. Before crossing the Pyrenees he left Hanno to secure his recent conquests with a detachment from his own army of 11,000 men. He sent back the same number of Spanish troops to their own cities, and with an army now reduced to 50,000 foot and 9000 horse, he advanced to the Rhone. Meantime two Roman armies had been levied; one, commanded by the consul P. Cornelius Scipio, was intended to oppose Hannibal in Spain, and a second, under the other consul T. Sempronius, was designed for the invasion of Africa. The departure of Scipio was delayed by a revolt of the Boian and Insubrian Gauls, against whom the army was sent which had been intended for the invasion of Spain, under the command of one of the prætors. Scipio was therefore obliged to remain in Rome till a new army could be raised. When the forces were ready he sailed with them to the Rhone and anchored in the eastern mouth of the river; being persuaded that Hannibal must still be at a considerable distance from him, as the country through which he had to march was difficult, and inhabited by many warlike tribes. Hannibal however quickly surmounted all these obstacles, crossed the Rhone, though not without some opposition from the Gauls, and continued his march up the left bank of the river. Scipio did not arrive at the place where the Carthaginians had crossed the river till three days afterwards; and despairing of overtaking them, he sailed back to Italy with the intention of meeting Hannibal when he should descend from the Alps. Scipio sent his brother Cnæus into Spain with the greater part of the troops to oppose Hasdrubal.

Hannibal continued his march up the Rhone till he came to the Isère. Marching along that river, he crossed the Alps (probably) by the Little St. Bernard, descended into the valley of the Dora Baltea, and followed the course of the river till he arrived in the territories of the Insubrian Gauls. The passage of Hannibal across the Alps has been a matter of much dispute. Whittaker, in a work entitled 'The Course of Hannibal over the Alps ascertained,' Lond., 1794, 2 vols. 8vo., maintains that the passage was made over the Great St. Bernard: those who wish for further information on the subject may consult 'A Dissertation on the Passage of Hannibal over the Alps,' by Wickham and Cramer, 2nd ed., Oxford.

Hannibal completed his march from New Carthage to Italy in five months, during which he lost a great number of men, especially in his passage over the Alps. According to a statement engraved by his order on a column at Lacinium, in Bruttia, which Polybius saw, his army was reduced to 12,000 Africans, 8000 Spaniards, and 6000 cavalry, when he arrived in the territories of the Insubrian Gauls. After remaining some time among the Insubrians to recruit his army, he marched southward and encountered P. Cornelius Scipio on the right bank of the river Ticinus (Tesino). In the battle which ensued the Romans were defeated, and Scipio with the remainder of the army retreating along the left bank of the Po, crossed the river before Hannibal could overtake him, and encamped near Placentia. He afterwards retreated more to the south, and entrenched himself strongly on the right bank of the Trebia, where he waited for the arrival of the army under the other consul T. Sempronius. Sempronius had already crossed over into Sicily with the intention of sailing to Africa, when he was recalled to join his colleague. After the union of the two armies Sempronius determined, against the advice of Scipio, to risk another battle. The skill and fortune of Hannibal again prevailed; the Romans were entirely defeated, and the troops which survived took refuge in the fortified cities. In consequence of these victories the whole of Cisalpine Gaul (the northern part of Italy) fell into the bands of Hannibal; and the Gauls, who on his first arrival were prevented from joining him by the presence of Scipio's army in their country, now eagerly assisted him with men and supplies.

In the following year (B.C. 217) the Romans made great preparations to oppose their formidable enemy. Two new armies were levied; one was posted at Arretium, under the command of the consul Flaminius, and the other at Ariminum, under the other consul Servilius. Hannibal determined to attack Flaminius first. In his march southward through the swamps of the basin of the Arno his army suffered greatly, and he himself lost the sight of one eye. After resting his troops for a short time in the neighbourhood of Fæsulæ, he marched past Arretium, ravaging the country as he went, with the view of drawing out Flaminius to a battle. Flaminius, who appears to have been a rash, headstrong man, hastily followed Hannibal, and being attacked in the basin of the Lake Trasimenus, was completely defeated by the Carthaginians, who were posted on the mountains which encircled the valley. Three or four days after Hannibal cut off a detachment of Roman cavalry, amounting to 4000 men, which had been sent by Servilius to assist his colleague.

Hannibal appears to have entertained hopes of overthrowing the Roman dominion, and to have expected that the other states of Italy would take up arms against Rome, in order to recover their independence. To conciliate the affections of the Italians, he dismissed without ransom all the prisoners whom he took in battle; and to give them an opportunity of joining his army, he marched slowly along the eastern side of the peninsula, through Umbria and Picenum, into Apulia; but he did not meet with that co-operation which he appears to have expected.

After the defeat of Flaminius, Q. Fabius Maximus was appointed dictator, and a defensive system of warfare was adopted by the Romans till the end of the year.

In the following year, B.C. 216, the Romans resolved upon another battle. An army of 80,000 foot and 6,000 horse was raised, which was commanded by the consuls L. Æmilius Paulus and C. Terentius Varro. The Carthaginian army now amounted to 40,000 foot and 10,000 horse. The armies were encamped in the neighbourhood of Cannæ, in Apulia In the battle which was fought near this place the Romans were defeated with dreadful carnage, and with a loss which, as stated by Polybius, is quite incredible: the whole of the infantry engaged in the battle, amounting to 70,000, was destroyed, with the exception of 3000 men who escaped to the neighbouring cities, and also all the cavalry, with the exception of 300 belonging to the allies, and 70 that escaped with Varro. A detachment of 10,000 foot, which had been sent to surprise the Carthaginian camp, was obliged to surrender as prisoners. The consul L. Æmilius, and the two consuls of the former year, Servilius and Attilius, were also among the slain. Hannibal lost only 4000 Gauls, 1500 Africans and Spaniards, and 200 horse.

This victory placed the whole of Lower Italy in the power of Hannibal; but it was not followed by such important results as might have been expected. Capua and most of the cities of Campania espoused his cause, but the majority of the Italian states continued firm to Rome. The defensive system was now strictly adopted by the Romans, and Hannibal was unable to make any active exertions for the further conquest of Italy till he received a reinforcement of troops. He was in hopes of obtaining support from Philip of Macedon and from the Syracusans, with both of whom he formed an alliance; but the Romans found means to keep Philip employed in Greece, and Syracuse was besieged and taken by Marcellus, B.C. 214-212. In addition to this Capua was retaken by the Romans, B.C. 211. Hannibal was therefore obliged to depend upon the Carthaginians for help, and Hasdrubal was accordingly ordered to march from Spain to his assistance.

Cnæus Scipio, as already observed, was left in Spain to oppose Hasdrubal. He was afterwards joined by P. Cornelius Scipio, and the war was carried on with various success for many years, till at length the Roman army was entirely defeated by Hasdrubal, B.C. 212. Both the Scipios fell in the battle. Hasdrubal was now preparing to join his brother, but was prevented by the arrival of young P. Cornelius Scipio in Spain, B.C. 210, who quickly recovered what the Romans had lost. In B.C. 210 he took New Carthage; and it was not till B.C. 207, when the Carthaginians had lost almost all their dominions in Spain, that Hasdrubal set out to join his brother in Italy. He crossed the Alps without meeting with any opposition from the Gauls, and arrived at Placentia before the Romans were aware that he had entered Italy. After besieging this town without success, he continued his march southward; but before he could effect a junction with Hannibal he was attacked by the consuls C. Claudius Nero and M. Livius, on the banks of the Metaurus, in Umbria, his army was cut to pieces, and he himself fell in the battle. This misfortune obliged Hannibal to act on the defensive, and from this time till his departure from Italy, B.C. 203, he was confined to Bruttia; but by his superior military skill he maintained his army in a hostilo country without any assistance from his government at home.

After effecting the conquest of Spain, Scipio passed over into Africa to carry the war into the enemy's country (B.C. 204). With the assistance of Masinissa, a Numidian prince, he gained two victories over the Carthaginians, who hastily recalled their great commander from Italy to defend his native state. Hannibal landed at Leptis, and advanced near Zama, five days' journey from Carthago towards the west. Here he was entirely defeated by Scipio, B.C. 202; 20,000 Carthaginians fell in the battle, and an equal number were taken prisoners. The Carthaginians were obliged to sue for peace; and thus ended the second Punio war, B.C. 201.

After the conclusion of the war Hannibal vigorously applied himself to correct the abuses which existed in the Carthaginian government. He reduced the power of the perpetual judges (as Livy, xxxiii. 46, calls them), and provided for the proper collection of tho public revenue, which had been embezzled. He was supported by the people in these reforms; but he incurred the enmity of many powerful men, who represented to the Romans that he was endeavouring to persuade his countrymen to join Antiochus, king of Syria, in a war against them. A Roman embassy was consequently sent to Carthage to demand the punishment of Hannibal as a disturber of the public peace; but Hannibal, aware that ho should not be able to resist his enemies, supported by the Roman power, escaped from the city, and sailed to Tyre. From Tyre he went to Ephesus to join Antiochus, B.C. 196, and contributed to fix him in his determination to make war against the Romans. If Hannibal's advice as to tho conduct of the war had been followed, the result of the contest might have been different; but he was only employed in a subordinate command, and had no opportunity for the exertion of his great military talents. At the conclusion of this war Hannibal was obliged to seek refuge at the court of Prusias, king of Bithynia, where he remained about five years, and on one occasion obtained a victory over Eumenes, king of Pergamus. But the Romans appear to have been uneasy as long as their once formidable enemy was alive. An embassy was sent to demand him of Prusias, who being afraid of offending the Romans, agreed to give him up. To avoid falling into the hands of his ungenerous enemies, Hannibal destroyed himself by poison at Nicomedia, in Bithynia, B.C. 183, in the sixty-fifth year of his age.

The personal character of Hannibal is only known to us from the events of his public life, and even these have not been commemorated by any historian of his own country; but we cannot read the history of his campaigns, of which we have here presented a mere outline, even in the narrative of his enemies, without admiring his great abilities and courage. Polybius remarks (b. xi., p. 637, *Casaubon*), 'How wonderful is it that in a course of sixteen years, in which he maintained the war in Italy, he should never once dismiss his army from the field, and yet be able, like a good governor, to keep in subjection so great a multitude, and to confine them within the bounds of their duty, so that they neither mutinied against him, nor quarrelled among themselves. Though his army was composed of people of various countries, of Africans, Spaniards, Gauls, Carthaginians, Italians and Greeks—men who had different laws, different customs, and different language, and, in a word, nothing among them that was common—yet so dexterous was his management that, notwithstanding this great diversity, he forced all of them to acknowledge one authority and to yield obedience to one command. And this, too, he effected in the midst of very various fortune. How high as well as just an opinion must these things convey to us of his ability in war. It may be affirmed with confidence that if he had first tried his strength in the other parts of the world, and had come last to attack the Romans, he could scarcely have failed in any part of his design.' (Hampton's *Translation.*)

(Polybius, b. iii., which contains the history of Hannibal's campaigns till the battle of Cannæ, and the fragments of b. vii., viii., ix., xiv., xvi.; Livy, xxi.-xxxix.; Appian; Plutarch, *Life of L. Fabius Maximus*; Nepos' *Life of Hannibal.*)

HANNO'S PERIPLUS is a small Greek treatise, entitled 'The Periplus (*i. e.* voyage) of Hanno, king (*i. e.* commander) of the Carthaginians, round the parts of Libya beyond the pillars of Hercules, which he posted up in the temple of Kronos.' The authenticity of this work has been doubted by many critics; but it appears probable, from the testimony of Pliny (*Nat. Hist.*, ii. 67; v. 1, 36), Mela (iii. 9), and other antient authors, that such a voyage was actually performed; and the description which is given in the 'Periplus' of the western coast of Northern Africa could not have been written by a person who had no knowledge of the localities. The treatise we possess appears to be a translation of the Carthaginian document preserved in the temple of Kronos. The time at which this voyage was performed is quite uncertain; Pliny (*N. H.*, ii. 67) places it in the flourishing period of Carthaginian history.

The object of the expedition is stated at the commencement of the Periplus: 'It was decreed by the Carthaginians that Hanno should sail beyond the pillars of Hercules, and found Libyphœnician cities. He sailed accordingly with 60 ships of 50 oars each, and a body of men and women to the number of 30,000, and provisions and other necessaries.' The first city he founded was Thumiaterion, near the pillars of Hercules, probably in the neighbourhood of Marmora. He then doubled the promontory Soloeis, which Rennell considers to be the same as Cape Cantin, but other commentators to be the same as Cape Blanco, 33° N. lat. A little to the south of C. Cantin, five more cities were founded, namely, Karikon-teichos, Gutte, Akra, Melitta, Arambus, and Kerne. After passing the river Lixus, supposed by Rennell to be the modern St. Cyprian, and doubling Cape Blanco, Hanno founded Kerne. From Kerne the voyage was one of discovery; and after advancing as far south as Sierra Leona or Sherbro, according to Rennell, he was obliged to return through want of provisions.

The Greek text is printed in Hudson's 'Geographiæ veteris Scriptores Græci Minores.' It was also published by Falconer, with an English translation and many notes, 8vo., Lond., 1797. Many remarks upon this voyage are made by Compomanes, 'Antiguedad Maritima de la Republica de Cartago,' Mad., 1756; Bougainville, 'Mémoires de la Académie des Inscriptions,' vols. xxvi., xxviii.; Gosselin, 'Recherches sur la Géographie des Anciens;' Rennell, 'Geography of Herodotus,' vol. ii., p. 409-443, 8vo. ed.; Heeren, 'Researches on the Antient Nations of Africa,' vol. i., p. 492-501, Engl. Transl.

Many other Carthaginians of the name of Hanno are mentioned. Of these the most celebrated was the leader of the party at Carthage which was opposed to a war with the Romans at the time of the first and commencement of the second Punic wars.

HANOVER, THE KINGDOM OF, is situated between 59° 20′ and 53° 51′ N. lat., and 6° 51′ and 11° 51′ long. E. of Greenwich. It is bounded on the north-west by the German Ocean, on the north by the Elbe (which separates it from the territories of Hamburg, Denmark, and Mecklenburg), on the east and south-east by Prussia and Brunswick; on the south-west by Hesse Cassel, Lippe, and Prussia; and on the west by Holland. The whole contains an area of 14,570 square miles.

Divisions.—The kingdom of Hanover is divided into six provinces, called Landdrostei, and one Mining Intendancy (Berghauptmannschaft), the total population being 1,662,500:—

I. Hanover (320,180 inhabitants) consists of, 1, the principality of *Calenberg* (177,920 inh.), containing the towns of Hanover the capital, Pattensen, Hameln; 2, the county of *Hoya* (122,160 inh.), chief town Nienberg; 3, the county of *Diepholz* (20,100 inh.), chief town Diepholz.

II. Hildesheim (352,196 inh.) consists of, 1, the principality of *Hildesheim* (155,014 inh.), chief towns, Hildesheim the capital, Peine, Goslar, Bokenem, Gronau, Alfeld; 2, the principality of *Göttingen* (113,886 inh.), chief towns, Göttingen tho capital, Münden, Moringen, Uslar; 3, the principality of *Grubenhagen* (74,187 inh.), chief towns, Eimbeck the capital, Osterode, Duderstadt; 4, the county of *Hohnstein* (9,109 inh.), chief towns, Neustadt, Ilefeld.

III. Luneburg (303,114 inh.); chief towns, Lüneburg the capital (13,486 inh.), Harburg (5430 inh.), Celle, otherwise Zell (10,137 inh.).

IV. Stade (241,142 inh.) consists of, 1, the duchy of *Bremen* (190,119 inh.), chief towns, Stade (5680 inh.), Buxtehude; 2, the district of *Hadeln* (17,400 inh.), chief town Otterndorf (2050 inh.); 3, the principality of *Verden* (33,563 inh.), chief town Verden (5117 inh.).

V. Osnabruck (263,624 inh.) consists of, 1, the principality of *Osnabrück* (162,534 inh.), chief towns, Osnabrück (12,500 inh.), Fürstenau, Quackenbrück; 2, the lower county of *Lingen* (23,014 inh.), chief towns, Freesen (2840 inh.), Lingen; 3, the county of *Bentheim* (27,209 inh.), chief town Bentheim (1530 inh.); 4, the circle of *Meppen* (44,720 inh.), chief towns, Meppen (1820 inh.), Pappenburg (4700 inh.); 5, the circle of *Emsbühren*, part of tho county *Rheina-Wolbeck* (5141 inh.), chief town Rheina.

VI. Aurich, or the principality of East Friesland (153,671 inh.), chief towns, Emden (12,780 inh.), Norden (6350 inh.), Leer (6573 inh.).

VII. The Mining Intendancy of Clausthal, or the Upper Harz (28,573 inh.), chief towns, Clausthal (8370 inh.), Cellerfeld (3870 inh.), St. Andreasberg (4310 inh.).

The Lower Harz consists of detached districts on the northern and western declivities of the Harz, lying in the territory of Hanover and Brunswick, and belonging to both in common, Hanover having four-sevenths and Brunswick three-sevenths of the revenue.

Hanover, as a member of the German Confederation, is the fifth in rank, with four votes in the full council. It furnishes a contingent of 13,054 men to the army of the Confederation, which forms part of the 10th corps, and contributes 2000 florins annually to the treasury of tho Confederation.

Face of the Country, Soil, Climate.—The southern provinces of Grubenhagen and Göttingen are mountainous: in the former is the Harz [Germany], in the latter the Sollingerwald. Lower ranges, uniting these, traverse tho greater part of Hildesheim and Calenberg; but from the cities of Hildesheim, Hanover, and Osnabrück, to the sea-coast, the whole country is one vast plain, with only occasional and not considerable elevations. The mountains abound in mineral wealth, and are covered with forests of red pino and fir, with some oaks and other timber. The largest oak in tho kingdom is in the village of Hartmannshausen, near Celle. Its circumference close to the ground is 43 feet, and immodiately below the first branches 25 feet. Between the mountains are the most fertile valleys, and where the country slopes from the mountains to the plain there is excellent arable land. Then follows a sandy tract from 50 to 70 miles in breadth, which crosses the kingdom from east to west, and, where left to itself, is covered with heath, and in some places with fir: it is an elevated flat, broken only towards the north by sand-hills. In the lower tracts are great marshes, and the most productive parts are the banks of the rivers. All this part of the country is alluvial, and numerous marine substances are found preserved in it. The climate is on the whole mild and temperate, differing of course according to the relative situation of mountain or plain, and the state of cultivation. In the lower parts fogs are frequent, and on the sea-coast violent hurricanes. The prevailing winds are the north-west in winter, the east in spring, and the south-west in summer. The principal rivers are the Elbe, tho Weser, and the Ems, which receive in their course numerous secondary streams, as the Aller, Leine, Ilmenau, and Lühe, and empty themselves into the German Ocean. There are only two large lakes; the Steinhudermeer and the Dümersee, which latter abounds in fish. In East Friesland is the subterraneous Lake Jordan, the surface of which is so thickly overgrown with vegetation that waggons can pass over it.

Natural Productions.—Agriculture is the chief source of subsistence to the inhabitants, which is much favoured by the facilities for exportation when the harvest is abundant, as well as by the transit trade, and the consumption of the neighbouring maritime towns. The richest corn provinces are Hildesheim, Göttingen, the south of Calenberg, the lower part of Grubenhagen, the marsh lands on the Elbe, Jeeze, Oste, Weser, Leine, and Aller, part of Osnabrück and East Friesland. In the marsh land the breeding of cattle is more followed than agriculture. East Friesland has the finest breed of cattle: it possesses nearly 100,000 cows, 50,000 oxen, &c., 50,000 sheep, and excellent horses, of which above 5000 are annually exported to Italy. The immense heaths in the Duchy of Lüneburg aro partly used as sheep-walks, and when the heath is in blossom the keepers of bees go with their hives (above 60,000 hives) from the villages to the heath: tho honey so obtained is valued at 40,000*l.* per annum. The country produces flax, tobacco, hops, fruit, pulse, potatoes, &c. Timber is abundant, and considerable quantities are exported. If a better system of agriculture were introduced, the produce of the country might be very much increased. Many hundred thousand acres of land susceptible of cultivation still lie waste.

Manufactures and Trade.—Manufactures are not carried on to any considerable extent. Thread and linen are manufactured, partly for exportation, at Osnabrück and some other places, and woollens and calicoes at Göttingen, Münden, and some other towns. Tho commerce of the kingdom, though considerable, is far from being what might be expected from its favourable situation aud fine navigable rivers. It is chiefly confined to the exportation of the produce of tho country, and the importation of colonial articles, English manufactures, French silks, jewellery, and wines, fruits, &c. The principal commercial port is Emden; and Münden, at tho junction of the Werra and the Fulda, has an active trade with the interior of Germany. There are four annual fairs at Hanover, and two at Osnabrück, to which goods are brought from the fairs of Brunswick, Leipzig, and Frankfort.

The Revenue of the kingdom is larger than might be expected. The new system of financial administration began on the 1st of July, 1834. There are two exchequers, the Royal General Exchequer, for the revenues of the state, and the Exchequer of the Royal Crown Demesnes. The latest official account, published in April, 1838, is for the year ending 1st July, 1837. The Royal demesnes and forests had produced a net revenue of 2,660,982 rix-dollars, of which 513,888 wero given into the Crown Exchequer, and the remaining 2,147,094 rix-dollars into the General Exchequer. The remainder of the revenue was produced by the mines and salt-works, tho tolls on the Elbe and Weser, the post-office, direct and indirect taxes, export, import, and transit duties. The total net revenue was 6,306,173 rix dollars, being 445,876 above the estimate. The total expenditure was 5,747,594, leaving a surplus of 558,579 rix-dollars.

The military establishment is 20,000 infantry, 2700 cavalry, and 18,000 militia, or Landwehr. All men able to bear arms, from the age of 17 to that of 50, without exception, are liable to serve in the Landsturm, or local militia. There are 10 garrison towns. The manufactures connected with the army are, one of small-arms at Herzberg, one of gunpowder at Hersen, and a cannon-foundry in Hanover.

Religion, Education, National Church.—The religion is Protestant: of the inhabitants, 1,340,000 are Lutherans, 100,000 Calvinists, and about 2000 Mennonites and Moravians. There are 210,000 Roman Catholics and 10,000 Jews. In 1830 a superior board was established in Hanover for the direction of all matters relative to the schools. Hanover has a university at Göttingen [GÖTTINGEN]; an academy for the equestrian order; an academy for the general staff, founded in 1824; a seminary for schoolmasters; 16 gymnasia; 20 central schools; 5 seminaries; a surgical and two veterinary schools; and 3426 schools in the towns and country, of which 3085 are Protestant, and 341 Roman Catholic. There are besides, numerous poorhouses and work-houses and charitable institutions.

History.—In the remotest times of which we have any record the countries between the Elbe and the Weser were inhabited by small independent tribes of hunters and herdsmen. The Cherusci, celebrated for their victory over the Roman General Quintilius Varus, dwelt about the Harz and far into Westphalia; the Chauci were at the mouth of the Weser; the Longobardi, or Lombards, on both sides of the Elbe. When Charlemagne first introduced the Christian religion, the country was in the power of the Saxons. Though subsequently, as the imperial power declined, many powerful lords, both spiritual and temporal, arose, with almost despotic authority, yet the condition of the people improved; the mines of the Harz and the salt springs of Lüneburg were discovered, and a considerable traffic began, by which Bardowieck and Gandersheim in particular profited. Otho the Great gave, in 970, the investiture of the duchy of Saxony to Hermann Billing, a wealthy lord in Lüneburg, in whose family it remained till the death of the last descendant, Magnus, in 1107. His successor, Henry the black, duke of Bavaria, and brother of Guelf, or Welf, a prince of the north of Italy, marrying a princess of the house of Billing, obtained with her the duchy of Lüneburg, and afterwards acquired Brunswick, Göttingen, and other principalities. His son, Henry the Lion, favoured trade, though he treated with great severity the towns that resisted him; for instance, Bardowieck, which he totally destroyed in 1189.

The broils and troubles which continued for nearly a hundred years after his death proved the advantage of living in fortified towns. Numerous little republics rose, several of which became considerable cities. The Hanseatic League found great favour here, and of the 85 towns composing that celebrated confederation, 13 were in the present kingdom of Hanover. We cannot trace the various partitions of territory which took place in consequence of the division of the family into different branches, all which have however become extinct, except those of Brunswick Wolfenbüttel and Brunswick Lüneburg, the latter of which succeeded to the throne of England on the death of Queen Anne in 1712. [GEORGE LOUIS I.] In consequence of this event the electors of Hanover continued to be kings of Great Britain, till, on the death of his late majesty William IV., the crown of Great Britain devolving on Queen Victoria, and the succession to the throne of Hanover being limited to the male line, the two countries were separated, and the Duke of Cumberland, eldest surviving brother of King William, ascended the throne of Hanover by the name of Ernest Augustus. That Hanover gained great advantages by the union of the two crowns in one person cannot be denied, but whether they were not more than compensated by the disadvantages is a question that has often been discussed, but still remains doubtful. It is at least certain, that with the eighteenth century a period of prosperity commenced such as Hanover had not yet seen. But then it co-operated with Great Britain in the war of 1741, and in the Seven Years' War, which latter was peculiarly disastrous to it, as the country was through the whole time the arena of hostile armies, and suffered both from friends and foes. The tranquillity which Northern Germany enjoyed for nearly 30 years after the peace of Paris, 1763, and the vast increase of the commerce of England in North America, doubled the trade of Bremen, Hamburg, and Altona with the interior of Germany, which was still further augmented from 1792 to 1803 by the ruin of the commerce of France and Holland; and this trade being carried on from those seaports through Hanover, gave an extraordinary impulse to the prosperity of that kingdom.

From the spring of 1793 Hanover took part in the war with France; but in 1795 was included in the convention between France and Prussia for the neutrality of the North of Germany. In the spring of 1801, when differences arose between England and the Northern powers, Prussia occupied Hanover as hostile territory; but the death of the Emperor Paul produced another change, and the Prussians left Hanover. Bonaparte took possession of it in 1803, and treated it like a conquered country. In 1805, when the alliance was concluded between Austria, England, Prussia, and Sweden, it was hoped that Prussia would join, but instead of that, Prussia declared, on April 1, 1806, that Hanover had been ceded by France in exchange for Anspach, Cleve, and Neuchatel, and was for ever incorporated with Prussia. Bonaparte however again took possession of it in the following year; when the greater part of it was included in the new kingdom of Westphalia, and the remaining part administered by a French governor-general. In 1810 the whole of the former electorate, except Lüneburg, was assigned to Westphalia; but before the end of the year Napoleon drew a line opposite Lüneburg, from the Elbe, in a south-west direction, through the kingdom of Westphalia, and all to the north of that line, with the Hanseatic cities, Oldenburg, &c., was incorporated with the French empire. After the battle of Leipzig in 1813, the whole electorate was restored to the lawful sovereign, who assumed in 1815 the title of King of Hanover, that of elector having in fact ceased by the dissolution of the German empire. In 1816 the Duke of Cambridge was appointed governor-general; in 1819 a constitution was introduced with a general assembly of the estates of the kingdom in one chamber. In spite of many improvements, the people became dissatisfied with the government, and the French Revolution in July, 1830, gave the signal for disturbances at Osterode, on the 5th of January, 1831, and for more serious troubles at Göttingen on the 8th of May, which were however suppressed by the intervention of the military. In 1831 the duke of Cambridge was made viceroy, and a new constitution, agreed to by the estates, was in 1833 sanctioned as the constitution of the kingdom by King William IV., who however, without consulting the estates, made of his own authority various changes in fourteen of the articles. According to the constitution of 1833, the general assembly of the estates of the kingdom consists of a first and a second chamber. The first consists of members personally entitled to sit (as princes of the blood, nobles, or by virtue of their offices, such as the hereditary postmaster-general and the abbot of Loccum), and the deputies of the equestrian order. The second chamber is composed of the deputies of the towns, of certain religious foundations, and of the landowners and farmers. The deputies are elected for six years, and meet annually. What the constitution may be when this article is printed is uncertain; for his present majesty, King Ernest Augustus, soon after his accession declared the constitution not to be binding on him, partly on account of the changes arbitrarily made by William IV. (though the estates would not reject the constitution of 1833 on that account), and partly because he had not given his assent to it. He has accordingly abolished it, dissolved the assembly of the estates, and convoked a new assembly according to the constitution of 1819, to which he has presented a plan for a new constitution, which is now (May, 1838) actually under discussion. The result seems very doubtful; many public officers who took the oaths to the constitution of 1833 consider it to be still binding; seven of the professors of Göttingen published a vehement protest against the king's proceeding, and were dismissed by him in consequence. Several of the principal towns have refused to elect deputies, so that there are scarcely members enough present to transact any business. The affair causes an extraordinary sensation throughout Germany, and the conduct of the king has been most bitterly censured by some, though it is defended by others.

HANOVER, the capital of the kingdom and of the principality of Calenberg, lies in 52° 22′ N. lat. and 9° 42′ E. long. It is situated in an agreeable, well-cultivated plain, on the river Leine, which is navigable from the city to its junction with the Weser. The city consists of three parts, the Old Town, the Ægidian New Town, and the New Town on the left bank of the river. In the first the streets are for the most part crooked and narrow, and the houses old fashioned and irregular; but the two other parts are handsomely and regularly built. In the last is George Street, consisting of a row of houses built on one plan, and facing the rampart now converted into public walks. A tract or suburb outside of the walls, called the Gartengemeinde, contains above 500 houses with handsome gardens. The most interesting public buildings are the palace (with the opera-house and palace church), which the French converted into barracks and an hospital, and which is now used for the government offices, the palace of the duke of Cambridge, the mint, the arsenal, the royal mews, the town-hall, with a good library of 40,000 vols., the royal library with the archives, both situated on the esplanade (or parade). Hanover has also four Lutheran, one German Calvinist, one French Calvinist, and one Roman Catholic church, and a synagogue. Among the charitable institutions are the Orphan Asylum, infirmaries, hospitals, and poor-houses. For the purposes of education there is a lycoum, a female school of industry, many elementary schools, and a seminary for schoolmasters. The Georgianum was founded in 1776, for the education of forty sons of Hanoverian nobles, who are admitted at the age of ten years, paying a small sum on their admission, after which the expense of their education is defrayed by the establishment. A flourishing Bible Society has been established here for some years. The manufactures are numerous, and the trade extensive. In the neighbourhood are the royal country palace of Montbrillant, the gardens formerly belonging to Count Walmoden, and now to the crown, with fine collections of works of art, and the royal palace of Herrenhausen. The approach to this building, which is by no means remarkable for its architecture, is by a long avenue of lime-trees. The pleasure-grounds are extensive, in which there are remarkable water-works that throw up a column of water as thick as a man's body to the height of 120 feet. The orangery, greenhouses, and hothouses of Herrenhausen were formerly very celebrated, and the collection of rare exotics supposed to be exceeded only by that of the emperor of Austria at Schoenbrunn. But the French carried away all the finest plants, particularly an almost unique collection of Cape heaths, as they did the swans from the parks, to adorn the empress Josephine's seat at Malmaison. Great efforts have since been made to replace the loss.

Hanover was founded at the latter end of the eleventh century, and in 1203 was assigned to the eldest son of Henry the Lion. In 1641 duke Christian Louis took up his abode in the palace which had been lately erected, and it has ever since been the residence of the prince and the capital of the country. In 1725 the alliance between England, France, and Prussia was concluded here: and in 1745 the convention which preceded the peace of Dresden. The walls, with five gates, and broad ditches, were partly levelled in 1780, and laid out in streets, and the remainder converted into a handsome esplanade, on which is the marble bust of Leibnitz, by an Irish sculptor of the name of Hewetson, placed under a cupola in the antique style; and tho Waterloo Column, 162 feet high, with the figure of Victory on the summit, which was finished in 1832.

(Spielcker's *Description of the City of Hanover*, Hanover, 1819; and W. Lohmann, *Geschichtsabriss und Topog. Gemälde der Stadt Hanover*. H. D. A. Sonne, *Erdbeschreibung des König. Hanover;* H. Lüden, *Das Kön. Hanover;* C. P. Jansen, *Statist. Handbuch des König. Hanover*, besides numerous local and provincial works.)

HANSE TOWNS, called also the Hansa, and the Hanseatic League, a celebrated commercial confederacy, which took its name from the antient German word 'Hanse,' signifying an association for mutual support, in which sense it is used in two charters granted by king John, in 1199, to Dunwich in Norfolk and to the city of York. The cities of Hamburg, Lübeck, and Bremen were in the middle ages the depositories of the manufactures of Italy and Germany, imported by sea, with which they supplied the northern countries of Europe in exchange for their raw produce. The wealth which they acquired by their commerce excited the envy and the rapacity of the princes and nobles; the imposition of new and the augmentation of old tolls were great impediments to trade, which was likewise rendered unsafe by numerous banditti and pirates who infested the roads and the neighbouring seas and rivers. In order to protect the commerce on the Elbe and the German Ocean, Hamburg concluded in 1239 an alliance with the inhabitants of Ditmarsch, at that time independent, and those of the land of Hadeln. Two years later Lübeck concluded a similar alliance with Hamburg; the two cities engaged to maintain ships and soldiers at their joint expense, to clear the road between the Elbe and tho Trave, and the waters from Hamburg to the ocean, from robbers and pirates; and they further bound themselves to promote their commercial interest, and to defend their rights and privileges. The city of Brunswick, which was used by those two cities as a staple, joined the alliance in 1247; for while Italy was in possession of the trade to the Levant and India, a commercial route was opened, through the upper Palatinate, Franconia, and to the east of the Harz, by way of Brunswick to Hamburg. Other cities soon followed the example of Brunswick, and joined the league. The cities were divided into four classes, or quarters, the chief cities of which were Lübeck, Cologne, Brunswick, and Danzig. Lübeck was at the head of the league, issued the summons for the regular assemblies of the deputies of all the cities, which were held once in three years at Whitsuntide (the first in 1260), and also for the extraordinary assemblies, generally held once in ten years, in which they solemnly renewed their league, admitted new members, and excluded those that had not observed all obligations, compacts, &c. Lübeck also had the common treasury and the archives.

In 1266 they established in London their factory called the Steelyard. The number of the towns composing the League fluctuated; the greatest number was eighty-five, among which were Bergen in Norway, Berlin, Bremen, Brunswick, Colberg, Cologne, Cracow, Danzig, Deventer Dorpat, Elbing, Frankfort on the Oder, Goslar, Göttingen, Groningen, Halberstadt, Halle, Hamburg, Hameln, Hanover, Hildesheim, Königsberg, Lübeck, Lüneburg, Magdeburg, Münster, Nimeguen, Osnabrück, Reval, Riga, Ruremonde, Stade, Stettin, Stralsund, Thorn, Venloo, Warberg in Sweden, Wesel, Wisby in the Isle of Gothland, Wismar, Zutphen, and Zwoll in Guelderland. Their four principal factories in foreign countries were at London, Bruges, Novogorod, and Bergen.

This powerful confederacy formed the first systematic plan of commerce known in the middle ages. In its factories a discipline approaching in rigour that of the monasteries was observed, which even extended to the celibacy of factors, clerks, &c. The power of the Hansa rose daily. The cities enjoyed in England the privilege of exporting goods duty-free, and in Denmark of importing duty-free. Their alliance was courted and their hostility feared by the greatest powers. The Hanseatic League defeated kings Erich and Hakon, in Norway, and Waldemar III., king of Denmark, in 1348; they deposed Magnus, king of Sweden, and gave his crown to his nephew Albert, duke of Mecklenburg; they equipped in 1428 a fleet of 248 ships, with 12,000 soldiers on board, against Erich, king of Denmark; and the League concluded commercial treaties with Denmark, Flanders, and England, where Henry III., in 1266, granted them great immunities. But when the roads and seas were no longer insecure; when princes began to be sensible of the commercial interest of their own states; and above all, when the discovery of America, and the way to India by the Cape of Good Hope, gave an entirely new form and direction to commerce, the Hanseatic League gradually declined, and at the last general assembly at Lubeck, in 1630, the deputies from the several cities appeared merely to declare their secession from the League. Hamburg, Lübeck, and Bremen formed an association in 1641, and remained free republics till December, 1810, when they were incorporated with the French empire, but on the deliverance of Germany in 1813 they were again separated from France, and with Frankfort-on-the-Maine are now called the free Hanseatic Cities of the Germanic Confederation. For a particular account of their connexion with England, see Steelyard. There are numerous works treating of this league. In English, vol. i. of Anderson's 'Deduction of Trade and Commerce' may be consulted. The most recent work in German is F. Sartorius's 'History of the German Hansa, 3 vols., 1802-8, continued by Lappenberg, 2 vols., 1830-4.

HANWAY, JONAS, born in 1712, deceased in 1786, was a Russia merchant, connected through his Russian dealings with the trade into Persia. Business having led him into that country, he published in 1753 his 'Historical Account of the British Trade over the Caspian Sea, with a Journal of Travels from London through Russia into Persia, &c.,' 4 vols. 4to., a work of no pretension to literary elegance, but containing much information on the commercial subjects of which he speaks, and on the history and manners of Persia. The latter part of his life was employed in supporting, by his pen and personal exertions, a great variety of charitable and philanthropic schemes: and he gained so high and honourable a name, that a deputation of the chief merchants of London made it their request to government that some substantial mark of public favour should be conferred on him. He was in consequence made a commissioner of the navy. The Marine Society and the Magdalen Charity, both still in existence, owe their establishment mainly to him: he was also one of the great promoters of Sunday-schools. (Pugh's *Remarkable Occurrences in the Life of Jonas Hanway*.)

HA'PALE. The name employed by Illiger, Kuhl, and others, to distinguish the genus of *Simiadæ*, commonly known by the name of *Sanglins*, *Sanguins*, &c. [JACCHUS.]

HAPPISBURGH, a village on the coast of Norfolk, remarkable for bold cliffs of diluvial clay and pebbles. These wasting cliffs are supposed by most geologists to be the original repositories of the numerous remains of the mammoth and other quadrupeds which are dredged from the neighbouring oyster-beds; and though few such specimens have been obtained from the face of the cliffs, it is conceivable that in the course of ages many may have been collected on the bed of the sea, out of the enormous quantity of earthy materials which have been undermined and sorted by the waves. The specimens are in a peculi state of conservation.

HAPSBURGH. [HABSBURG.]

HAQUEBUT. [ARMS.]

HARDICANUTE, HARDECANUTE, or HARDACNUTE, was the eldest of the sons of Canute the Great, king of England, Denmark, and Norway, by Emma, styled the 'Flower of Normandy,' daughter of Richard I., duke of Normandy, and widow of King Ethelred II., whom he had married in 1017. [ETHELRED II.] The death of Canute, in 1035, brought forward as claimants to the inheritance of his dominions Sweyn and Harold, his two sons by Alfgiva, daughter of Alfhelm, earl of Northampton, to whom however it is asserted by most historians that he never had been married; Hardicanute, his son by Emma; and Edward, the elder of the two sons of Emma by her former husband Ethelred. Sweyn, who obtained the throne of Norway, made no pretensions to that of England. Edward (afterwards Edward the Confessor) and his brother were with their uncle, Duke Richard II., in Normandy. Hardicanute was also absent in Denmark, the government of which country had been some time before entrusted to him by his father. It has been supposed that Canute had intended that Hardicanute, as his eldest legitimate son, should succeed him in all his three kingdoms; it is certain that he designed him for his successor in the sovereignty of England, in conformity with a special arrangement which had been made on his marriage with Emma. Harold however had the important advantage of being on the spot at the time of his father's death, and was thus enabled to triumph over the pretensions of both his rivals. A civil war was prevented by an agreement that the authority of Hardicanute should be confined to the country to the south of the Thames, constituting the ancient kingdom of Wessex, and that all the rest of England, including London, should be resigned to Harold. Meanwhile Hardicanute remained in Denmark, leaving the government of his English province in the hands of his mother Queen Emma. This state of things subsisted till the invasion of England, in 1037, by Emma's younger son Alfred, which terminated so calamitously for himself and his followers. [EDWARD THE CONFESSOR.] On the failure of this unhappy attempt, Emma fled to the Continent, and Harold became undisputed king of all England. For the next two years Hardicanute did nothing to vindicate his rights. At last, on the repeated importunities of his mother, who had taken up her residence at Bruges, he fitted out an armament for that purpose, with nine ships of which he proceeded in the first instance to that place, to advise with her before proceeding on his enterprise. While they were together, in 1040, news was received of the death of Harold, and soon after a deputation arrived from the English nobility, offering the crown to Hardicanute, who thereupon immediately came over and assumed the government. His short reign affords scarcely any events requiring to be mentioned. His character appears to have been that of a good-natured debauchee, not wanting in generosity of sentiment, nor stained with any darker vice than the habit of inordinate eating and drinking. His plentiful table however, which was spread for a numerous company four times a day, is said to have won him the strong attachment of his thanes, who were admitted to feast along with him, however much it may have disgusted the body of the people. The chronicler John Rouse, in the end of the 15th century, writes that the anniversary of his death even then continued to be celebrated as a holiday by the people of England under the name of Hog's-tide, or Hock Wednesday. That event happened on the 8th of June, 1042, in consequence of what appears to have been a stroke of apoplexy, by which he had been suddenly rendered speechless four days before, as he was about to swallow a cup of wine at the marriage feast of one of his Danish thanes, held at Lambeth, or, perhaps, Clapham. Hardicanute was never married, and left no issue. He was succeeded by his half-brother Edward, surnamed the Confessor.

HARDNESS (in mineralogy). The different degrees of hardness possessed by minerals of similar external characters will often serve to distinguish them from each other. Mohs has formed a scale, which affords an approximation in estimating the hardness of minerals, and according to which it is expressed in numbers. The substances which he uses are such as are easily obtained in a state of purity. They are,—

1. Talc, white or greenish.
2. Rock salt, pure and cleavable, and gypsum, uncrystallized and semi-translucent.
3. Calcareous spar, cleavable.
4. Fluor spar, which cleaves perfectly.
5. Apatite, the asparagus-stone, from Salzburg.
6. Adularia.
7. Rock crystal, limpid and transparent.
8. Topaz.
9. Corundum, from Bengal, with smooth fractured faces.
10. Diamond.

Any mineral which neither scratches nor is scratched by any one of the substances above named is stated to possess the degree of hardness expressed by the number opposite that mineral. Thus, supposing a body neither to scratch nor to be scratched by fluor spar, its hardness is represented by 4; but if it should scratch fluor spar and not apatite, then its hardness is stated to be from 4 to 5.

Another method of trying the hardness of minerals is passing them very gently over a fine hard file, and judging by the touch and appearance of the file as to the degree of hardness.

HARDOUIN, JOHN, commonly called **PÈRE HARDOUIN**, was born of obscure parents at Quimper in Bretany, in 1647. He entered the society of the Jesuits at an early age, and devoted himself to the study of belles-lettres, the learned languages, history, philosophy, and divinity. A large portion of his life was spent in undertaking to prove, chiefly from medals, that the greater part of those writings which are considered as antient, both classical and of the early Christian age, were forged by monks of the thirteenth century. He excepted only the works of Cicero, Pliny's 'Natural History,' Virgil's 'Georgics,' and Horace's 'Satires and Epistles.' These he supposed to be the only genuine works of antiquity remaining, except a few inscriptions and fasti; and that from these the monks had drawn up and published Terence's Plays, Livy's and Tacitus's Historics, Virgil's Æneid, Horace's Odes, &c. See his 'Chronologiæ ex Nummis Antiquis restitutæ: Prolusio, de Nummis Herodiadum,' 4to., Paris, 1693. His opinions upon religious subjects were not less wild than those upon profane learning.

The Society of Jesuits at last interfered, and Hardouin, in 1708, published the recantation of his fancies.

His edition of Pliny's 'Natural History,' prepared for the use of the Dauphin, was published at first in five volumes, 4to., Paris, 1685; republished with great improvements in three volumes folio, Paris, 1723, with a more copious Index than had up to that period been appended to any classic. In 1715 he edited a new edition of 'The Councils,' printed at the royal press in 12 vols. folio.

Père Hardouin died at Paris, Sept. 3rd, 1729. After his death a volume of his 'Opuscula,' in folio, was published by an anonymous friend.

HARDWICKE, PHILIP YORKE (first Earl of), was the son of an attorney at Dover, where he was born the 1st December, 1690. His father was in very indifferent circumstances, and wholly unable to afford him the education generally bestowed upon young men in his station of life. The great abilities of the son enabled him however to surmount all difficulties. He was a great favourite with Mr. Samuel Morland, a man of considerable learning, who kept a school at Bethnal Green, at which he was placed for a short time. When removed to the office of Mr. Salkeld, an eminent solicitor in London, his diligence and talents won the respect and esteem of that gentleman also. So steady was his perseverance, and so rapid his progress in the knowledge of the law, that Mr. Salkeld caused him to be entered of the Middle Temple, in November, 1708, as a preparatory step to his call to the bar. During the time he was keeping his terms, he became acquainted with Mr. Parker, one of the sons of Lord Chief-Justice Macclesfield, the consequence of which was an introduction to Lord Macclesfield, who highly appreciated Yorke's merits, and employed him as the companion and tutor of his sons. To this lucky acquaintance the rapid and extraordinary success of Mr. Yorke at the bar is mainly attributable. In May, 1715, he was called to the bar, when the support of his old benefactor Salkeld, who was in very extensive practice as a solicitor, together with the favour and patronage of Lord Macclesfield, enabled him at the very outset to acquire an extensive practice: indeed the favouritism of Lord Macclesfield, even in court, justly offended and aggrieved many old and eminent practitioners.

The elevation of Lord Macclesfield to the woolsack (1719) enabled him further to promote the interests of his favourite, and accordingly, through his interference, in the same year Yorke took his seat in the House of Commons as member for Lewes, the whole expenses of his election being defrayed by the ministry. In the same year he married Mrs. Lygon, a young widow, the daughter of Mr. Cocks, a gentleman of good estate in Worcestershire, and the niece of Lord Somers and Sir Joseph Jekyl, then master of the rolls.

In March, 1720, while upon the circuit, and within five years after his call to the bar, he was, through the influence of his patron the chancellor, appointed solicitor-general. This step was a very hazardous one; for besides the professional jealousy which was perhaps not unjustly excited towards him, he had to contend with the doubts felt by all parties whether so young a man could be possessed of sufficient learning and experience to discharge the duties of a leading counsel. The talents however which he displayed in the conduct of the business in which he was employed soon made it evident that he was fully equal to the duties of his new station. Shortly after his appointment he was knighted, and in 1724 he was made attorney-general. It was after this period that his patron, Lord Macclesfield, was impeached for gross corruption in office, and Sir Philip Yorke had great difficulty in procuring himself to be excused from the task of assisting the managers of the Commons in making good their charge. In 1733, having held the office of attorney-general nearly ten years, he was appointed lord-chief-justice of the King's Bench, and created Baron Hardwicke. He presided in the King's Bench for three years and a half, during which period he added largely to his former high reputation. On the death of Lord Chancellor Talbot (1737) he was raised to the dignity of lord chancellor. It is upon his judgments as chancellor that the reputation of Lord Hardwicke is principally founded; he held the great seal during nearly twenty years, dispensing justice throughout that period with the most consummate skill at a time when the principles of equity jurisdiction were by no means in a settled state. His integrity was never called in question; the wisdom of his decrees was the theme of universal eulogy, and it is a remarkable fact that during the whole time that he presided in the Court of Chancery three only of his judgments were appealed from, and those were confirmed by the House of Lords. In 1754 he was created Earl of Hardwicke and Viscount Royston. He continued to hold the great seal until the 19th of November, 1756; the Duke of Newcastle having resigned the premiership on the 11th. After his retirement from public life Lord Hardwicke divided his time between his seat at Wimpole in Cambridgeshire and his house in Grosvenor Square, enjoying unimpaired his vigorous intellect until nearly the close of his 73rd year, when he was attacked by a disorder which proved fatal on the 6th March, 1764. The labours of Lord Hardwicke's mind are recorded in his legal judgments. They are preserved, so far as the points decided by them, in the reports of Atkyns and Vesey, sen., and in a volume recently published from Lord Hardwicke's own notes, by Mr. West. Some notes of his decisions have also been made public by Mr. Lee. These volumes however do not give any notion of the language in which the judgments were delivered. Few specimens of his style of writing remain. A short treatise, 'A discourse of the Judicial Authority of the Master of the Rolls,' has been attributed to him, and some few letters have been preserved by Dr. Birch. It has also been said that he was the author of the paper in the 'Spectator' for the 28th April, 1712, signed Philip Homebred; but this statement is exceedingly doubtful.

This brief memoir and the facts and dates are taken from a very able Life of Lord Hardwicke, in the 3rd No. of the 'Law Magazine.'

HARDYNG, JOHN, one of our old historians, descended of a respectable northern family, was born in 1378, and at the early age of twelve was admitted into the family of Sir Henry Percy, eldest son to the earl of Northumberland, known by the name of Hotspur, with whom he fought as a volunteer at the battles of Homildon and Cokelawe. After the death of his patron, whom he accompanied in the fight of Shrewsbury, as soon as a pardon had been proclaimed for the adherents of the Percies, Hardyng enlisted under the banner of Sir Robert Umfravile, who was connected with the Percies by affinity, and under whom in 1405 he became constable of the castle of Warkworth in Northumberland. How long he remained at Warkworth is unknown; but his knowledge of Scottish geography seems soon to have engaged him in the secret service of his country. The exact time when Hardyng was first sent to obtain restitution of the deeds of homage, which had been given up by Mortimer in the minority of Edward III., does not appear; but it must have been early in the reign of Henry V. He remained in Scotland three years and a half, indefatigable in the search, and obtained some at the hazard of his life. In 1415 we find him, with Sir Robert Umfravile, attendant on the king at Harfleur. His journal of the march which preceded the memorable battle of Agincourt forms one of the most curious passages in his chronicle. In 1416 he accompanied the duke of Bedford to the sea-fight at the mouth of the Seine.

An obscure notice in a rubric of the Lansdowne manuscript of Hardyng's Chronicle intimates that he was at Rome in 1424. Soon after we find him again employed in ascertaining the fealty due from the Scottish kings. In one or two passages of his Chronicle he distinctly alludes to an incurable injury received, as he himself expresses it, for England's right; and in one or two others he states the offer of a thousand marks which had been made to him by king James I. of Scotland, on condition of his embezzling some of the earlier instruments he had procured. The letter of protection from king James, making this offer, is still preserved among the antient deeds in the Chapter House at Westminster. In another passage of his Chronicle, as well as in an address to king Henry VI., Hardyng mentions 450 marks as the price for which he obtained some other of the deeds of homage. Notwithstanding these declarations however several writers have considered our author as a dexterous and notable forger, who manufactured the deeds for which he sought reward. The spurious instruments by which king David II. and king Robert II. were made to acknowledge the superiority of England appear principally to have occasioned this strong change of fabrication. But whether Hardyng in his zeal for his country became the tool of some more powerful person, or was imposed upon in the purchase of the deeds, cannot now be thoroughly ascertained.

Actively as Hardyng was engaged in life, he seems to have been constantly employed in gathering materials for his Chronicle, the first composition of which he finished toward the latter end of the minority of Henry VI. The Lansdowne manuscript already referred to closes with the life of Sir Robert Umfravile, who died January 27th 1436, under whom Hardyng seems to have lived, in his latter years, as constable of Kyme Castle in Lincolnshire.

Of the rewards which Hardyng appears to have received, the first was in the 18th Henry VI., when he had a grant for life of 10*l.* per annum out of the manor or alien preceptory of Wyloughton in the county of Lincoln. In the 19th Henry VI. a confirmation of the grant occurs for seven years, with the further grant after that time of the reversion of the manor for life. In 1457 he received a pension of 20*l.* a year for life, charged in the patent-roll upon the revenues of the county of Lincoln.

The evening of Hardyng's days was passed in the entire recomposition of his work for Richard duke of York, father to king Edward IV., who fell in the battle of Wakefield, December 31, 1460. It was afterwards presented to king Edward IV. himself. The history comes no lower than the flight of Henry VI. to Scotland. But, from a passage in which the queen is mentioned, it is evident that he could not have finished his work before 1465. How long he survived its completion is unknown, but he must then have been at least eighty-seven years of age.

'The Chronicle of Jhon Hardyng, in Metre, from the first begynnyng of Englande, vnto the reigne of Edwarde the Fourth,' was printed by Grafton in 1543; to which Grafton added a continuation to the 34th Henry VIII., a small thick quarto; and it is not a little singular that there should be two editions of this work, both printed in the same month of the same year, January, 1543, differing in almost every page, and one, in Grafton's own portion, containing twenty-nine pages more than the other. A collation of both, together with that of a valuable manuscript of Hardyng, was published by the booksellers of London in 1812, under the care of Sir Henry Ellis.

The present printed text of Hardyng's Chronicle is from the re-composition presented to Edward IV. The Chronicle as written for Henry VI., the only manuscript known of which is preserved in the Lansdowne collection in the British Museum, has never been printed. It differs in every page from the printed copy. Hearne had intended its publication. Several manuscripts of the later text of Hardyng's Chronicle are extant: one in the Harleian Collection, No. 661; one in Selden's; another in the Doucean Collection in the Bodleian; and one in the Ashmolean Library at Oxford. A sixth manuscript was formerly preserved in the library of Basil earl of Denbigh.

HARE-LIP, a malformation in which the lip is divided in one or more situations by clefts extending from its free edge towards its attachment. It has received this name from the resemblance which it bears to the divided upper lip of hares and other gnawing animals, and is one of the most common of the malformations by arrest of development. [MONSTER.] In the embryo each lip is formed of four pieces which project separately from the jaws and unite with each other at different periods of fœtal life; but if by any circumstance their healthy development is checked, they remain permanently in the condition which they had at the time of its occurrence. The separate portions of the lower lip unite long before those of the upper, and fissure of the former is so exceedingly rare as to be seldom the subject of treatment. Of the portions of the upper lip the two middle unite first, and then the two lateral to them; hence a fissure in the middle line is more rare than one on either or each side. Hare-lip may be single or double, that is, there may be one or two fissures—the one may be seated in the middle line of the lip, or opposite to the union of the two incisors with the canine tooth—if there be two, they will be found in the latter situation on each side. It may be simple or complicated with fissures of the gum or palate, which being developed in an analogous manner may be influenced by the same cause as the lips, though being earlier united they are less rarely affected.

The cure of hare-lip is important, not only for the uncouth deformity, but because sucking is prevented in infancy, and in later life the speech is affected. It is accomplished by cutting off quite smoothly the opposite edges of the fissure in its whole length, and then bringing them together and maintaining them in accurate apposition till, like the edges of a common wound, they have firmly united. For this purpose, after fixing the portion of the lip with forceps, each edge of the fissure is to be cut off with a knife or a pair of knife-edge scissors, taking especial care that the wounded surface should be left of the same form and size in each. They are then to be placed in accurate contact by transfixing them with one or two hare-lip pins (according to the length of the fissure), and connecting them with silk wound round them in the form of an 8. These pins should be made of silver, with removeable steel points; the lowest should be passed through full two-thirds of the thickness of the lip, just above its vermillion border, taking care that it penetrates to the same depth in each portion, lest the edge of one should project beyond that of the other. The next pin should be passed midway between the lower edge of the lip and the nostril, and the remaining aperture should be closed with a suture or with sticking-plaster. The intervening portions of the lip are now to be compressed by the silk wound about the pins, and additional security is afforded by placing a compress on each cheek, and there bandaging it firmly, so as to prevent the muscles of the lips from contracting and separating the cut edges. After the operation the part should be kept perfectly quiet and cool; in four or six days the pins and other dressings may be removed, and the edges of the wound, which ought to be completely united, will now need only to be secured by sticking-plaster.

When the fissure is double, it is generally advisable to operate first on one side, and when that is completely healed, on the other; but in some cases the whole may be done at once, by cutting off both edges of the middle and each of the lateral ones, and transfixing the whole by the same pins and sutures. In those cases in which a portion of the jawbone projects much, it may be sufficient to draw the teeth from it, and then the lip may be stretched to unite over it; but often it will be necessary to remove it by cutting-forceps, or to depress it by long-continued pressure. In all cases it must be remembered, that however wide the fissures may be, there is no loss of substance in the lip; its edges are drawn asunder by the muscles on each side, just as those of a cut made in a healthy lip (which may indeed require the very same treatment) are.

The best authorities seem now agreed that after six or eight weeks, the earlier this operation is performed on the infant the better, only avoiding the period of dentition; for besides that very young children are likely to be quiet and asleep all day, and that the healing processes are then very active, it has the great advantage of enabling them to resort at once to their natural food by restoring the power of sucking.

HARFANG, one of the names of the Snowy Owl, *Strix nyctea*. [STRIGIDÆ.]

HARFLEUR. [SEINE INFERIEURE.]

HARIOT. [HERIOT.]

HARLE, the French name for the *Mergansers*. [MERGANINÆ.]

HARLEIAN COLLECTION. [BRITISH MUSEUM.]

HARLES, GOTTLIEB (or THEOPHILUS) CHRISTOPHER, a learned and laborious German philologer, born at Culmbach, 1738, died November 2, 1815, held several academical offices in the university of Erlangen. He published many editions of Greek and Latin authors, which however are not highly esteemed; and has the character of a laborious student rather than of a judicious and able critic. Those of his works most highly recommended are his 'Introductions to the History of the Greek and of the Latin Language;' and his 'Lives of the Most Eminent Philologers of our age,' a very useful collection to those who are concerned with literary biography, 1770, 3 vols. 12mo., Bremæ. See the 'Biog. Univ.' for a list of the persons herein contained. The most important of his publications is an edition of the 'Bibliotheca Græca' of Fabricius, Hamburg, 1790-1811, in 12 vols. 4to., which contains great additions, and a new arrangement of the original matter. [FABRICIUS, J. A.] (*Biographie Univ.*; Watt, *Bibliotheca Britann.*)

HARLEY, ROBERT, EARL OF OXFORD, was born in London in 1661, of a family long of distinguished note in the county of Hereford. His grandfather, Sir Robert Harley, was master of the mint in the reign of Charles I., and his father, Sir Edward, was governor of Dunkerque after the Restoration. In the troubles of the seventeenth century the Harleys acted with the Presbyterian party, of which the family was considered one of the heads, and, although both Sir Robert and his son Sir Edward took the field on the side of the parliament in the early part of the civil war, they went into opposition when the republicans obtained the ascendancy, and Sir Edward afterwards took an active part in bringing about the Restoration. The subject of the present article entered parliament after the Revolution as member for Tregony, and afterwards sat for

Radnor, professing for some time the whig principles of his family. After a transition period however, in which he followed a course that perplexed and successively excited the expectations of all parties, he went fairly over to the tories, and soon became one of their most active and efficient combatants in the House of Commons. In the House which met under the tory administration of Rochester and Godolphin, in February, 1701, Harley was elected speaker by a great majority; and even in the next parliament, which assembled in December of the same year, although his friends now appeared in diminished numbers, they were still strong enough to place him again in the chair. He was a third time chosen to the same office by Queen Anne's first parliament, in October, 1702, and retained it till April, 1704, when he was made secretary of state. He is believed to have been principally indebted for this promotion to the good offices of Miss Abigail Hill, who had been introduced into the royal household by her cousin Sarah, Duchess of Marlborough, and who was by this time beginning to supplant her patroness in the queen's favour. Miss Hill's father, it seems, a merchant in the city, who had fallen into distressed circumstances, was as near a relation of Harley as her mother was of the duchess; and this circumstance had probably something to do in bringing him and the daughter together. According to the scandalous chronicle of the duchess of Marlborough, Miss Hill, having fixed her affections on Mr. Masham, the queen's page, applied to her cousin Harley for his aid in forwarding her object: by Harley's management she became Mrs. Masham; and in return she exerted all her influence to attach the weak mind of the queen to Harley and his friends. It is certain that from this time she and Harley acted in confederacy against the Marlborough interest. In this state of things the latter party began to seek a new support by inclining towards the whigs; and various circumstances chanced for the moment to favour this line of policy. In the parliament which met in October, 1705, the whigs were stronger than they had been since the beginning of the reign; this sufficed to introduce into the cabinet two distinguished members of that party, William Cowper Esq. (afterwards Lord Cowper), as lord chancellor, and Charles, Earl of Sunderland, the son-in-law of Marlborough, as one of the secretaries of state. But the struggle was finally decided against Harley by the public suspicion and odium to which he became exposed in consequence of the conviction of one of his clerks named Gregg, for carrying on a treasonable correspondence with France. Gregg, who was executed for his crime, left a paper with the sheriff, in which he entirely exculpated Harley: even this however did not allay the outcry against the latter; it was said that he himself was the writer of the paper, which he had induced Gregg to sign and to deliver by the promise of a reprieve. On the other hand, Harley's friends asserted that the strongest endeavours were made by the opposite party to suborn Gregg, and to prevail upon him, by the promise of a pardon, to accuse Harley. In the beginning of February, 1708, after the conviction, but before the execution, of Gregg, the Duke of Marlborough and Lord Godolphin intimated to the queen that unless Harley were removed, they would leave her service; on this, although it is believed that the queen was herself willing to incur the threatened risk of continuing to support him, the secretary resigned, along with his friend St. John (afterwards Lord Bolingbroke). Harley remained out of power for about two years and a half; at the end of which time the whig ministry was partly undermined by his intrigues and those of Mrs. Masham, partly destroyed by its own imprudence and over-confidence. In August, 1710, Godolphin was dismissed, and Harley was appointed chancellor of the Exchequer, all the other whig members of the cabinet having at the same time resigned or been turned out, and tories put in their places. A new parliament was soon after called, which completely sanctioned this arrangement; so inflamed was the temper of the public mind against the late ministry, that only about a hundred of their friends were returned from all England. The duke and duchess of Marlborough, and all their connexions, were now completely discarded both from office and from the queen's favour, which continued to the end of her life to be wholly engrossed by Mrs. Masham (whose husband was soon after made a peer), and by those to whom she lent her influence and protection.

On the 8th of March, 1711, an accident happened to Harley, which in the end proved very serviceable to his schemes of ambition: a French emigrant, who called himself the Marquis de Guiscard (he was in fact an abbé, and brother of the Count de Guiscard), having been apprehended on a charge of high treason and brought for examination to the cockpit, suddenly seized a penknife and struck at the minister. Harley's wound was very slight, but he took care to remain as long as possible in the surgeon's hands. In May following he was appointed lord high treasurer, being about the same time created earl of Oxford and earl Mortimer, and invested with the order of the garter. As the victories of Marlborough constituted the glory of the Godolphin administration, the peace of Utrecht, concluded 5th May, 1713, is the event for which that of Harley is chiefly memorable. It was after this that the jealousy between the premier and Bolingbroke assumed the character of an open rivalry, although it is believed to have been fermenting in secret for years before, one account deducing its origin from so remote a date as the affair of Guiscard, of whose blow, which he asserted was intended for himself, Bolingbroke never forgave his colleague for taking all the credit and reaping all the advantage. The ambitious and intriguing dispositions of the men, both, it is probable, equally unprincipled, made it impossible that they should long continue to act together after their one common object, the achievement of peace with France, ceased to unite their efforts. Bolingbroke had now the art to gain the favourite, Lady Masham, whose influence Harley, on the other hand, seems to have erroneously calculated that he was by this time sufficiently established to despise. It was soon proved that he was wrong: on the 27th of July, 1714, the lord treasurer received his dismissal. It is said that a few days before he had excited the determined vengeance of Lady Masham by demurring to a grant of an annuity of 1500*l.* a year which she had obtained from the queen. The queen's death, three days after, put an end for ever to the political existence of both Oxford and Bolingbroke. In August, 1715, both were impeached by the House of Commons. When St. John made his escape to France, Harley was committed to the Tower, and there he lay for nearly two years. At last, in June, 1717, he was on his own petition brought to trial before the House of Lords; but the Commons not appearing to prosecute their impeachment, the prisoner was on the 1st of July acquitted and discharged. After this the earl of Oxford lived in retirement till his death, 21st May, 1724. He was succeeded in his titles and estates by Edward, his eldest son by his first marriage with Elizabeth, daughter of Thomas Foley, Esq., whose brother was made Baron Foley in 1711, being one of the twelve peers then introduced in a body into the House of Lords. The present earl of Oxford is descended from a younger brother of the lord treasurer, the peerage having been bestowed with remainder to the issue male of his grandfather. By his second wife, Sarah, daughter of Thomas Middleton, Esq., he had no issue. Lord Oxford showed his attachment to literature both by his patronage of Swift, Pope, and others, and by the extensive and valuable library of printed books and manuscripts which he spared no pains or expense to collect. [British Museum.] His own writings do not show much literary talent. They are, a Letter to Swift on Correcting and Improving the English Tongue; an Essay on Public Credit; an Essay on Loans; and a Vindication of the Rights of the Commons of England. He has given an account of his own administration in a letter to the queen, written a few days before his dismissal, which is printed in Tindal's History and elsewhere. On this subject also may be consulted the Duchess of Marlborough's Account of her own Life, and the anonymous reply to that work by James Ralph, entitled 'The Other Side of the Question' (8vo., London, 1742), many of the materials of which had evidently been supplied by the Oxford family. The proceedings on the trial of Lord Oxford are in the 'State Trials.' Some very strong evidence, implicating both Bolingbroke and Oxford in the crime of carrying on secret negotiations with the French court for some years before the peace of Utrecht, has been lately laid before the public in the 'Edinburgh Review,' No. 125, in an account of the collections made by the late Sir James Mackintosh, in 1814, from the archives of the foreign office at Paris.

HARLOW. [Essex.]

HARMER, THOMAS, a Protestant dissenting minister, was born at Norwich, A.D. 1715, of pious parents. He received his education under the care of Mr. Eames in London, and was ordained in the twentieth year of his age as the minister of the Independent church of Watesfield, in Suffolk. In this place he continued till his death in 1788, 'beloved by all and useful to many.'

Tho work by which Harmer is principally known is his 'Observations on various passages of Scripture, placing them in a new light; compiled from relations incidentally mentioned in books of Voyages and Travels into the East.' By the interest of Dr. Lowth, bishop of London, who warmly approved of the work, Harmer obtained the MS. papers of Chardin, which furnished him with a variety of curious additions to his book. The last and best edition was published by Dr. Adam Clarke in 1816, in 4 vols. 8vo. Harmer was also the author of 'An Account of the Jewish Doctrine of the Resurrection of the Dead,' and of 'Outlines of a New Commentary on the Book of Solomon's Song,' 8vo., 1768, 2nd ed., 1775.

(*Memoirs of the Life, Character, and Writings of Mr. Harmer*, prefixed to Dr. Clarke's editiou of the 'Observations.')

HARMO'DIUS. [Aristogiton.]

HARMODYTES, a genus of tubular stony corals, proposed by Fischer and adopted by Bronn. The same species were afterwards designated by Goldfuss, Syringopora, a name generally adopted.

HARMONIC PROPORTION. The reciprocals of numbers which are in arithmetical proportion are themselves said to be in harmonic proportion; thus

$$\frac{1}{a}, \frac{1}{a+b}, \frac{1}{a+2b}, \text{\&c.},$$

is a series in harmonic progression.

A line A B is said to be harmonically divided when two

A C B D

points, C and D, ono within it and one on its continuation, are so placed that A C is to C B as A D to D B. In this construction, C D is an harmonic mean between A D and B D, or A D, C D, and B D, are as the reciprocals of terms in arithmetical proportion.

HARMONICS (Acoustics). By the harmonics of a musical note are meant all those other notes in which the number of vibrations per second are twice, three times, four times, or any multiple of, the number of vibrations which produce the note in question. Thus the harmonics of a note which is sounded by 200 vibrations per second are those notes which require 400, 600, 800, &c., vibrations per second. The following explanation will be rendered complete by reference to Acoustics (vol. i., p. 96) and Temperament. It presumes the reader to be acquainted with the fundamental mathematical laws of the scale. The harmonics of a note are infinite in number, theoretically speaking, and proceed by less and less intervals. And since every note may be considered as identical with any of its octaves, every harmonic has a corresponding note in any given octave. Denoting any key-note by C, and the octave above it by C′, there is no possible sound between C and C′ which is not theoretically either an harmonic of C, or as near to one as we please (which is equivalent to the mathematical proposition that a whole number, divided by a whole power of 2, may be made as near as we please to any given number or fraction).

But, in practice, not only is it impossible to produce any number of harmonics we please, that is, to maintain in vibration any aliquot part we please of a string or column of air, but even among the harmonics which we can produce we find a limit to the number of those distinct harmonics which deserve the name, etymologically considered. Some few of the first harmonics are melodious sounds, considered in relation to the key-note, but others are discordant, and find no place in the scale according to any system of temperament. We shall therefore, taking a given note, say C, simply mention the most important harmonics, and reduce them to their proper places between C and C′.

Let a be the number of vibrations per second which produce C; then $2a$ is well known to produce C′, or the first harmonic of a note is its octave. The next has $3a$ vibrations, auswering to G′; so that the twelfth, or octave of the fifth, is the second harmonic. The third has $4a$ vibrations, and answers to C″, the ootave of the octave. The fourth harmonic has $5a$ vibrations, and gives E″, the double octave above the third, in the untempered diatonic scale. The fifth harmonic, with $6a$ vibrations, gives G″, the octave of G′ the second harmonic. In goneral, every harmonic whose vibrations are an even multiple of those in the key-note, is an octave to a preceding harmonic, and presents no new character. The sixth harmonic, having $7a$ vibrations, is an imperfect (being too flat) double octave to the flat seventh above the key-note, or B flat. This last note, in the common mode of tempering, makes $1{\cdot}77a$ vibrations per second; whereas the same note derived from the harmonic makes $1{\cdot}75a$ vibrations. The eighth harmonic, with $9a$ vibrations, is correctly D‴, or three octaves above the untempered major second. The tenth, with $11a$ vibrations, is a little too sharp for F‴, being $11a$ instead of $10\frac{2}{3}a$. The twelfth, with $13a$ vibrations, is a little too flat for A‴, being $13a$ instead of $13\frac{1}{3}a$.

The preceding summation is useful, as giving an account of the scale of all thoso musical instruments which consist of one unaltered pipe. These are the bugle, the French horn, the trumpet, and (but for its slide) the trombone; in all of which (except the last) no note can be produced except an harmonic of the fundamental note of the whole tube. Calling the fundamental note C (which however is not very easily sounded), the ordinary scale of these instruments is—

C C′ G′ C″ E″ G″ (B″ flat) C‴ D‴ E‴ F‴ G‴ A‴,

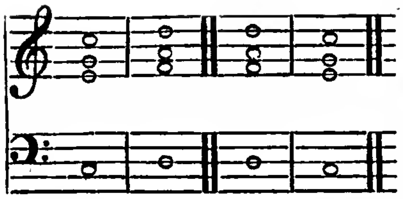
in which B″ flat is too flat, F‴ is too sharp, and A‴ too flat. A short pipe however will not produce many harmonics; the bugle goes no further than G″, at least with common lips. Various contrivances have been introduced to extend and correct this scale; the keyed bugle, the use of the hand in the French horn, the pistons sometimes applied to the same instrumont, and the short slide of the trumpet, to say nothing of the slide which is the principal distinction of the trombone, will suggest themselves to all who are acquainted with musical instruments. In other instrumonts harmonics are much used, particularly in those of the violin class, and in the flute. The performance of Paganini upon a single string, which a few years ago created great sensation among violin players, arose from extraordinary power of producing harmonics. In the fluto C‴ may be attained without much practice, as an harmonic of the fundamental note of the instrument; and we have heard of players who could produce D‴ and even E‴ in the same way. On the long strings of a piano-forte, as the fundamental note subsides, G′, C″, and E″ may be perceived; and we have beard, among the vaulted roofs of a cathedral, several of the harmonics of the notes sounded in chanting. For further information see the references in Acoustics.

HARMONY (in Music), musical sounds simultaneously produced according to certain rules, forming a chord, or a succession of chords. The simplest harmony, namely, the triad, or common chord, is the result of the vibration of all sonorous bodies, and the foundation on which much artificial harmony is built. Under the word Chord the reader will find this matter further explained. M. Catel, a modern French theorist of great authority, has divided harmony into natural and artificial, including in the former all chords not requiring preparation; in the latter, all that are formed by retardation, suspension, &c. But we cannot acquiesce in this arrangemont, for it places the chord of the seventh, which is the source of the three real chords of dissonance, in the same category as the triad, or the chord of nature, which of course will never be admitted. It is true that the chord of the seventh requires no preparation—that is, the dissonant note need not be heard as a concord in the immediately preceding chord [Discord]; nevertheless this privilege cannot make natural that which is essentially artificial.

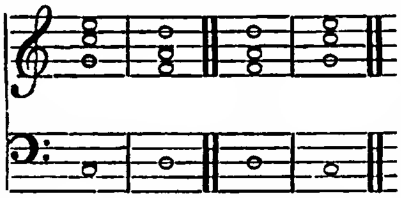
Harmony and Counterpoint are now practically considered as synonymous terms, and for some rules concerning the latter, as well as for examples, we refer to that word. To what has been said under the head Chord, we also again call attention. Chords are tho language in which harmony expresses itself, and the laws whereby the one is governed likewise regulate the other. Besides the rules given under different heads in this work, we here add the few following:—

1. No two perfect concords, namely, two 5ths or two 8ths, are allowed to succeed each other in the same progression, but are permitted in contrary motion; that is, when the one rises and the other falls. Examples:

Similar motion, bad.

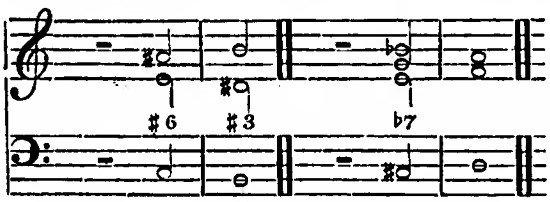


Contrary motion, good.



2. Most discords require to be *prepared*, and all must be *resolved; i.e.* the dissonant note is to be first heard as a concord, and after *percussion*, or being sounded, must pass into a concord, generally by falling a tone or semitone. But sometimes the resolution is brought about by the base, as in the instance of the discord of the 2nd. Examples:

3. It is in the nature of sharpened intervals to rise, and of flattened ones to fall; but extreme sharp intervals almost invariably must rise, and extreme flat ones as invariably must fall. Example:



These examples will also show a reason for giving two names and appearances to that which is, practically speaking, one and the same note; though, theoretically, A sharp and B flat are different sounds.

4. In music in four or more parts, the parts should be dispersed, or separated, in a manner as nearly equal as possible: thus a more perfect symmetry is obtained, and a richer harmony produced. But with a view to some particular effect, a very different distribution of the parts is occasionally made.

5. As a general rule, every composition, whatever its kind, is to commence in its key; but as regards the termination, the rule is without exception, and peremptory: though sometimes the third is changed, from minor to major.

To enter fully into the subject of Harmony would be to give a treatise on musical composition, and require the appropriation of a much larger portion of a volume than the nature of our work admits. The symbols of harmony—or certain figures, some written, some implied—will be explained in the article THOROUGH-BASE, a term of the most inadequate, and indeed unmeaning kind, but which time, and the backwardness of musicians in the march of improvement, have so firmly fixed, that any attempt to substitute a better would be vehemently opposed, and rendered nugatory. For the accompaniment of the scale—*La Règle de l'Octave*, as the French call it—a very important study when properly carried out, see ACCOMPANIMENT.

That the term *harmony* was not used in the same sense by the ancients as by the moderns, seems now to be generally admitted, but admitted without at all affecting the long-disputed and, we believe, undecidable question, as to the knowledge of counterpoint possessed by the Greeks and Romans, or compromising any opinion delivered or entertained on that most obscure and perplexing subject. By Harmónia (ἁρμονία) the Greeks meant simply to express the proper relationship of one sound to another, the pleasing agreement of intervals, in a melody, and nothing beyond. Though, however, they employed the word harmony in a very different sense from that given to it in later ages, it does not thence necessarily follow that they were ignorant of the high branch of the science to which we apply the term. That they played and sung in octaves is undeniable; and it is almost equally certain that they occasionally used simultaneous thirds, instrumentally and vocally. It seems unlikely, then, that so active, so ingenious and musical a people, furnished with an abundance of many-stringed lyres, of double-flutes, as well as other instruments, should not have discovered, even by mere accident, something of harmony, and have been led to investigate its nature and cultivate its practice. But on the other hand, if they were acquainted with the effect of combined sounds, and, as a sure consequence, had converted their knowledge to some useful purpose, they would, to almost a moral certainty, have left, among the numerous disquisitions and lengthened conversations on the subject of music which have reached us, some undeniable evidence of so important a fact.

HARMO'TOME. *Andreolite; Ercinite.* This mineral occurs in attached crystals, generally intersecting each other lengthwise. Primary form a right rhombic prism; cleavage parallel to the primary planes, and to both the diagonals of the prism; hardness 4·5; colour greyish-reddish, yellowish-white; fracture uneven; lustre vitreous, and sometimes pearly; streak white; sp. gr. 2·35, 2·4.

By acids, unless heated, harmotome is scarcely acted upon. Before the blowpipe it fuses into a clear glass. It occurs at Strontian in Scotland, and at Andreasberg and Oberstein in Germany.

The analyses of this substance do not greatly differ in general. The harmotome of Strontian yielded, by the analysis of Mr. Connell—

Silica . .	47·04
Alumina . .	15·24
Barytes . .	20·85
Lime . .	0·10
Soda or potash .	0·88
Water . .	14·92
	99·03

HAROLD I., surnamed Harefoot, was the younger of the two sons of Canute the Great, by his mistress, or, according to others, his first wife Alfgiva. On the death of his father, in 1035, Harold disputed the possession of the English crown with his half-brother Hardicanute, whom their father had designed for his successor, and succeeded in acquiring the sovereignty of London and all the country to the north of the Thames. [HARDICANUTE.] In 1037 the thanes and people of Wessex also submitted to him, on which he was crowned king of all England, although it is stated that Egelnoth, the archbishop of Canterbury, at first refused either to perform the ceremony himself, or to permit any of his brother bishops to officiate in his stead. No events of the reign of Harold, after he became sole king, have been preserved. Even his character may be said to be unknown —some of the chroniclers representing him as a friend to the church, others as not even professing a belief in christianity. He died in 1040, and was succeeded by his brother Hardicanute. The common account of his surname of 'Harefoot' is that it was given him for his swiftness in running; it is said that, in his favourite amusement of the chase, he used often to pursue the game on foot. According to Brompton it refers merely to his general preference of walking to riding—a most unbecoming taste, says that annalist, for a king. Another explanation is that his foot was all over hairy.

HAROLD II. was the second of the sons of Godwin, earl of Kent. This Godwin, or Gudin, makes his first appearance in English history in the reign of Canute, and appears to have been born a few years before the close of the tenth century. He was undoubtedly of Saxon descent. The English writers call him the son of Wulfnoth, a 'child' (which may perhaps mean a peasant) of Sussex. One writer, Radulphus Niger (whose MS. chronicle is in the

British Museum), says distinctly that he was the son of a cowherd ('filius bubulci'). These statements are consistent, so far as they go, with a curious account which Mr. Turner has translated from the Knytlinga Saga, and which represents Godwin to have been the son of a peasant named Ulfnadr (evidently the same name with Wulfnoth), and to have owed his introduction at the court of Canute to a service which he performed to Ulfr, one of the noble captains of that Danish conqueror, who, having lost himself in a wood after the battle of Skorstein, or Sceorstan [EDMUND II.], accidentally met with Godwin driving his father's cattle, and was by him conducted in safety first to the cottage of Ulfnadr and then to the camp of Canute. This story however makes Ulfnadr to have had an uncle Edric who had already raised himself from the same humble station to be duke or chief governor of Mercia. Godwin's talents and address, his handsome person and fluent speech, speedily enabled him to make his way at court. In course of time he married Gyda, or Githa, the sister of Ulfr, who was himself married to a sister of Canute; and on this Canute made him a jarl, or earl. Earl Godwin's first appearance in political history is after the death of Canute, as a supporter, in concert with Queen Emma, of the succession of Hardicanute. [HARDICANUTE.] On this occasion, as in the general course of his after-life, he attached himself to what was considered the Saxon, in opposition to the Danish or other foreign interest. It seems improbable therefore that he should soon after this have been a party, as the historians after the Norman Conquest allege, to the treacherous murder of Prince Alfred, the younger brother of Edward the Confessor. [EDWARD THE CONFESSOR.] The common story indeed affirms that Godwin in this instance acted again in concert with Queen Emma; but, besides the extreme unlikelihood that the mother should thus plot the destruction of her own child, whose death was, at the moment at least, to benefit nobody except Harold Harefoot, the enemy of herself and of her families by both her husbands, the actual immediate result of this murder was her own exile as a fugitive, and the complete overthrow, for the time, of whatever power she or her son Hardicanute, for whom she was acting, possessed in England. The contemporary author, it may be further observed, of the 'Encomium Emmæ,' addressed to her, and written by her orders, never would have made the murder, as he does, one of the subjects of his detail, if there had then been the least suspicion of her participation in it. If Emma was innocent, Godwin, who was and had all along been her associate in governing Wessex for Hardicanute, was in all probability equally so. It is true that a few years after, in the reign of Hardicanute, he was, in a quarrel with Alfric, archbishop of York, passionately accused by that prelate of having been the instrument through whom the murder was effected; but he immediately met the charge by demanding to be put upon his trial, and the result was his complete acquittal. When Alfred and his followers were fallen upon by the soldiers of Harold, they were under the protection of Godwin, who had met them on their landing, having, as he asserted, been sent by Emma to be their conductor; this circumstance seems to have formed the sole ground for an imputation which pursued him to his grave, and after his death was eagerly taken up by the Norman historians, when everything that could blacken the characters of Godwin and his family was grateful to the reigning dynasty. After the accession of Hardicanute, Godwin was employed in conjunction with Archbishop Alfric to disinter the body of Harold Harefoot, and see the fragments thrown into the Thames. It was a disagreement arising out of this barbarous commission that gave occasion to the quarrel between the archbishop and the earl. The history of Godwin and his family during the next reign has been sketched in the notice of Edward the Confessor. The historians after the Conquest assert that his death, which certainly happened in consequence of a sudden seizure of illness as he sat at the royal table on Easter Monday, 1053, was occasioned by his being choked in attempting to swallow a piece of bread, which, in reply to an observation of the king obliquely hinting that he had been the murderer of Prince Alfred, he had wished might stick in his throat if there was any truth in the charge. The story, which was unknown to the contemporary annalists, is of a kind too well adapted to the credulous superstition of the age in which its first relaters lived, as well as to their interests and prejudices, to leave much doubt as to its origin. At the time of his death Godwin was the most powerful subject in England, he and his sons dividing among them the government of a large portion of the kingdom, while his only daughter was the wife of the king. His eldest son, Sweyn, indeed, after having been repeatedly pardoned for resistance to the royal authority and other crimes, had died abroad a short time before the death of his father. On Godwin's death his earldom of Kent, which, besides that county, comprehended all Wessex and Sussex, was given to his second son, Harold; Harold's own earldom, under which were included the counties of Essex, Middlesex, Huntingdon, Cambridge, and the rest of the antient kingdom of East Anglia, being at the same time transferred to Alfgar, the son of Leofric, styled Earl of Leicester, the potent rival of the Godwin family. This latter arrangement was not tamely submitted to by Harold: Alfgar was outlawed by the witenagemot, on a charge of treason which Harold brought against him; on which flying to Ireland he speedily returned with a force of Danes from that country, and of auxiliaries from Wales, to levy open war against the Saxon king. Harold was despatched by Edward to meet the rebels; but a contest of arms was prevented by a negotiation which restored his earldom to Alfgar, who soon after also succeeded to the honours and estates of his father Leofric, but did not live above a year to enjoy them. Harold meanwhile, as the king's commander-in-chief, turned to chastise the Welsh for the aid they had given to the revolt; and a series of hostilities with that people commenced, which did not finally terminate until, in 1063, after Harold had twice carried fire and sword through their country, they sent him the head of their Prince Griffith, in token of their entire submission. It was about two years after this that Harold was shipwrecked on the coast of Ponthieu, where he was immediately seized by the Earl Guy, and on the demand of William, duke of Normandy (afterwards king of England), delivered over to that prince. William did not permit his prisoner to embark for England till he had compelled him to take a solemn oath, in presence of the assembled Norman barons, that he would do every thing in his power, on the decease of Edward, to promote the duke's succession to the English crown. It would appear to have been already well understood, or at least generally suspected, that the English earl looked to this prize for himself. Immediately after he returned home Harold found himself involved in a new affair of difficulty. This was the insurrection of the people of Northumberland against his younger brother Tostig, who a few years before had been appointed their earl on the death of the great Siward, but whose misgovernment and savage excesses of despotism had at length become insupportable. The insurgents had placed at their head Morcar, the eldest of the two sons of the recently deceased Earl Alfgar; and he and his brother Edwin had come to their assistance, with the men of Lincoln, Nottingham, Derby, and Leicester, and also a body of Welsh auxiliaries. Harold, who was sent to meet them, either deemed their force too formidable, or their demands too just, to be resisted; it was agreed, without coming to blows, that the earldom should be taken from Tostig and given to Morcar. On this Tostig retired to Bruges, brooding, as it presently appeared, on schemes of vengeance. The death of Edward the Confessor (5th January, 1066) followed in little more than a month after this pacification, which had been perhaps the more readily accorded by Harold in consequence of the near prospect of that event: he was at hand when it took place. On the evening of the same day, a report having been circulated that Edward had named him for his successor before he breathed his last, he was proclaimed king in an assembly of the thanes and of the citizens of London, held in the cathedral of St. Paul's. The next day he was solemnly crowned in the same place, a few hours after the interment of the late king.

For more than half a year Harold was left to occupy the throne he had thus obtained in quiet. His accession evidently took place with the general assent of the nation; the nobility with few exceptions, and the bishops with scarcely any, avowed themselves its authors and supporters; the acquiescence of the people was complete everywhere, except, for a brief space at first, among the Northumbrians, who were however easily induced to lay aside their scruples by the influence of their Earl Morcar, whose sister Editha Harold had married; and on the whole there is no reason to suppose that he would have had any trouble in maintaining himself if he had been allowed to remain unmolested by attacks from abroad. Two foreign enemies however at length assailed him nearly at the same time. His brother Tostig, having formed a confederacy with Harold Hardrada, king of Norway, first made a descent upon the Isle of Wight, and after he had levied contributions from the inhabitants, sailed round at the head of his fleet of sixty vessels to the mouth of the Tyne, where he was joined about the beginning of September by Hardrada with a navy of three hundred sail. The invaders had driven back Earls Morcar and Edwin, and made themselves masters of the entire province of York before Harold came up. On the 25th however he engaged them at Stamford Bridge, on the Derwent, when both Hardrada and Tostig fell, and the English king obtained a complete victory. Only three days after this the Duke of Normandy landed at Bulverhithe, between Pevensey and Hastings, on the southern coast, with a mighty armament, which he had spent the preceding eight months in fitting out. Harold, having first proceeded to London, did not reach the Norman camp till the 13th of October. On the morning of the following day battle was joined at a place then called Senlac (now Battle), about nine miles from Hastings. The issue of this memorable engagement, which lasted the whole day, was the complete defeat and rout of the English, after Harold himself had fallen, pierced through the head by an arrow—his two brothers, Gurth and Leofwine, having also been already slain. This victory, as all know, gave the crown of England to the Duke of Normandy, by whose descendants it has ever since been worn.

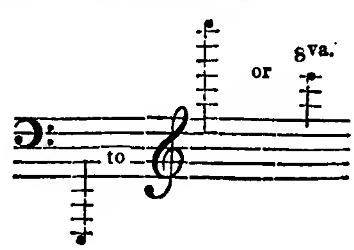
Harold is said to have been twice married. By his first wife, whose name has not been preserved, he had three sons, Edmund, Godwin, and Magnus, who, on the death of their father, fled to Ireland, from which they afterwards attempted some descents on the western coasts of England, but eventually retired to Denmark. His second wife, Editha, otherwise called Algitha, the daughter of Earl Alfgar, is said to have been the widow of Griffith, the Welsh prince, whose head had been sent by his subjects as a peace-offering to Harold. By her Harold is asserted to have had a son and two daughters; but, as it is admitted that he was only married to her some time in 1065 at the earliest, we may doubt if she could already have produced so considerable a family. The son, named Wolf, is said to have been knighted by William Rufus: Gunilda, the eldest daughter, became blind, and passed her life in a nunnery; the second, whose name is unknown, is supposed to have gone to Denmark with her half-brothers. Queen Editha survived her husband many years, during which she is said to have lived in obscurity in Westminster. This lady, according to the Scottish historians, was the mother, by her first husband, of a daughter who married Fleance, the son of Banquo, thane of Lochaber, whose son Walter, marrying a daughter of Alan the Red, earl of Britanny, became the progenitor of the Stewarts. (On this story see appendix No. X. to the first volume of Hailes's 'Annals of Scotland.')

HARP (hearp, *hearp*, Saxon), a musical instrument which, under different forms and denominations, may be traced to the remotest ages. According to Holy Writ, Jubal, seventh only in descent from Adam, was its inventor; he 'was the father of all such as handle the harp and organ,' as Moses tells us. Notwithstanding the wonders related of Amphion's lyre, or harp, we are compelled to believe, judging from representations in sculpture and on coins, that the Greeks themselves did not so much improve the instrument as their writings would lead us to conjecture. But there now seems little doubt that the Egyptians brought the harp to a comparatively high degree of perfection: the fresco painting discovered by Bruce near the ruins of Thebes, which he thinks was executed by order of Sesostris, who reigned between fourteen and fifteen hundred years before the Christian æra, exhibits a harp so much resembling that of the present day, in form, dimensions, and ornament, that it might, upon a hasty inspection, be mistaken for one of modern manufacture. He describes it as wanting the pillar, an omission, most likely, of the painter. 'The back part, he says, 'is the sounding-board, composed of four thin pieces of wood, joined together in form of a cone, that is, growing wider towards the bottom. . . . . . . Besides that the principles on which the harp is constructed are rational and ingenious, the ornamental parts are likewise executed in the best manner. The bottom and sides of the frame seem to be veneered, or inlaid, probably with ivory, tortoiseshell, and mother-of-pearl, the ordinary produce of the neighbouring seas and deserts. It would be now impossible to finish an instrument with more taste and elegance.' This account, among others by the same, was at first received with some suspicion; but later travellers in Egypt, among whom is Denon, have vindicated Bruce and confirmed his statements. Rosellini too, one of the latest and best authorities, in his splendid work, *I Monumenti dell' Egitto*, &c., published at Pisa in 1832, has given coloured engravings of harps corresponding in nearly all respects with the instrument designed and described by Bruce, which prove beyond every reasonable doubt his fidelity in this instance, and the great superiority of the Egyptian harp over every instrument of the kind known to have been in use among the Greeks or Romans.

Many learned persons, observes M. Ginguené, are of opinion that the Europeans are not indebted to the Egyptians for the harp, notwithstanding the resemblance of the instruments used by both the former and the latter; they believe that it originated in the north, that it was introduced into England, and subsequently into Ireland, by the Saxons and other piratical hordes from the Baltic. Martianus Capella found it among the northern tribes which overran the Roman empire in the fifth century. Jones, the Welsh bard, claims for his country the possession of a harp of twenty-six diatonic notes, so early as the beginning of the sixth century, and moreover adds that musical compositions proving the validity of his claim were extant in his time, that is, about fifty or sixty years ago. But he offers no authority for the statement. The Irish were, we are persuaded, well acquainted with the harp from a very early period, and if the inquiries pursuing by Sir William Betham into the origin of their language lead to the results he not very unreasonably anticipates, it may become probable that harps of the Egyptian kind were known in Ireland long before our æra. In Bunting's *Historical and Critical Dissertation on the Harp* is an engraving and description of an antient Irish one still in being, though in an imperfect state. It had in a row forty-five strings, and an additional seven in the centre, as unisons. Its form is not unlike that of the modern instrument, but the pillar is curved outwards, and in point of workmanship the whole is remarkable 'both for the elegance of its crowded ornaments and for the general execution of those parts on which the correctness of a musical instrument depends.' Its height is 3 feet 10 inches, and the longest string is 3 feet 4 inches.

The Welsh triple-stringed harp of the present day extends from G an octave below the first line in the base, to G or A in altissimo on the *right* side; and from G, the first line in the base, to the same upper notes on the left hand; the middle row consists of the semitones of the outward rows. Hence, if the outside rows be tuned in the diatonic scale of G, each parallel note being in perfect unison, the notes of the middle row are tuned a semitone higher; 'that is, G is made sharp, &c., so that in modulating from the key of G to that of D, the performer introduces a finger between the C natural and D of the outside strings to strike C sharp, which is in the middle row.'

The harp, as a generally useful instrument, may be said to date its existence from the time when pedals were added to it. With these it is possible to modulate into all keys, and to execute any music suited to keyed-instruments. We are indebted for the present improved and nearly perfect state of the harp to the late M. Sebastian Erard, who, in 1794, took out a patent for a harp with seven pedals that rendered the chromatic scale. This was a single-action-harp, the pedals only effecting one change on the strings. In 1808 the same admirable mechanist produced his double-action harp, the pedals of which have two actions. This last is tuned in the key of C flat. By fixing the pedals in the first groove the instrument is at once transposed into C natural; and by fixing them in the second groove it is transposed another semitone higher, into the key of C sharp. The compass of the harp thus improved is from double E below the base to E in altissimo; or—



But though the harp in this highly improved stato may be used for the performance of any music written for the piano-forte, yet in executing compositions in which there is much modulation, the difficulty is of an extreme kind, and unconquerable without devoting more time to practice than ought to be bestowed on an accomplishment, however elogant and fascinating.

HARPA (Conchology). [ENTOMOSTOMATA, vol. ix., p. 455.]

HARPA'LIDÆ, an extensive family of Coleopterous insects of the section of Geodephaga, the species of which are distinguished by the tarsi of the two anterior pairs of legs being dilated in the male sex.

In these insects the tibiæ of the anterior pair of legs have always a deep notch on the inner side; the head is almost always short and rounded in front; the thorax is generally broader than long, somewhat convex, but slightly narrower behind than before, and nearly equal in width to the elytra. The body usually approaches more or less to a cylindrical form; the elytra are almost always rounded at the apex, and never truncated at this part. They are usually found under stones.

Of the family Harpalidæ, Dejean, in his 'Species Général des Coléoptères,' enumerates twenty-seven genera: others however have been discovered since the publication of that work.

The number of species known is probably upwards of five hundred.

The most convenient way perhaps of grouping the genera of this family is to take, in the first place, the form of the mentum as a guide. We then find almost all the species divided into two great groups, those in which the mentum is simply emarginated, and those in which there is a small projecting process in the middle of the emargination. Besides these there are certain species (the natural situation of which is perhaps somewhat doubtful) which have the mentum trilobed, and there are others in which the mentum is bilobed.

The various genera described by Dejean are as follows:—

Section I.—*Mentum trilobed.*

Genus 1. Pelecium (*Kirby*), containing two species, both inhabiting the Brazils.

2. Eripus (*Höpfner*), containing two species, one of which is from California· the other inhabits Mexico.

Section II.—*Mentum bilobed.*

3. Promecodorus (*Dejean*), of which there is one species from New Holland.

4. Cyclosomus (*Latreille*), containing two species, one from India, the other from Senegal.

Section III.—*Mentum emarginate, and without central tooth.*

5. Daptus (*Fischer*); two species. Found in North America.

6. Cratognathus (*Dejean*); one species. Probably from Buenos Ayres.

7. Agonoderus (*Dejean*); five species; three of which are from North America, one from India, and one from Senegal.

8. Barysomus (*Dejean*); Two species from India, and one from Mexico.

9. Amblygnathus (*Dejean*); Five species. All inhabitants of Cayenne.

10. Platymetopus (*Dejean*); Ten species. From Africa and India.

11. Selenophorus (*Dejean*); Fifty-nine species. From North and South America.

12. Anisodactylus (*Dejean*); Twenty-three species. Chiefly from Europe and North America.

13. Bradybænus (*Dejean*); Three species. From Senegal.

14. Stenolophus (*Megerle*); Twenty-two species. Almost all European.

Section IV.—*Mentum emarginate, and with a small projecting process in the middle.*

15. Cratocerus (*Dejean*); One species. From Brazil.

16. Somoplatus (*Dejean*); One species. From Senegal.

17. Axinotoma (*Dejean*); One species. From Senegal.

18. Acinopus (*Ziegler*); Six species. Chiefly European.

19. Cratacanthus (*Dejean*); Threo species. From North America.

20. Paramecus (*Dejean*); Two species. From South America.

21. Geodromus (*Dejean*); One species. From Senegal.

22. Hypolithus (*Dejean*); Eighteen species; the greater portion of which inhabit Africa. Four are from South America.

23. Gynandromorphus (*Dejean*); One species. From Italy and South of France.

24. Ophonus (*Ziegler*); Forty-five species. Chiefly European.

25. Harpalus (*Latreille*); One hundred and thirty-four species. From Europe, Asia, Africa, America, and Australia.

26. Geobænus (*Dejean*); Two species. From the Capo of Good Hope.

27. Acupalpus (*Latreille*); Forty-six species. Chiefly European. There are however species found in all the other quarters of the globe.

28. Tetragonoderus (*Dejean*); Africa, India, and South America. One species is found in North America.

29. Trechus (*Clairville*); Twenty-two species. Chiefly European.

30. Lachnophorus (*Dejean*); Four species; three of which are from South America, and one from North America.

For the characters of the genera and species above alluded to, we must refer our readers to M. Dejean's work which has been quoted, and for the British species to Mr. Stephens's *Illustrations of British Entomology*. It will be seen that we have followed the former of these authors in restricting tho family Harpalidæ to such species only as will come under the definition given at the commencement of this article. Two very distinct groups aro included in the family Harpalidæ as defined by Mr. Stephens.

HA'RPALUS. [DEMOSTHENES.]

HARPE, JEAN FRANÇOIS DE LA, was born at Paris in 1739, and educated gratis at the College d'Harcourt. He unfortunately undertook the correction of a pasquinade against one of his instructors, and was accordingly suspected of being its author, and also the author of another which was directed against the tutor who had been his greatest benefactor. In consequence he was imprisoned for nine months in the Bastile. His juvenile poems proving successful, he published a collection of them in 1762. He was fortunate with a tragedy called 'Warwick,' which he produced in the following year, but less so with two others entitled 'Pharamond' and 'Timoleon.' It was about this time that his acquaintance with Voltaire commenced. Ho now began to write éloges for the Académie, and those of Henry IV., Fenelon, and Racine wore highly commended. His poems and dramas, excepting 'Warwick,' and his translations from Sophocles, made comparatively small impression. He afterwards published his 'Lycée, ou Cours de la Littérature,' his 'Mémoires Littéraires,' and a satirical work called 'Correspondenco Turque.' At the commencement of the Revolution he was a zealous republican; but the imprisonment which he suffered from the democrats changed his politics, and he became a warm defender of the church and the monarchy. He was bold enough at the first sittings of the 'Lycée des Arts' to inveigh against the Terrorists, and he would have suffered from their vengeance if he had not escaped by flight. After the 18th Brumaire (9th November, 1799) he began anew his lectures at the Lycée. Shortly before his death his freedom of speech offended the first consul, and he was banished to Orleans. He returned to Paris soon afterwards, and died in 1803.

The reputation of La Harpe rests on his 'Lycée,' which is an invaluablo work to the student of French literature, of which it gives a complete history from its commencement to tho author's own time. The criticisms on tho different writers are not founded on principles acknowledged by the English, but perhaps the value of the book is on that account greater, as it exhibits the object of the French authors, and the standard according to which they aro to be judged when compared with each other. The philological remarks also are highly serviceable in instructing the reader in the niceties of tho language. The part relating to an tient literature is of little value.

HARPER'S FERRY. [VIRGINIA.]

HARPOCRA'TION, VALE'RIUS, a Greek rhetorician of Alexandria. We have no particulars of his life, nor of the time in which he lived. He wrote a 'Lexicon to the Ten Orators,' which contains an account of many of the persons and facts mentioned in the orations of the ten principal orators of Athens, and also an explanation of many words and phrases in their writings.

The 'Lexicon' was first printed by Aldus in 1503, with the scholia of Ulpian on the Philippic orations of Demosthenes. The work has been also published by Massac, 4to., Paris, 1614, with many notes; Blancard, with a Latin translation, Leyden, 1683, 4to.; Gronovius, 4to., 1696; W. Dindorf, Leip., 1824, 2 vols. 8vo.; Bekker, 8vo., Berlin, 1833.

Suidas also mentions another work of Harpocrates, entitled 'A Collection of Flowery Extracts,' which has not come down to us.

HARPSICHORD (originally, and with some reason, written *Harpsicon*), a keyed musical instrument, in form the same as the grand piano-forte, but smaller, strung with steel and brass wires, two to each note, which are struck by *jacks* armed with small pieces of quill, acting as plectrums, and thus made to render a brilliant but somewhat harsh sound, wholly unlike that produced by the hammers of the piano-forte. The compass of the harpsichord did not at first exceed three octaves, but by degrees reached five, from double F below the base to F in altissimo · or—

All harpsichords had *stops*, which increased or diminished the string power: they also were generally furnished with a *swell*, or a means of opening and closing the lid: and many were supplied with two rows of keys, the upper acting on a separate set of strings, which gave a very soft sound, intended as an imitation of a muted violin, &c.

The period at which the harpsichord was invented is quite uncertain. It is not absurd to surmise that the organ speedily suggested some instrument of the keyed kind, in which strings were substituted for pipes, but of that under notice there are no traces before the fifteenth century. Indeed we find no intimation of the harpsichord having been introduced into England till the early part of the seventeenth century; and in less than two hundred years it had fallen into disuse in this, as well, we believe, as in every other, country. During the present year (1838) Mr. Moscheles, wishing at his *Soirées Musicales* to perform some of the lessons of Scarlatti, Handel, and Seb. Bach on the instrument for which they were written, had great difficulty in finding, in the vast city of London, a harpsichord to enable him to accomplish his purpose.

HARPY. HARPY EAGLE. [FALCONIDÆ, vol. x., pp. 174-175.]

HARQUEBUSS. [ARMS.]

HARRIER (Ornithology), a name applied to certain Hawks (*Circus*). [FALCONIDÆ, vol. x., p. 183]; and see, among other works, Gould's *Birds of Europe*, and Yarrell's *British Birds*.

HARRIER, the English name for the hound employed in hunting the *Hare*. The size and breed of the Harrier depend upon the taste of the owner, and that is most frequently regulated by the nature of the country in which the pack is to hunt. Mr. Beckford, a great authority in such cases, says, 'The hounds, I think, most likely to show you sport are between the large slow hunting harrier and the little fox-beagle; the former are too dull, too heavy, and too slow; the latter too lively, too light, and too fleet. The first, it is true, have most excellent noses, and, I make no doubt, will kill their game at last if the day be long enough, but you know the days are short in winter, and it is bad hunting in the dark. The other, on the contrary, fling, dash, and are all alive; but every cold blast affects them, and if your country be deep and wet, it is not impossible that some of them may be drowned. My hounds were a cross of both these kinds, in which it was my endeavour to get as much bone and strength in as small a compass as possible. It was a difficult undertaking. I bred many years, and an infinity of hounds, before I could get what I wanted. I at last had the pleasure to see them very handsome; small, yet very bony; they ran remarkably well together; went fast enough; had all the alacrity that could be desired, and would hunt the coldest scent.'

Hare-hunting, it has been said, is generally followed by sportsmen in the decline of life; though when the district is tolerably open and the hare 'flies the country,' there is often opportunity for a good horse and bold rider to show themselves. But these capital runs come 'few and far between,' and the old fox-hunter can seldom brook the change. In a close or woody district, the constant repetition of the same scene, and the discovery that in consequence of a sudden double of the hare a rustic upon his galloway who knows the country is frequently as near the hounds as the man who is mounted on a first-rate hunter and has taken some daring leaps at the first burst, prove rather disgusting both to the ardour of youth and the experience of age. The rapidity, variety, and dangers of a fox-chace are more congenial to the young man and the good horse, and are not readily forgotten by the old sportsman. In most of the countries where harriers are kept, a bag-fox, or 'bagman,' as he is sometimes facetiously termed, is occasionally procured by way of giving the weary 'thistle-whippers' a taste of the nobler hunting. But the authority to which we have already referred strongly reprobates this practice. 'Harriers to be good,' says Mr. Beckford, 'like all other hounds, must be kept to their own game: if you run fox with them you spoil them; hounds cannot be perfect unless used to one scent and one style of hunting. Harriers run fox in so different a style from hare that it is of great disservice to them when they return to hare again; it makes them wild and teaches them to skirt. The high scent which a fox leaves, the straightness of his running, the eagerness of the pursuit, and the noise that generally accompanies it, all contribute to spoil a harrier.'

HARINGTON, SIR JOHN, was born at Kelston near Bath, in the year 1561. His mother was a natural daughter of Henry VIII., and his father held an office in the court of that monarch. This pair having on one occasion shown great fidelity to the princess (afterwards queen) Elizabeth, she manifested her gratitude by standing godmother to their son John. She was afterwards wont to speak of him as 'that witty fellow, my godson,' or 'that merry poet, my godson,' or in some such way.

Having been educated at Eton and at Christ's College, Cambridge, and having afterwards for a short time made a pretence of studying law, he, by means of his wit and many accomplishments, gained the notice of Queen Elizabeth, and became a member of her court. He had exercised his wit, on one occasion, in translating a tale out of Ariosto's 'Orlando Furioso,' (the story of Giacondo, in the twenty-eighth book), and he circulated this among the ladies of the court, who were greatly pleased with it. When the queen saw it, we are told that she affected great indignation at the indelicacy of some passages, and, by way of punishment, forbad Harington the court until he had translated the whole poem. This he accomplished in 1591, and dedicated it to the queen.

When the Earl of Essex was appointed Lord Lieutenant of Ireland in 1599, Harington was made a commander of horse under Lord Southampton, in his service. When Essex shortly after made his precipitate return to England, Harington was one of the few officers whom he chose to accompany him, and he came in for a share of the queen's indignation. She was angry also, we are told, that Essex had, in Ireland, conferred on Harington the honour of knighthood. 'I came to court,' writes Harington to one of his friends, 'in the very heat and height of all displeasures; after I had been there but an hour, I was threatened with the Fleet; I answered poetically that "coming so late from the land-service, I hoped that I should not be pressed to serve in her majesty's fleet in Fleet Street." After three days every man wondered to see me at liberty.' But the queen shortly relented, and then, writes Sir John in the true style of a courtier, 'I seemed to myself, for the time, like St. Paul, rapt up in the third heaven, where he heard words not to be uttered by men.' On the accession of James I. in 1602, Harington continued in possession of royal favour; for with the new monarch, who affected learning, a literary reputation was everything. He now wrote for the private use of Prince Henry his 'Brief View of the State of the Church,' which is an account of the bishops who lived in the reigns of Elizabeth and James I. He died in 1612.

Besides the translation of the 'Orlando Furioso' and the 'Brief View of the State of the Church,' which have been mentioned, Sir John Harington wrote a satirical poem entitled the 'Metamorphosis of Ajax,' a volume of epigrams, and several occasional pieces in verse, most of which have never yet been published. His epigrams and letters, many of which are preserved in Harington's *Nugæ Antiquæ*, show him to have been a man of wit and taste; and the 'View of the State of the Church' is pleasantly written. On his translation of 'Ariosto' Warton has passed the following criticism: 'Although executed without spirit or accuracy, unanimated and incorrect, it enriched our poetry by a communication of new stores of fiction and imagination, both of the romantic and comic species, of Gothic machinery and familiar manners.' (*History of English Poetry*, vol. iii., p. 485.)

The above sketch of Sir John Harington's Life is taken entirely from an account prefixed to Park's edition of Harington's *Nugæ Antiquæ*, 2 vols. 8vo., 1804.

HARRINGTON, JAMES, descended from an antient and noble family in Rutlandshire, and the eldest son of Sir Sapcotes Harrington, was born in January, 1611. He entered as a gentleman-commoner at Trinity College, Oxford, in 1629, and had there the advantage of Dr. Chillingworth's instructions. At the close of his residence at the university, during which his father had died, he set out on a course of travels; and going first to Holland, resided for some time at the Hague, where he lived on terms of familiarity with the queen of Bohemia, daughter of James I., who was then a fugitive in Holland, and with the prince of Orange. With the latter he visited the court of Denmark; and the prince of Orange subsequently confided to Harrington the management of all his affairs in England. From Holland he proceeded to France and Italy.

On his return to England, Harrington principally passed his time in retirement, cultivating the family affections and pursuing his studies in political science. But in 1646 he was requested by the commissioners whom parliament had appointed to carry king Charles I. from Newcastle nearer to London, to undertake the task of waiting on his Majesty, as being personally known to him, and as being no partisan. He complied with the request, and the manner in which he performed the task having pleased the king, he was shortly after made a groom of the bedchamber. The king now became much attached to him. 'His Majesty loved his company,' says Anthony Wood, 'and, finding him to be an ingenious man, chose rather to converse with him than with others of his chamber. They had often discourses concerning government; but when they happened to talk of a commonwealth, the king seemed not to endure it.' On the king's removal from the Isle of Wight to Hurst Castle, Harrington, who had offended the parliament commissioners at Newport, was removed from the king's service, and on his subsequently refusing to swear that he would not assist or conceal the king's escape, he was placed under arrest, and detained until an application of General Ireton obtained him his liberty. He afterwards showed his attachment to the king by accompanying him to the scaffold.

'After the king's death,' says Mr. Toland, 'he was observed to keep much in his library, and more retired than usually, which was by his friends a long time attributed to melancholy or discontent.' He was engaged however in the composition of his 'Oceana.' And when he had proceeded some way in its composition, making no secret of his views on government and of his partiality towards a commonwealth, he found that he had already brought down upon himself the suspicions both of Cromwell and of the Royalists. His book was seized, while in the press, by Cromwell's order. Harrington, having failed in other attempts to recover the book, bethought himself at last of an application to Lady Claypole, Cromwell's favourite daughter, who was personally unknown to him, but of whose affability and kindness he had heard much. Being ushered into her room, he found there at first only a child of three years old. 'He entertained the child so divertingly, that she suffered him to take her up in his arms till her mother came; whereupon he, stepping towards her and setting the child down at her feet, said, Madam, 'tis well you are come at this nick of time, or I had certainly stolen this pretty little lady. Stolen her, replied the mother, pray what to do with her? for she is yet too young to become your mistress. Madam, said he, though her charms assure her of a more considerable conquest, yet I must confess it is not love but revenge that prompted me to commit this theft. Lord, answered the lady again, what injury have I done you that you should steal my child? None at all, replied he, but that you might be induced to prevail with your father to do me justice, by restoring my child that he has stolen. But she urging that it was impossible, because her father had children enough of his own, he told her at last it was the issue of his brain which was misrepresented to the Protector, and taken out of the press by his order.' Harrington's wit fascinated the lady, and through her intercession he succeeded. Cromwell afterwards read the book, which, according to promise, had been dedicated to him, and professed to admire it.

The 'Oceana' on its appearance excited great attention. Answers were published, and those Harrington in turn answered. Richard Baxter's 'Holy Commonwealth' was written principally against the 'Oceana;' but so far was this work from gratifying the party for whose favour it was designed, that in 1683 it was publicly burnt by a decree of the University of Oxford, together with some of the writings of Hobbes and Milton, and other works, among which however the 'Oceana' was not included. In 1659 Harrington published an abridgement of the 'Oceana,' under the title of the 'Art of Lawgiving;' and he subsequently published several tracts, many of which are quite of a temporary nature, and the others devoted more or less to the same subject as the 'Oceana.' He had also founded a club, called the Rota Club, at which he gave nightly discourses on the advantage of a commonwealth and of the ballot. The club was broken up after the Restoration. But the members of the club had become marked men.

On the 28th of December, 1661, he was seized by order of the king on a charge of treasonable designs and practices, and was carried to the Tower. He was at first ignorant of the precise charge against him; but on a private examination taken by Lord Lauderdale, Sir George Carteret, and Sir Edward Walker, it came out that he was suspected of having taken part in a conspiracy to subvert the monarchy and establish a commonwealth. He stoutly denied all cognizance of the proceedings which those gentlemen with great show of circumstance and detail attributed to him; but his denial was set down, it appears, to faithfulness to an oath. He subsequently presented through his sisters several petitions to the king, praying that he might either be released from confinement or brought to a public trial. Having received no answer to his petitions he made application for a Habeas Corpus; and shortly after this had been granted he was removed without previous notice, and without any communication being made to his friends, to a rock opposite Plymouth, called St. Nicholas's Island. His close confinement here soon produced an effect upon his health, and upon petition he was allowed to be removed to Plymouth. Shortly after he became deranged, owing, it is supposed, to a medicine recommended to him for the cure of the scurvy. Lord Bath, the governor of Plymouth, then made intercession with the king, and Harrington was released from imprisonment. On being removed to London, and obtaining the best medical advice, he rallied considerably as regards bodily health, but his mind was never again right. At his advanced age, and in this unsatisfactory state of health, he married. He died of palsy on the 11th of September, 1677, in the sixty-seventh year of his age.

The 'Oceana,' which is Harrington's chief work, is an imaginary account of the construction of a commonwealth in a country of which Oceana is the imaginary name. It opens with an exposition of the grounds and arguments for a commonwealth; and the principles which are there established are afterwards sought to be applied in detail. Harrington lays great stress on a doctrine which he enunciates thus: that dominion follows the balance of property; by which he means that the form of government in a state must depend on the mode in which property is distributed therein. Proceeding on this doctrine, he requires what he calls an equal Agrarian law as the foundation of his commonwealth. Its other chief features are popular election of councillors by ballot, and the going out at certain periods of a certain number of these councillors, which is also managed by ballot. Harrington is a very powerful advocate of the plan of vote by ballot.

HARRIOT, THOMAS, an eminent mathematician and astronomer, was born at Oxford in the year 1560. He took his degree of Bachelor of Arts in 1579, and in 1584 he accompanied Sir Walter Raleigh in his expedition to Virginia, where he was employed in surveying and mapping the country, and upon his return to England in 1588 he published his 'Report of the Newfoundland of Virginia, the commodities there found to be raised, &c.' Harriot was introduced by Sir Walter Raleigh to the earl of Northumberland, whose zeal for the promotion of science had led him to maintain several learned men of the day, such as Robert Hues, Walter Warner, and Nathaniel Tarporley. This enlightened nobleman received Harriot into his house, and settled on him an annual salary of 300*l.*, which he enjoyed to the time of his death, in July, 1621. His body was interred in St. Christopher's Church, London, and a monument erected to his memory, which, with the church itself, was destroyed by the great fire of 1666. During his lifetime Harriot was known to the world merely as an eminent algebraist; but from a paper by Zach in the 'Astronomical Ephemeris' of the Royal Academy of Sciences at Berlin for the year 1788, it appears that he was equally deserving of eminence as an astronomer. The paper referred to contains an account of the manuscripts found by Zach at the seat of the earl of Egremont, to whom they had descended from the earl of Northumberland. From it we learn that Harriot carried on a correspondence with Kepler concerning the rainbow; that he had discovered the solar spots prior to any mention having been made of them by Galileo, Scheiner, or Phrysius: also that the satellites of Jupiter were observed by him January 16, 1610, although their first discovery is generally attributed to Galileo, who states that he had observed them on the 7th of that month. A correspondence with Kepler on various optical and other subjects is printed among the letters of Kepler. Ten years after Harriot's death his algebra, entitled 'Artis Analyticæ Praxis, ad Æquationes Algebraicas nova, expedita, et Generali Methoda, resolvendas,' was published by his friend Walter Warner. It is with reference to this particular work that Des Cartes was accused of plagiarism by Wallis, whose admiration of its author was so high, that he could not even see the discoveries of Vieta anywhere but in the 'Praxis' of Harriot. This charge however has sunk with time, though the French writers still continue to answer it. The geometry of Des Cartes appeared in 1637, six years after the publication of Harriot's algebra. (Hutton's *Dictionary; Mathematical Tracts*, vol. ii., &c.; and Montucla's *Histoire des Mathématiques*, tom. ii., p. 105.)

HARRIS, JOHN, D.D., born about 1667, died Sept. 7, 1719, a voluminous writer, in the list of whose works we find numbers of sermons, treatises on algebra and fluxions, geometry, trigonometry, astronomy, and navigation. He also wrote, 'Remarks on some late papers relating to the Universal Deluge and the Nat. Hist. of the Earth;' 'Navigantium atq. Itinerantium Bibliotheca, or a complete collection of Voyages and Travels,' &c., 1705, 2 vols. fol., reprinted with additions and corrections in 1744 and 1764; 'Lexicon Technologicum, or an Universal English Dictionary of the Arts and Sciences, explaining not only the terms of Arts, but the Arts themselves,' 2 vols. fol., 1704-10. From this, says Watt, 'have originated all the other dictionaries of arts and science and cyclopædias that have since appeared;' and it is as the originator of this important and useful class of works that his memory best deserves to be preserved. [DICTIONARY.] 'History of Kent,' 2 vols. fol., 1719. Harris was secretary and vice-president of the Royal Society, and possessed considerable church preferment, but was reduced to poverty by neglect of his affairs. He died in want, and was buried at the expense of his friends.

HARRIS, JAMES, born July 20, 1709, was the eldest son of James Harris, Esq., of Salisbury, by the Lady Eliz. Ashley Cooper, sister of Lord Shaftesbury, the author of the 'Characteristics.' He was educated at the grammar-school in his native place, and passed thence to Wadham College, Oxford. In his twenty-fifth year he lost his father, and thereby became independent in fortune, and able to devote his time to studies more congenial to his taste than the law, in which he had been engaged. For fourteen years of his life he did little else than study the Greek and Latin authors with the greatest diligence, and his works show how deeply imbued he was with their spirit. In 1745 he married the daughter of John Clarke, Esq., of Sandford, near Bridgewater, by whom he had five children. In 1761 he was returned for Christchurch, which seat he retained till his death. In 1762 he was appointed to the post of a lord of the Admiralty, and next year to that of a lord of the Treasury, which he held for two years, when his party went out of office. In 1774 he became secretary and comptroller to the queen. He died in 1780.

Harris is best known by his 'Hermes, or a Philosophical Inquiry concerning Language and Universal Grammar,' a work which Lowth characterized as one of the most beautiful pieces of analysis which had appeared since the days of Aristotle. He begins by defining grammar, and giving Bacon's distinction between literary and philosophical or universal grammar, turns directly to the latter, which he proposes to treat in two ways; first, by dividing speech into its constituent parts; and secondly, by resolving it into its matter and form. In pursuing the former inquiry he determines speech to consist of sentences, and these sentences to be resolvable into two grand classes, those which refer to our perceptions, and those which refer to our will; the first including all forms of assertion, the other all forms of command. A sentence he defines, with Aristotle, to be 'a compound quantity of sound significant of which certain parts are themselves also significant, and these parts or words to be 'sounds significant of which no part is of itself significant.' Giving instances of words, he says that in the sentence '*the sun shineth*,' the words *sun* and *shineth* have each a meaning; but that there is 'certainly no meaning in any of their parts, neither in the syllables of the one, nor in the letters of the other.'

Going next to words, he divides them into those significant by themselves, and those significant by relation. The former class, he observes, are significant either of substances or of attributes; the latter from being associated either with one word or with more. Hence he arrives at four species of words, substantives, attributives, definitives, and connectives, which he further explains by giving them the better-known names of noun, verb, article, and conjunction. Substantives he divides into primary and secondary, or nouns and pronouns; the first of which denote things general, special, or particular. On arriving at attributives, which include adjectives, verbs, and participles, he finds it necessary to qualify his assertion that there is no meaning in the parts of words, which he does by saying that the verb *is* becomes a latent part in every other verb, so that *riseth* means *is rising*, and *writeth*, *is writing*. The contemplation of the verb brings him to a discussion of the nature of time, in which he stops just short of the conclusion that it only exists in the mind, but does not quite arrive at it. His argument in this, as well as in many other parts of his book, is taken nearly word for word from Aristotle. In the matter of tenses his exposition is very intelligible, founded on the distinction between absolute and relative time; but when we get to number and person, all he tells us is that they are '*supposed* affections of the verb,' of which 'the most that can be said is that verbs, in the more elegant languages, are provided with certain terminations, which respect the number and person of every substantive, that we may know with more precision, in a complex sentence, each particular substance, with its attendant verbal attributes.' As verbs consist of an attribute, time, and an assertion, by abstracting the last we get a participle, and by abstracting the two last an adjective. Furthermore we have attributives of attributives, or adverbs, which concludes the subject of attributes.

Definitions, or articles, cost him very little trouble, and he passes thence to connectives, or conjunctions and prepositions. What he says on this subject is not so satisfactory as might be wished, as, in defining a conjunction to be a part of speech void of signification itself, but so formed as to help signification, he makes an assertion very hard to understand under any known meaning of the words in which it is couched. This brings us to the end of the second book. The third treats of the matter or sound, and the form or meaning of language, and under the latter head he defines a word to be 'a voice articulate and significant by compact:' under which definition we are at a loss to know, first, how it can include those words which he has before asserted to be without signification; and secondly, by what communication that compact was instituted through which we now derive our only channel of communication.

Having now got through the subject-matter of his essay, he concludes it by a rapid glance at the genius of different languages; and in his admiration of the Greek, what scholar is there who will not go along with him?

The real merit of this work of Harris is perhaps best expressed in the following few words from the first sentence of his sensible preface: 'The chief end proposed by the author of this treatise in making it public has been to excite his readers to curiosity and inquiry.' A careful perusal of the treatise cannot fail to make a man think more accurately, though he may, as he ought to do, reject some of the writer's premises.

Harris's 'Hermes' was published in 1751. Some years before, he had written three treatises, on Art, on Music, Painting, and Poetry, and on Happiness; and in 1775 he published his 'Philosophical Arrangements,' a part of a large work on tho Aristotelian Logic. His last work is called 'Philological Enquiries;' it does not however answer to its title, as it is in fact a history of literature subjoined to dissertations on criticism. It is considerably interlarded with quotations from the authors of antiquity, but not nearly to such an extent as his other works.

His private character appears to have been excellent, and his son's admiration for him proves that his moral nature was so perfect as to secure the respect of those who had the best possible opportunity of judging it. It rarely happens, let a man deceive the world ever so completely, that he succeeds in deceiving his own children.

HARRISON. [HOLINSHED.]

HARRISON, JOHN, was born at Faulby, near Pontefract, in Yorkshire, in the year 1693. He was the son of a carpenter, which profession he also followed during several years. In 1700 the family removed to Barrow, in Lincolnshire. Harrison early displayed an attachment to mechanical pursuits, and his attention was particularly directed to the improvement of clocks. After many failures and many minor improvements, he at length succeeded in constructing a pendulum, the excellence of which depended on the different degrees in which metals are expanded or contracted by variations of temperature. This important principle is now employed in the construction of the balance-wheels of chronometers, and is that on which the accuracy of those timekeepers mainly depends. [CHRONOMETER.]

In the year 1714 an act was passed offering a reward of 10,000*l*., 15,000*l*., and 20,000*l*. respectively, for a method of ascertaining the longitude within 60, 40, or 30 miles. In 1735 Harrison came up to London with a timepiece which he had constructed. Having obtained certificates of its excellence from Halley, Graham, and others, he was allowed, in 1736, to proceed with it to Lisbon in a king's ship, and was enabled to correct the reckoning a degree and a half. On this the commissioners under the act gave him 500*l*. to enable him to proceed with his improvements. After constructing two other timepieces, he at last made a third, which he considered sufficiently correct to entitle him to claim a trial of it, and the commissioners accordingly, in 1761, sent out his son William in a king's ship to Jamaica. On his arrival at Port Royal, the watch was found to be wrong only $5\frac{1}{10}$ seconds; and on his return to Portsmouth, in 1762, only 1 minute $54\frac{1}{2}$ seconds. This was sufficient to determine the longitude within 18 miles, and Harrison accordingly claimed the reward. After another voyage to Jamaica and some further trials, an act was passed, in 1765, which awarded the 20,000*l*. to Harrison, one-half to be paid on his explaining the principle of its construction, the other half as soon as it was ascertained that the instrument could be made by others. After some delays and disputes, Harrison, in 1767, received the whole sum of 20,000*l*.

Next to the principle of the different expansibility of metals, which is applicable both to the pendulums of clocks and the balance-wheels of watches, the most important of the many inventions and improvements which in the course of fifty years he introduced, is perhaps that of the *going fusee*, by which a watch can be wound up without interrupting its movement.

He died at his house in Red Lion-square in 1776, in his 83rd year. His phraseology is said to have been uncouth. On mechanics and subjects connected with that science he could converse with considerable clearness; but he found great difficulty in expressing his sentiments in writing, as is evident in his 'Description concerning such Mechanism as will afford a nice or true Mensuration of Time.' In the last volume of the *Biographia Britannica*, published in 1766, there is a memoir of Harrison drawn up from materials furnished by himself. See also Hutton's *Mathemat. Dict.* and the *Gallery of Portraits*, vol. v., p. 153.

HARROW. [MIDDLESEX.]

HARROWGATE. [YORKSHIRE.]

HARRY, BLIND, as he was commonly called, or *Henry the Minstrel*, lived towards the close of the fifteenth century. Major, the Scottish historian, remembered him to have been alive in his own boyhood, and he was born about the year 1470, according to Warton. The work for which Blind Harry is celebrated is a poem on the adventures of Wallace. It is in eleven books, in the heroic metre. Readers of Walter Scott will remember a note to one of his poems where he relates from Blind Harry the account of Wallace's meeting with Fawdoun in the 'Gask Hall.' There are many other very spirited descriptions in the poem, particularly those of fighting and war. Blind Harry is chiefly remarkable as affording a modern and true parallel to the account, true or false, which we have of Homer. (Warton, vol. i.; *The Bruce and Wallace*, by Jameson, preface passim.)

HARTE, WALTER, was educated at Marlborough school and Oxford. The dates of his birth and academic life are uncertain; he seems to have been born about 1700, and to have graduated as M.A. of St. Mary Hall, January 21, 1730, according to the Catalogue of Oxford Graduates. At an early age he became acquainted with Pope, whose style he imitated; and in return the great poet corrected his admirer's verses. With this advantage Harte published 'Poems on Several Occasions,' 1727; 'Essay on Satire,' 1730; 'Essay on Reason,' 1735, to which Pope is said to have contributed very considerably; 'Essay on Painting,' date unmentioned; 'The Amaranth,' 1767, his last work. As a poet however he is not distinguished from other once successful but now forgotten imitators; but he has made a valuable addition to our literature in his 'History of the Life of Gustavus Adolphus,' 2 vols. 4to., 1759; republished in 8vo., corrected and improved, in 1763. An affected, harsh, and pedantic style has done much to throw discredit and neglect on this laborious and able work. It is translated into German, with preface, notes, and corrections by J. Gottl. Böhme, and, if the translator has done his work well, will probably appear to most advantage in its foreign garb. Harte left unfinished, in MS., a 'History of the Thirty Years' War.' The account of his life is soon told. He took orders, acquired reputation as a preacher, was appointed Principal of St. Mary Hall, and through the interest of Lord Chesterfield, whose son's tutor he had been, canon of Windsor. He died at Bath in 1774. (*Biog. Univ.*)

HARTLEPOOL. [DURHAM.]

HARTLEY, DAVID, was born on the 30th of August, 1705, and was the son of a clergyman of Armley in Yorkshire. Having been first educated at a private school, he entered, at fifteen years of age, at Jesus College, Cambridge, and became in time a Fellow of that society. Scruples which would not allow him to subscribe the Thirty-nine Articles prevented him from afterwards entering the church, as had been originally intended: and he applied himself to the medical profession. In this profession he practised with success, and attained to considerable eminence.

He commenced the composition of the work by means of which he has become universally known, the 'Observations on Man, his Frame, his Duty, and his Expectations,' at the age of twenty-five. It had been the subject of his thoughts even previously to this. He tells the world in his Preface, that the fundamental idea of the work, the possibility of explaining all states of mind by association, was first suggested to him by Mr. Gay's admirable 'Essay on the Fundamental Principle of Virtue or Morality,' prefixed to Law's translation of Archbishop King's 'Origin of Evil.' Having been begun so early as 1730, the work was not finished until sixteen years after; and it was ultimately published in 1748. It had constantly occupied his thoughts during the best and most important period of his life; and when his labour was completed, and his work had been given to the world, he felt, as it were, that he had performed his part, and that he might now rest. He lived nine years after the publication of his work.

Dr. Hartley was twice married, and had children by both marriages. He practised medicine successively at Newark, Bury St. Edmunds, in London, and at Bath, where he died on the 25th of August, 1757, at the age of fifty-two years. Combining as he did with his profession the pursuit of learning, he enjoyed through life the friendship of many distinguished literary men of his time. Among these may be mentioned Bishops Law, Butler, Warburton, and Hoadley, Dr. Jortin, Young the poet, and Hooke the Roman historian. One of his children thus writes concerning the qualities of mind and heart which endeared Dr. Hartley to his private friends: 'His thoughts were not immersed in worldly pursuits or contentions, and therefore his life was not eventful or turbulent, but placid and undisturbed by passion or violent ambition. From his earliest youth his mental ambition was pre-occupied by pursuits of science. His hours of amusement were likewise bestowed upon objects of taste and sentiment. Music, poetry, and history were his favourite recreations. His imagination was fertile and correct, his language and expression fluent and forcible. His natural temper was gay, cheerful, and sociable. He was addicted to no vice in any part of his life, neither to pride, nor to sensuality, nor intemperance, nor ostentation, nor envy, nor to any sordid self-interest: but his heart was replete with every contrary virtue. The virtuous principles which are instilled in his works were the invariable and decided principles of his life and conduct.'

In an article like the present nothing more than the most general notion can be furnished of the character and object of Hartley's great metaphysical work. Its chief end and its great achievement is the application of the principle of association to all our states of mind, or, as he himself calls them not perhaps very happily, 'our intellectual pleasures and pains.' But before proceeding to set forth and apply the principle of association, he attempts to explain physically sensations and ideas, which he resolves into vibrations of the medullary substance. The first hints of this his doctrine of vibrations were derived, he tells us, from Sir Isaac Newton; but, while such speculations as these do not properly belong to the province of the psychologist, it is obvious that they can never rest upon any better foundation than conjecture. The commencement therefore of Hartley's work detracts from rather than enhances its value. But the doctrine of vibrations being dismissed, the principle of association, of which little more than hints had previously been given by Hobbes and Locke, is explained and applied by Hartley with a fulness and acuteness which will ever render the work valuable. The second part of the work is wholly occupied with natural and revealed religion.

HARTSHORN, the horn of the Cervus Elaphus, the common stag [Deer], which has a place in the pharmacopœia because it contains less earthy matter, and more gelatine, than other bones. It is kept in the form of shavings, of which a sufficient quantity boiled in water yields a jelly suitable to convalescents, which may be flavoured with lemon-juice or wine, &c.; but there is no proof that it is superior to jelly made from calves' feet. It is sometimes a useful addition to milk for young children, but it possesses no alkaline properties, and the further addition of a little lime-water is often necessary to fit it for irritable stomachs.

HARTSHORN, SPIRIT OF. [Ammonia, *Carbonates*.]

HARUN AL RASHID. [Abassides.]

HARUSPICES, a class of priests in antient Rome, whose principal duty was to inspect the entrails of the victims which had been sacrificed, and thereby to foretel future events. They also interpreted various phenomena, such as lightning, earthquakes, &c. (Cicero, *Cat.*, iii. 8.; *Div.*, i. 41.) This art, called *Haruspicina*, was derived from Etruria, where it is said to have been discovered by one Tages. (Cic., *Div.*, iii. 23.) The Romans used frequently to send their children to Etruria in order to be instructed in this art (Cic., *Div.*, i. 41); and Etrurian haruspices often practised their profession in Rome. The duties of the Haruspices in many respects resembled those of the Augurs; but they were not reckoned so important, and they never acquired that political influence which the Augurs possessed. (Augurs.) They were formed into a college or corporation at Rome, of which the chief was called 'Summus Haruspex,' or 'Magister Publicus.' Their art fell into disrepute amongst the well educated Romans in the later times of the republic. Cicero ridicules their pretensions of foretelling future events, and relates a tale of Cato, who used to say that he wondered how one haruspex could meet another without laughing. (Cic., *Div.*, ii. 24.) The Emperor Claudius wished to revive the study; and under his directions a decree of the senate was passed for that purpose (Tac., *Ann.*, xi. 15); but it probably produced little effect.

HARVEST is a most important period to the husbandman. When by his skill and industry the ground has been well prepared to receive the seed, and every circumstance has been favourable to the growth and ripening of his crops, he may be deprived of a great portion of his reward by an unseasonable time of harvest. Although the state of the weather is beyond his control, he may, by an attentive observation of the usual changes at particular periods of the year, anticipate its influence in any particular situation. The precautions which are necessary in a northern climate, where the fruits of the earth come late to maturity, would be superfluous in more southern latitudes. It is from the inhabitants of northern and mountainous countries that we are likely to learn the means of obviating the effects of an unfavourable season and a late harvest.

In those southern climates where the heat and want of moisture are not too great for the growth of corn, the only care of the farmer is to procure hands sufficient to reap it. The heat of the sun and air soon dry the straw, and harden the grain. A spot is levelled in the field, and the corn is threshed out immediately, either by the tread of cattle driven over it, or by the flails of numerous threshers. The corn is winnowed and stored in granaries; and the straw is reserved till winter, when it forms the chief fodder of horses and cattle. In these regions the harvest is a continued feast; no ungenial weather disappoints the hopes of the husbandman. But in northern climates, where the harvest is later, and cold rains and storms are frequent in autumn, the ingenuity is often taxed to save the corn from being entirely spoiled, after it has been severed from the ground; roomy barns are erected to secure it in the straw, till it can be threshed; and the joy of harvest is frequently interrupted by the anxiety which is the consequence of sudden changes of weather.

To lessen the casualties of harvest in a moist climate, the experienced husbandman endeavours to arrange the time of sowing each kind of grain, so as to insure its coming to maturity in a regular succession. Thus he has more time to attend to the precautions of which experience has taught him the utility; and if the duration of harvest is longer, there is less danger of all his crops being spoiled by a wet season.

It was long the custom through the whole of the north of Europe to store all the produce of the farm into barns, especially the corn; and it was thought that as soon as the sheaves were collected under a roof, all danger was past The increase of the produce raised on most lands by an improved system of agriculture gave rise to the practice of stacking corn in the open air, and securing it by a covering of thatch. It was soon found that the grain thus stored in the straw was better preserved than that which was in the barn; and the invention of stone, or cast-iron pillars, as supports for the frames on which the grain was stacked, not only secured it from the depredations of vermin, but kept it in a much drier state than when stacks were made on the ground. This was a great improvement; and now, in the best managed farms, the only barns required are those in which the corn is threshed; and if there is sufficient room to hold the contents of one stack of the usual dimensions, it is all that is absolutely required.

The want of room in the barns was probably one of the reasons why the reapers were permitted to cut the straw half-way between the ear and the root, leaving more than half the straw in the field. Another reason also was the profusion of weeds which grew amongst the corn, and which retarded its drying, by retaining the wet much longer than the ripe straw. It was thought also that the seeds of weeds were thus prevented from mixing with the grain in the threshing, and giving more trouble in the winnowing. The usual prohibition against selling any straw also made the farmers less careful to secure the whole. The stubble was mown after harvest, and formed into broad walls, called in some places *haulm-walls*, round the yards where the cattle were fed in winter, for the double purpose of fodder and shelter. But it is evident that this practice is defective; there can never be too much straw to be converted into manure by the dung and urine of cattle, and what is left as stubble is much wasted before it is mown and carried into the yard. The seeds of noxious plants remain on the land, whereas they would be much more effectually destroyed if they were stacked with the corn. The subsequent separation of them is a very trifling additional labour, where a winnowing machine is in use. It may therefore be admitted as a general rule in reaping, to cut the straw as near to the ground as possible: this is best done by an instrument called a *cradle scythe*, which mows the straw, and collects it so as to be readily gathered into sheaves.

The Hainault scythe has a very short handle, and is used with one hand, while the other collects the straw into a sheaf by means of a large hook at the end of a wooden rod. It is a most useful instrument, and greatly preferable to the fagging-hook in use in Middlesex and the neighbouring counties, where straw is valuable and sells at a high price. It cuts more straw at each stroke, and is less fatiguing to the reaper, because his position is nearly upright when he uses it. In many places it is not usual to tie up any corn into sheaves, except rye, wheat, and beans. Barley and oats are usually mown, raked into heaps, and carried into the stack or barn when dry, like hay; but this is a slovenly practice, which should not be recommended. With good tillage and proper manuring the straw of barley and oats will be strong, and of sufficient length to require being tied up into sheaves; and much less of the grain is shaken out and lost in this way than by the usual method.

In rainy seasons it frequently happens that the sheaves remain a long time in the field before they are sufficiently dry to be carried and stacked. If the ears are not secured from the wet they become soaked, and the grain sprouts in the ear. This is a great loss; for sprouted grain is very inferior, and can only be sold at a low price. A little attention will often prevent the bad effect of rains. In some places six or eight sheaves are set up in a circle, with the butt-ends diverging, so as to admit the air to circulate among them; a sheaf is opened by spreading out the ears, and is placed inverted over the ears which lean against each other, forming a truncated cone. Thus the butt-end of the top sheaf is the only part in which the rain can lodge; and the first sunshine will soon dry this: the rain runs off the sides of the inverted sheaf, and the ears, pointing downwards, will not long retain the wet.

When the stack is building, the butts of the sheaves are placed outwards, and project gradually over the sides of the frame, and over one another, so as to build the stack in the form of a bowl, with a cone or pyramid over it, according as the frame is round or square; this is carefully thatched with straw, and the outer surface is cut smooth by means of shears. This not only saves all the ears which chance to lie outwards, and which would have become the prey of birds, but it also prevents the rain from beating into the stack and injuring the corn. It may then be considered as safe.

Where there are no raised frames, and the stack is built on the ground, or on a bottom made of faggots to keep it dry, a belt of plastering or stucco is sometimes laid, a foot wide, round the stack, about 18 inches from the ground, after the surface has been cut quite smooth and even. This contrivance is intended to prevent the rats from lodging in the stack, and it is very effective. A frame made entirely of iron, and supported upon iron columns, has lately been invented. It may be readily taken to pieces and put together again when it is wanted. The advantage of it is, that it is cheaper and more easily moved than any other; and it is very convenient for a temporary purpose.

Harvest is proverbially a joyous time, and one when hospitality is practised with more good-will than at any other season. The custom of giving a supper to the harvest men and women, when the last corn is carried, has been observed from time immemorial; and it is much to be regretted that in many farms it is now omitted, or a mere gratuity is given instead. The community of good feelings which ought ever to exist between the master and his servants or labourers, is most effectually kept up by occasional friendly intercourse; and a harvest-home supper was formerly a kind of Saturnalia in which every exuberance of spirit was allowed without fear of offence. The anticipation of it was an incitement to exertions in the field; and the farmer was amply repaid the expense which the feast occasioned. The stimulus of strong beer is still applied at harvest, and frequently to such a degree as to defeat its own object. In some places the labourers have a certain sum in addition to food *to finish* the harvest, whether it is a longer or shorter time. In others they have the usual weekly wages, and a gratuity at the end, with plenty of beer so long as it lasts: accordingly as labourers are abundant or not, the price is less or greater. Many thousands of Irishmen come over to England and Scotland in the time of harvest, and are of great use in finishing it in a short time.

HARVEY, WILLIAM, was born at Folkstone on the 1st of April, 1578, and after having been some years at the grammar-school of Canterbury, was admitted at Caius College, Cambridge, in the year 1593, being then in his sixteenth year. Having devoted himself to the study of logic and natural philosophy for six years in that university, he removed to Padua, at that time a celebrated school of medicine, where he attended the lectures of Fabricius ab Aquapendente on anatomy, of Minadous on pharmacy, and of Casserius on surgery. He was admitted doctor of medicine there, and returned home at the age of twenty-four. At thirty he was elected fellow of the College of Physicians, and shortly after appointed physician to St. Bartholomew's Hospital. On the 4th of August, 1615, he was chosen by the College to deliver the Lumleian lectures on anatomy and surgery, and upon this occasion he is supposed to have first brought forward his views upon the circulation of the blood, which he afterwards more fully established, and published in 1628.

The importance of this great discovery was such, that it will be necessary to investigate from the writings of the author the steps by which it was attained. We are informed by Boyle in his 'Treatise on Final Causes,' that in the only conversation which he ever had with Harvey, he was told by him that the idea of the circulation was suggested to him by the consideration of the obvious use of the valves of the veins, which are so constructed as to impede the course of the blood from the heart through those vessels, while they permit it to pass through them to the heart. Before the time of Harvey the opinions on the circulation were numerous and inconsistent. The blood was supposed to be distributed to the various parts of the body by means of the veins, and that intended for the nutrition of the lungs by the action of the right side of the heart. According to the same doctrines the arteries were destined for the conveyance of the vital spirits, which were formed in the left side of the heart from the air and blood derived from the lungs. These vital spirits were supposed to be taken in by the arteries during their diastole, and distributed by them during their systole, whilst the vapours or fuligines, as they are called by Harvey, were returned to the lungs by the action of the left ventricle. Opinions did not agree upon the mode in which the blood found its way to the left side of the heart, for whilst some supposed that it was conveyed with the air from the lungs, others maintained that it transuded by certain imaginary pores in the septum between the ventricles. These opinions, it is evident, rested more upon imagination than any careful observation of facts. Those of Harvey, on the contrary, were drawn from the most accurate dissections of dead and living animals, and supported by arguments depending entirely upon the anatomical structure and obvious uses of the parts. The result of these observations is thus stated by him. The heart has periods of action and of rest, but in warm-blooded animals its motions are so rapid, that the different steps of them cannot be distinguished. In cold-blooded animals they are more slow, and in warm-blooded also after the examination of its action, by opening the chest in a living animal, has been continued some time. During its action the heart is raised, and its point tilted forward so as to strike against the parietes of the chest. It contracts in every direction, but more especially on its sides; it also becomes harder, as other muscles do during their contraction. In fishes and cold-blooded animals the heart may be observed to become paler during its systole, and assume a darker colour during its diastole. If a wound be made in the ventricle, the blood is ejected from it during its contraction From these facts Harvey concluded that the essential action of the heart is its systole, and not its diastole, as was supposed by physicians before his time, and that the result of this contraction is the expulsion of the blood into the pulmonary artery and aorta. The diastole of the arteries or pulse is synchronous with and caused by the propulsion of the blood during the systole of the ventricle, and is a passive, and not, as was previously supposed, an active operation of the vessels. If the motions of the heart be carefully observed for some minutes, it will be seen first that the two auricles contract simultaneously, and force the blood contained in them into the ventricles; and secondly, that the ventricles in their turn assume the same action, and propel most of the blood into the pulmonary artery and aorta, from which it is prevented from returning by the valves situated at the entrance of those vessels. The author next proceeds to describe the manner in which the blood passes from the right to the left side of the heart.

During fœtal life, says he, this is sufficiently evident. Part of the blood passes directly from the right to the left auricle through the foramen ovale, whilst the rest is conveyed into the right ventricle, and by its contraction forced into the pulmonary artery, and so through the ductus arteriosus into the descending aorta; for, as he observed, the lungs do not admit of its passage through them in the fœtus. In the adult a new condition is introduced, namely the function of the lungs, by which, as Harvey observed, the question was so much obscured that physicians were unable to give a correct explanation of the phenomena. However the consideration of the obvious use of the valves of the pulmonary artery had led Galen to maintain that a portion of the blood contained in that vessel passed through the lungs into the pulmonary veins, but this passage he supposed to depend more upon the action of the lungs themselves than of the heart. Harvey carried out this argument still further, and maintained from it that the whole of the blood which is propelled from the right side passes through the lungs to the left side of the heart. In like manner he showed that the blood is propelled from the left ventricle into the arteries and so distributed to all parts of the body. He next proceeded to give approximate calculations of the quantity of blood which passes from the veins through the heart in a given time. This he showed to be so much more than is required for the nutrition, or can be supplied to the veins by the absorption of alimentary substances, that the surplus must of necessity return through the various tissues of the body to the veins again. He then argued from the construction of the valves of the veins that the course of the blood in them must be from the smaller to the larger divisions, and thus to the heart again. These views he still further confirmed by reference to the now well-known effects of ligatures placed on a limb with different degrees of tightness. If the ligature be so placed as to compress the veins alone, they become swelled and tumid beyond the ligature, and quite empty between it and the heart, whilst the pulsations of the artery remain unaltered. If it be drawn a little tighter the pulsations of the artery cease beyond, but are felt more violent than usual just within the ligature.

Such is a brief abstract of the principal steps in this the greatest and most original discovery in physiology, which was so directly opposed to all the previous notions of physicians, that its author might well observe, 'Adeo nova sunt et inaudita ut non solum ex invidiâ quorundam metuam malum mihi, sed verear ne habeam inimicos omnes homines: tantum consuetudo aut semel imbibita doctrina altisque defixa radicibus quasi altera natura, apud omnes valet, et antiquitatis veneranda suspicio cogit.' This anticipation proved correct; for Harvey afterwards complained to one of his friends, that his practice fell off considerably after the publication of his treatise 'On the Circulation of the Blood,' and it is well known that the doctrine was not received by any physician who was more than 40 years old. His opinions were violently opposed by Primirosius, Parisanus, Riolanus (1645), and others. Parisanus was ably refuted by his friend Dr. George Ent, Fellow of the College of Physicians, and other advocates of Harvey's views appeared on the Continent. The only man who was honoured by a reply from Harvey himself was Riolanus, professor of anatomy in Paris, in answer to whom he published two letters. In 1652 Harvey had the satisfaction of seeing one of his early opponents, Plempius, professor at Louvain, declare himself a convert to his opinions, and by his example many more were induced to withdraw their opposition. In the whole of this controversy, says Sprengel (*Hist. of Med.*, sect. xii., c. 1), the discretion and rare modesty of Harvey afford the best model for naturalists and scientific writers. Harvey had been so much disgusted by the disputes in which he was involved on the publication of his views on the circulation of the blood, that he had determined to publish nothing more, and it was only at the earnest request of his friend Dr. Ent that he was induced to allow his 'Exercitationes de Generatione' to be printed. This work consists partly of a commentary upon the writings of Aristotle and Fabricus ab Aquapendente on the same subject, and partly of details of his own observations and experiments. The earlier 'Exercitationes' contain a description of the organs of generation in the common fowl, of the formation of the egg and its extrusion from the body, and of the use and nature of its various parts, as well as the changes which it undergoes during the process of incubation. He then proceeds to enter upon some discussions on the nature of the act of generation, and of the degree in which the male and female respectively contribute to its performance, in the course of which he examines the opinions of Aristotle upon this abstruse subject, and advances some of his own. The concluding treatises contain a description of the analogous processes in the deer.

Without venturing upon an abstract of the whole contents of these papers, we shall endeavour to give some idea of the knowledge possessed by Harvey, and especially of his own discoveries and additions to this most interesting branch of physiology. He described the organs of generation in the fowl: he observed that the vitellus or yolk is at first in vascular connection with the parent; that this connection is afterwards broken off, and that in its passage through the oviduct the layers of albumen are added, and that before its final extrusion from the body of the mother the hard shell was formed: he asserted that all these parts, even the shell itself, are formed from the same substance under the influence of the assimilative power of the egg itself, and are not mere secretions from the organs of the parent, as was previously supposed: he was the first to describe accurately the two layers of albumen, and to show that each is contained in its own proper membrane: he was aware that the shell is porous, and admits of the respiration of the chick through it: he described the chalazæ at each end of the egg, and showed that they exist in the unimpregnated as well as the impregnated egg; whereas it had been previously supposed, and especially by his master, Fabricius, that these parts represent the germ from which the future chick was to be formed. The greatest discovery however made by Harvey in this branch of physiology was the use and importance of the 'cicatricula,' which he showed to be the true germ in which all the future changes take place, and for the increase and nutrition of which all the other parts of the egg are destined. He showed that it is present before the yolk has left the ovary, and pointed out the error of Fabricius, who considered it the remains of the pedicle by which the vitellus was attached to the ovary: he was aware that eggs occasionally contain a double yolk, and asserted that twins are produced from such eggs, but that they do not survive. The fifteenth and seven following 'Exercitationes' contain a description of the changes which the egg undergoes from the first to the fourteenth day of incubation. He described minutely the changes which take place in the cicatricula at the end of the second day. These observations appear to have been quite original. 'At this time it attains the size of the finger-nail nearly; two and sometimes three concentric layers may be observed in it. The central one is the more transparent of the two. In the middle of it is a white speck, which from its appearance may be compared to a cataract in the centre of the pupil of the eye. During this day the central layer especially enlarges and entrenches upon the external one.' This description appears to accord with that of the 'area pellucida,' to which so much importance is attached by later writers on this subject. 'At the end of the third day a pulsating spot may be observed in the centre of the "cicatricula," which forms the rudiment of the future heart.' He observed that the pulsations may be called forth afresh, when languid or intermitted, by the employment of various stimuli: he showed that the liver is formed round the umbilical vein, but he does not seem to have been aware that the liver, as well as all the other glands whose ducts communicate with the intestinal canal, is a prolongation or growth from the intestinal sac: he described five umbilical vessels, of which three are veins and two arteries, one of the veins being distributed to the albumen, the other four vessels to the vitellus. The first-mentioned vein goes to the vena cava, the other two to the vena porta, just before it enters the liver. The arteries are branches of the common iliacs. On this point, though his observations are correct as far as they go, his knowledge fell short of that of later inquirers; for he does not appear to have had any very accurate acquaintance with the uses of the allantois. He was aware that the vitellus is drawn into the intestine of the chick shortly before hatching, and serves for its early nutriment; and in this relation he well compared it to the milk. This fact was known to Aristotle. He corrected the error of Fabricius, who supposed that the egg is chipped by the hen, and showed on the contrary that this process is performed by the chick itself.

His observations on the process of generation in mammalia were confined chiefly to the deer species, of which he was enabled to obtain numerons specimens by the liberality of Charles I., who allowed him to take them from the royal parks. He supposed conception to take place either in the uterus or its born. This view, as is now well known, is incorrect. His description of the vessels and of the placenta is of considerable value. 'The smaller divisions of the umbilical veins coalesce into two trunks, which go to the vena cava and porta. The two arteries arise from the branches of the descending aorta. These vessels arise from and pass to the cotyledons of the placenta. In like manner the maternal vessels are distributed to the same cotyledons. A layer of honey-like matter is interposed between the maternal and fœtal portion of the placenta; and it is by absorption from this substance that the nutrition of the fœtus is carried on, for there is no vascular connection between the mother and the fœtus.'

He noticed the late union of the lateral parts of the upper lip and assigned it as a cause of the frequency of hare-lip. He claims to have been the first to discover the connection between the bronchi and the abdominal cells in birds, and to show that in all birds, serpents, oviparous reptiles, quadrupeds, and fishes, kidneys and ureters exist, a fact unnoticed by Aristotle and all succeeding writers. This account is, we apprehend, sufficient to show the extent and importance of the discoveries of Harvey in this branch of physiology, and to make us withhold our assent to the assertion of Sprengel (sect. 12, ch. 6), that the Treatise *De Generatione* is unworthy of the discoverer of the circulation.

In 1623 Harvey was appointed physician extraordinary to James I., with a promise of succeeding on the first vacancy to the physicianship in ordinary, the duties of which he actually performed. He was afterwards physician to Charles I., and was in the habit of exhibiting to him and to the most enlightened persons of his court the motion of the heart and the other phenomena upon which his doctrines were founded. During the civil war he travelled with the king, and while staying for a short time in Oxford was made by him master of Merton College, and received the degree of Doctor of Medicine. He held the mastership however for only a few months, when Brent, who had been expelled by the king for favouring the parliamentary cause, was replaced by that party, which had now gained the ascendency. Soon after his house was plundered and burned by the same party, and unfortunately several unpublished works, of which we have only notices in his other writings, were destroyed. The latter years of his life were chiefly spent at his country-house at Lambeth, or at his brother's near Richmond. In 1654 he was elected president of the College of Physicians, but in consequence of his age and infirmities he was induced to decline that honourable office. But he testified his regard for the society by presenting them with his library, and conveying over to them, during his lifetime, a farm which had been left him by his father. He died on the 3rd of June, 1657, in the 80th year of his age, and was buried at Hempstead in Essex, where a monument was erected to his memory. The best edition of his works, which were written in correct and elegant Latin, is that published by the College of Physicians in 1 vol. 4to., in 1766, with an engraving by Hall from the portrait by Cornelius Jansen, in the college library. They consist of the 'Exercitatio de Motu Cordis et Sanguinis;' 'Exercitationes duæ Anatomicæ de Circulatione Sanguinis, ad J. Riolanum, Fil.;' 'Exercitationes de Generatione Animalium;' 'Anatomia Thomæ Parri;' and nine Letters to celebrated contemporaries on different anatomical subjects. Among the works destroyed were, 'Observationes de usu Lienis;' 'De Motu Locali;' 'Observationes Medicinales'—'De Amore Libidine et Coitu Animalium;' 'De Insectorum Generatione;' 'De Quantitate Sanguinis Singulis Cordis Pulsationibus Protrusâ;' and 'Tractatum Physiologicum.' Two other MS. works by him are preserved in the Library of the British Museum; one, 'De Musculis et Motu Animalium Locali;' the other, 'De Anatome Universali;' in the latter of which, bearing date April, 1616, the principal propositions of the doctrine of the circulation are contained.

(*Life*, prefixed to his Works; Sprengel's *History of Medicine.*)

HARWICH, a parliamentary and municipal borough and seaport town in the hundred of Tendring, and county of Essex, 71 miles north-east from London. On the east it is bounded by the sea, and on the north by the æstuaries of the Stour and Orwell. The town is of Saxon origin, and its name is derived from two Saxon words, *Here*, an army, and *Wic*, a fortification (Morant's *Essex*, vol. 1, p. 499), from which circumstance it is supposed that a Saxon army was always stationed here to oppose the descents of the piratical Danes. It was not a place of any importance till after the Norman conquest. In 1318 Edward II. made it a borough corporate, and several charters and letters-patent were granted by succeeding kings, but none of these, prior to that of James I., are now extant. Under the Municipal Corporation Act the council of the borough consists of a mayor, four aldermen, and twelve councillors. The revenue of the corporation, in 1831, arising from lands, port dues, and other property, amounted to 671*l.*, and its expenditure for the same year was 585*l.* The borough returns two members to parliament, a privilege which it had enjoyed previous to the time of Edward III., in whose reign it was discontinued, and was not restored till the commencement of that of James I. The town consists of three principal streets, is well paved, and lighted with gas. The church, dedicated to St. Nicholas, is a spacious structure of brick, with stone buttresses and steeple, and occupies the site of an antient chapel, founded, about the commencement of the 13th century, by Roger Bigod, earl of Norfolk. The living is a vicarage in the patronage of the crown, with an average net income of 221*l.* The inhabitants are chiefly employed in ship-building and other maritime occupations, but the trade of the town is in a declining state, which is partly attributed to the removal of the government packets. Within the last twenty years the number of vessels belonging to the port, and the custom-house receipts, have fallen off considerably. The harbour is deep and spacious, the anchorage good, and there is a lighthouse, erected upon a hill below the town for the safe guidance of vessels into port. The population in 1831 was 4297. There is a free grammar-school for the education of 32 boys, the children of residents. The master, who is always the vicar of the parish, receives a salary of 40*l.* per annum, besides being provided with a house rent-free. Immediately opposite to Harwich, and at the south-east extremity of the county of Suffolk, is situated Languard Fort, a fortification of considerable strength, erected in the reign of James I. for the defence of the harbour, the entrance to which it completely commands. (Morant's *Essex; Beauties of England and Wales; Parliamentary Papers*, &c.)

At Walton, near Harwich, the crag yielding many fossils may be seen resting on the London clay, a rare and important occurrence.

HARWOOD, EDWARD, a biblical and classical scholar of the last century, was born in Lancashire, in 1729 and educated as a dissenting minister. In that capacity, after going through various other employments, he accepted the charge of a congregation at Bristol, in 1765, which however, at the end of five years, he was obliged to quit, in consequence of reports (unfounded it is said) touching his religious opinions, which gave offence to his congregation, and also of a slur cast on his moral character. He then removed to London, devoted the rest of his life to private tuition and literary labour, and died in distress, Jan. 14, 1794. He used to say that he had written more books than any living author, except Dr. Priestley. (For the list, see Watt, *Bibl. Britann.*) His reputation as a scholar rests chiefly on his 'View of the various editions of the Greek and Roman Classics,' 1775, fourth and best edition 1790, 'a valuable little book, no doubt far from being perfect, but that can hardly be expected in a work of the kind.' (Watt.) It has been translated into German and Italian. His 'Biographia Classica, the Lives and Characters of the Greek and Roman Classics,' 1778, a new edition of an old book, with additional matter, is another useful work. Dr. Harwood also published an 'Introduction to the Study of the New Testament,' 1767; a New Translation of the New Testament, 1768; a new edition of the Greek Testament, with English Notes, 1776, &c. &c.

HASDRUBAL, the name of several Carthaginians.

1. Hasdrubal, the son-in-law of Hamilcar. [HAMILCAR.]

2. Hasdrubal, the son of Hamilcar and brother of Hannibal. [HANNIBAL.]

3. Hasdrubal, who commanded the Carthaginians in their last war against the Romans, B.C. 146.

HASLINGDEN. [LANCASHIRE.]

HASSE, ADOLPH, a composer of great celebrity during the early part and middle of the last century, was born at Bergedorf, near Hamburg, in 1705. When very young, he distinguished himself as a superior tenor singer, but soon left Germany for Italy, and became first the disciplo of Porpora, then of Alessandro Scarlatti. In 1725 he produced an opera, *Sesostrate*, at Naples, which was followed by others in different parts of Italy. In 1733 Hasse, being then in London, was engaged by the noblemen hostile to Handel to compose for the opposition Italian theatre, at which he brought out with success his *Artaserse*. He could however be persuaded to remain in London, the head-quarters of a cabal he did not approve, but went to Dresden, where he remained several years. It was there, in 1745, that Frederick of Prussia heard his *Armenio*, which so pleased that warlike, musical, and commonly parsimonious prince, that he sent the composer 1000 dollars and a diamond ring.

In 1760, at the bombardment of Dresden, Hasse lost all his property, including his valuable manuscripts, by fire. This was his first affliction. In 1763 he experienced a second, having been obliged, by changes made in tho court of Dresden, to leave that city, and proceed to Vienna. In that capital he wrote several operas. He finally retired to Venice, where he produced a grand *Te Deum*, which was performed before the pope in the church of Santo Giovanni. He died in 1783. Some years previous to his decease he composed a *Requiem* for his own funeral, which was duly applied to the intended purpose, and is a work affording evidence of his powers in an advanced period of life. Hasse is certainly entitled to be considered as one of the best composers of his day. Some of his productions, and among these his *Pellegrini* and two Litanies, are much admired by real unprejudiced judges, and are occasionally heard at that asylum for what is classical and rejected of fashion—the Antient Concerts. But it must be acknowledged that many of his operas have sunk into an oblivion by no means unmerited.

HASSELQUIST, FREDERIC, a Swedish naturalist, and pupil of Linnæus, was born at Törnvalla, in East Gothland, on the 3rd January, 1722, old style. His father, Andrew Hasselquist, a poor curate, having died young, without having made any provision for his family, his wife's brother, a clergyman of the name of Pontin, took charge of young Hasselquist's education, and placed him with his own children in the school of Linköping. After the death of his benefactor, Hasselquist was transferred to the university of Upsal, where he entered in 1741. He there acquired a taste for natural history, became a pupil of the great Linnæus, and was led very particularly to apply himself to the study of the properties of plants. An inaugural thesis, called 'Vires Plantarum,' which appeared in 1747, evinced him to be a young man of a strong original turn of mind, and worthy of his master. He showed how puerile were the notions at that time entertained regarding the medical properties of many plants, how much the whole of vegetable materia medica stood in need of reformation; and he pointed out a philosophical mode of investigating the facts connected with it, by insisting upon the old doctrine of 'liko forms, like virtues.' This truth, which is one of the most important among those connected with the practical application of botany to useful purposes, had been so obscured by want of science in the age immediately preceding Linnæus, that it had ceased to be a point of belief, and was rather set down as a fanciful speculation of forgotten theorists. Hasselquist however maintained its accuracy, and with so much skill that he may be said to have established it upon a solid foundation, from which it could never afterwards be shaken. This, and his general proficiency in other branches of science, procured Hasselquist some of the royal stipends provided for travelling students, and he was thus eventually enabled to carry into execution a favourite project of visiting tho Holy Land for the laudable purpose of investigating its natural history. Having sailed from Stockholm in August, 1747, he proceeded to Smyrna, thence to Egypt, and afterwards to the Holy Land. His constitution sunk however under the exertions of his enterprising spirit, and he died at Smyrna, on his return homewards, on the 9th February, 1752, in the 31st year of his age. The result of his investigations of these, at that time little known, countrics, was given to the world by Linnæus in the year 1757, under the name of 'Iter Palæstinum.' Like most travellers' books of that age, this work showed that the author had combined with energy and industry great attainments in the sciences of his day. It is rich in observations upon the quadrupeds, birds, reptiles, fishes, insects, mollusca, plants, minerals, and materia medica of the countries he visited, and is to this day a standard work of reference. His science was not the flimsy, superficial, and unintelligible gossip of most modern travellers, but the sound matter-of-fact, precise, and definite information of which use may be made so long as science endures, whatever changes it may undergo in its forms. His name is perpetuated in botany by having been given to a curious genus of Egyptian Apiaceæ.

HASSELT. [LIMBURG.]

HASTINGS, a parliamentary borough and the chief town of the rape to which it gives name, is situated in the hundred of Guestling and county of Sussex, 64 miles south-east from London. Hastings is a town of considerable antiquity, but nothing is known with certainty respecting its origin, or whence it derived its present name. Dallaway, in his 'History of Western Sussex,' says, 'In 893 the Danes, in 250 ships, commanded by the pirate Hastinges, landed at the mouth of the river Rother, near Romney Marsh, and immediately possessed themselves of Apuldore, where and at Hastings (so called from thoir leader) they constructed forts and ravaged all the coast to the westward of the country,' but it is probable that the town had an earlier origin, as in the reign of Athelstane, A.D. 924, it was a place of sufficient importance to havo a mint. Edward the Confessor granted it a charter, and several other kings did the same down to James II., but the governing charter is that of Queen Elizabeth, dated 1588, and subsequently confirmed and enlarged by Charles II. The borough council consists of a mayor, six aldermen, and eighteen councillors, and the style of the corporation is the 'Mayor, Jurats, and Commonalty of the town and port of Hastings in the county of Sussex.' (5 and 6 Will. IV., cap. 76.) Hastings has returned two members to parliament since the reign of Edward III. It is one of the Cinque-ports, and is next in importance to Dover, the chief of those antient communities. [CINQUE-PORTS.] The town is pleasantly situated on the sea-coast, in a hollow, sheltered on every side, except the south, by lofty hills, and has of late years been much resorted to during the bathing season. It consists principally of two streets, running nearly north and south, and separated by a small stream called the Bourne, which runs into the sea. To the westward of the town, upon a lofty cliff, are the ruins of an antient fortress, supposed to have been erected prior to the Norman conquest. The town-hall, recently rebuilt, is a handsome structure, supported on arches, with a market-place beneath it; but the gaol is small and inconvenient. There are five principal hotels, which are said to be generally well conducted. The places of amusement and public resort are numerous, and comprise the theatre, marine parade, Royal Pelham Arcade, &c., besides subscription libraries. Tho inhabitants are chiefly employed in the coasting trade and fisheries, but a considerable number are engaged in boat-building and in the making of lime. The kilns are situated to the west of the town, and produce on an average 120,000 bushels a year. Hastings is in the diocese of Chichester. There are two churches, both very antient edifices, dedicated to All Saints and St. Clement. Tho living is a rectory, with an average net income of 300*l.* The port is divided into eight parishes, the aggregate population of which, in 1831, was 10,097. There is a school for the education of boys, founded and endowed by the Rev. William Parker in 1619, and another founded and endowed by James Saunders, Esq., in 1708. The average yearly income of Parker's charity is about 210*l.*, that of Saunders's is about 240*l.*

About a mile to the west of Hastings is situated the new and well built town of St. Leonard's. The principal range of buildings extends along the coast, about three-fourths of a mile in length, and is fronted by a very beautiful esplanade. As the town was only commenced in 1828, the public buildings are not yet very numerous. There is however abundant accommodation for visitors, and the three principal hotels are erected upon a very splendid scale.

(Allen's *History of Sussex*, 8vo., 1830; Dallaway's *History of Western Sussex*, 4to., 1830; *Parliamentary Papers*, &c.)

HASTINGS SANDS. The middle group of the Wealden formation, which constitutes the uppermost part of the oolitic system in England, is thus named from its characteristic development around Hastings in Sussex. In the Hastings sands we may distinguish four divisions, which lie in the following order:—

The Horsham beds.	Fawn-coloured sand and friable sandstone: good flagstone occurs here.
The Tilgate beds.	Sandstones often calcareous, with various grits and conglomerates, resting on blue clay. These have yielded a considerable number of organic remains, plants, mollusca, fishes, and reptiles of gigantic dimensions. [IGUANODON and HYLÆOSAURUS.]
"	White sand and friable sandstone, alternating with clay.
The Ashburnham beds.	Nodules and beds of limestone, alternating with clays and sandstones.

The axis of elevation or forest ridge of the Weald of Kent and Sussex is chiefly formed of Hastings sands, which rise in Crowborough Beacon to 804 feet above the sea. [GEOLOGY.] (Mantell's *Tilgate Forest;* Fitton's *Geology of Hastings*, &c.)

HASTINGS, WARREN, a memorable name in the history of British India, was born in the rank of middle life in 1733, and after receiving the usual education at Westminster School, went out in 1750 as a writer in the service of the East India Company. His first advancement was due to his own industry and discernment, which led him to master tho Persian and Hindustanee languages, a study at that time almost universally neglected; and he was therefore chosen for more than one useful and honourable employment, commercial and diplomatic, in the interior. After residing about fourteen years in India, he returned home with a moderate fortune, intending apparently to pass the remainder of his life in tranquillity. In 1769 however he unexpectedly received the appointment of second in council at Madras, and in 1772 was appointed to the highest office in the Company's service, that of President of the Supreme Council of Bengal. His powers were enlarged by the alteration of the Indian constitution by act of parliament, in virtue of which he became, January 1, 1774, governor-general and supreme head of all our Indian dependencies. Affairs were at this time in great disorder. The territories of the Company had been greatly extended by the conquests of Clive and his successors; but their dominion, authority, and influence were still unconsolidated, and were exposed during the government of Mr. Hastings to great danger from the inveterate enmity of Hyder Ali, rajah of Mysore, supported by the Mahrattas, and others of the native powers. That he did many things under the pressure of circumstances, which nothing but expedience could justify, is hardly denied by his defenders or himself: indeed it seems to have been part of his defence, that Indian statesmen were not to be bound or judged by European rules of justice and morality. Right or wrong, he weathered the dangers to which the British Empire in India was exposed; and if he left the provinces under his charge wasted and depopulated, the increased revenue more than counterbalanced by the increased debt, he also left the power of our enemies broken, our own consolidated, and an easier task to his successors than fell to his own share. Notwithstanding his services, he gave satisfaction neither to the home administration nor to the Court of Directors. The public ear was offended by rumours of cruelty, corruption, and unjust aggression; the directors censured the lavish and corrupt expenditure, and the presumptuous independence of his conduct. Repeated attempts were made to obtain his dismissal, but those were uniformly defeated by the Court of Proprietors. Thus supported, he carried matters with a high hand; neglected or positively refused to obey the orders sent by the Directors; overruled tho opposition of the Council, of which a majority was, in the first instance, opposed to his views [FRANCIS, SIR PHILIP]; and practically exercised an absolute and irresponsible power until February, 1785, when he resigned his office and set sail for England, well aware that a storm awaited his arrival.

As soon as Mr. Hastings had arrived, Mr. Burke intimated his resolution of instituting an inquiry into the late Governor-General's conduct. Proceedings however were not commenced until the session of 1786, in the course of which articles of impeachment were brought forward by Mr. Burke, charging him with numerous acts of injustice and oppression committed against native princes and people dependents or allies of the Company; with the impoverishment and desolation of the British dominions; with the corrupt and illegal reception of presents himself; with the corrupt exertion of his great influence by conniving at unfair contracts, and granting inordinate salaries, and with enormous extravagance and bribery, intended to enrich his dependents and favourites. The several accusations were finally confined to four heads:—the oppression and final expulsion of the rajah of Benares; the maltreatment and robbery of the Begums (or princesses) of the house of Oude; and the charges of receiving presents and conniving at unfair contracts and extravagant expenditure. The sessions of 1786-7 having been consumed in preliminary proceedings, the House of Lords assembled in Westminster Hall, February 13th, 1788, to try the impeachment, and on the 15th, the preliminary forms having been gone through, Mr. Burke, in the name of the Commons of England, opened the charges against the prisoner in a comprehensive, elaborate, and most eloquent speech [BURKE], which lasted upwards of three days. He was assisted in the management of this most arduous cause by Fox, Sheridan, Grey, and others. The sessions of 1788, 1789, and 1790 were consumed in going through the caso for the prosecution. In 1791 the Commons expressed their willingness to abandon some part of the charges, with the view of bringing this extraordinary trial sooner to an end; and on the 2nd of June, the seventy-third day, Mr. Hastings began his defence. This was protracted until April 17, 1795, on which (the 148th) day he was acquitted by a large majority on every separate article charged against him.

There seems no doubt but that public opinion changed greatly during the trial; and that Mr. Hastings came to be regarded as an oppressed, instead of an offending man. This feeling was probably caused in a great measuro by the suspicious appearance of so great a delay of justice, and the skilful manner in which Mr. Hastings and his counsel threw all the blame on the managers of the prosecution, when in truth the smallest share of it seems to have belonged to them The extreme violence of their invective was perhaps calculated to hurt their cause, and the upper ranks, more especially the powerful interest connected with India, were disposed to look jealously at so close a scrutiny into the conduct and gains of an official man.

Mr. Hastings attempted to refute the oharges of extortion by publicly asserting in the most solemn manner, that never at any time of his life was he worth 100,000*l.* The law-charges of his defence amounted to 76,080*l.* In March, 1796, the Company granted him an annuity of 4000*l.* for twenty-eight years and a half, and lent him 50,000*l.* for eighteen years, free of interest. He retired completely from public life, to an estate which he purchased at Daylesford, in Worcestershire, formerly in the possession of his family. Ho died August 22nd, 1818, having been raised to the dignity of privy-counsellor not long before.

On his real character as a man and a statesman it is somewhat hard to decide. That his talents and his services were alike ominent, is admitted; that the means which he used were often most culpable, appears to be equally certain. His apology is to be found in the necessities of his situation, in the general neglect of justice in our dealings with the Asiatic princes, and in the notorious laxity of Anglo-Indian morality, where making a fortune was concerned, in those days. Mr. Mill, after exhibiting without reserve or favour the errors and vices of Mr. Hastings' administration, thinks it necessary to recommend him to the favourable construction of the reader, on the ground that he 'was placed in difficulties and acted on by temptations, such as few public men have been called on to overcome:' and adds, 'It is my firm conviction that if we had the advantage of viewing the conduct of other men, who have been as much engaged in the conduct of public affairs, as completely naked and stripped of all its disguises as his, few of them would be found whose charaoter would present a higher claim to indulgence; in some respects, I think, even to applause. In point of ability he is beyond all question the most eminent of the chief rulers whom the Company have ever employed; nor is there any one of them who would not havo succumbed under the difficulties which, if he did not ovorcome, he at any rato sustained.

He had no genius, any more than Clive, for schemes of policy, including large views of the past and large anticipations of the future; but he was hardly ever excelled in the skill of applying temporary expedients to temporary difficulties; in putting off the evil day, and in giving a fair complexion to the present one. He had not the forward and imposing audacity of Clive; but he had a calm firmness, which usually by its constancy wore out all resistance. He was the first, or among the first, of the servants of the Company who attempted to acquire any language of the natives, and who set on foot those liberal inquiries into the literature and institutions of the Hindoos, which have led to the satisfactory knowledge of the present day. He had that great art of a ruler, which consists in attaching to the governor those who are governed; aud most assuredly his administration was popular, both with his countrymen and the natives in Bengal.' (Book v., ch. 8.)

We have thought it fair to give at length the testimony of Mr. Mill, who has dissected the events of Hastings' government with an unsparing hand. At the same time, assuming Mr. Mill's representations of particular events and his strictures on them to be just, we feel bound to dissent from the meed of comparative praise conveyed in this passage, and believe that most persons, on perusing the fifth book of the 'History of British India,' will do the same. (Mill's *British India; Obituary*, for 1819.)

HAT. In every civilized community it has been the custom for men to wear a covering on their heads in the open air; and in Western Europe, and those countries which have been peopled from it, the form of covering employed since the fourteenth century has been that which we call a hat. The difference between a hat and a turban, the covering generally used throughout Asia and a part of Eastern Europe, is sufficiently marked. The distinction between a hat and a cap consists in the shape, as both may be made of the same materials. The hat has usually a cylindrical crown, or receptacle for the head, and a rim or brim encircling the base, and perpendicular to it, which brim does not form part of a cap; but this distinction is not sufficient, as hats such as those worn by naval and military officers, and those which until late years were employed in polished society, on occasions of ceremony, and known as cocked-hats, have not any brim, properly so called, but a part, of ample dimensions, answering to it, and turned up so as to be parallel with the crown.

Hats are made of straw, of silk, or of wool. Straw-hats are little used by men in this country. The material chiefly used in making them is wheat-straw plaited in strips and sewed together in the required form. Silk-hats are composed of a form made of chip or of felt, and covered with woven silk plush, or shag, fashioned to the required shape and drawn over the form. A considerable number of these hats are made for exportation to different places in the Mediterranean and to our Colonies. The greater part of the hats used in England are made of wool by felting, a process peculiar to that substance. There are three descriptions or qualities of hats made of wool, viz. beaver-hats, plate-hats, and felt-hats. Each of these has the body composed of felt: the first has a covering or nap of beaver; the second, a nap of the fur of the musk-rat, or the nutria, or some other fur of small value; and the third kind is without a nap. It will be sufficient to describe the mode of making beaver-hats.

According to the general belief the art of felting was brought to Western Europe by the Crusaders, who found the tents of their enemies covered with that substance. Wool in the yolk, that is, with the natural grease, will not felt, and it is necessary to the process that it should be well scoured, when the fibres being brought together have a tendency to mat together. This tendency is so strong that it is not possible to spin woollen yarn without previously oiling the wool. Hats of the very finest quality are made with lamb's-wool imported from Spain or Saxony, and the fur of English rabbits. The nap is composed of the fur of the beaver and nutria and the down from the back of the English hare mixed together. To form the body of the hat the wool and rabbit's-fur are separately *bowed* in the manner employed for freeing cotton from its seeds. [COTTON.] The two substances are next bowed together until they are intimately mixed, after which the mass is spread evenly, covered with an oil-cloth and pressed, first gently and afterwards more strongly, by which means the fibres will become tangled or interlaced. A very loose and imperfect felt is thus produced. The next process is to cover the felt with a triangular piece of damp brown paper, and then to fold it in a damp cloth and work it well with the hand, pressing and bending, rolling and unrolling it, until the interlacing or felting is much more perfect, and the mass is compact. The felt thus prepared is next taken to the wide brim of a boiler charged with water and beer-grounds and a small quantity of sulphuric acid. In wine countries the lees of wine are substituted for beer-grounds. This mixture is kept near to the boiling point. The workmen having the palms of their hands protected by a covering of thick leather, lay the felt on the margin of the boiler, and then proceed to sprinkle it with the hot liquor and to work it about with the palms of their hands; by this means it shrinks and becomes more compact; it is then dipped into the boiler and worked, first with the hands, and next by the help of a rolling-pin, which admits of more force being used, and this process is continued until the felt no longer contracts.

The next process is that of stiffening. The substance employed for this purpose is shell-lac, a solution of which is applied by means of a brush to one side, and sometimes to both sides of the felt, after which it is stoved, and by this means the whole substance becomes duly impregnated with the resin. Shell-lac being insoluble in water, spirit of wine is usually employed as the solvent, but rectified naphtha made from coal-tar is sometimes substituted for it. The use of this resin is the greatest modern improvement in hat-making; the substance is thus rendered perfectly waterproof, and hats are not now, as formerly, spoiled by exposure to rain. The stiffening of hats was formerly composed of gum-arabic, or of glue, which are both soluble in water. To form the nap of a hat one half or three-fourths of an ounce of beaver, and some other less costly fur, are bowed together and imperfectly felted in the manner already described, and shaped the same as the body to which it is to be applied; that body is then softened by immersing it in the boiler, when the nap is applied and worked as in felting, until the required union is effected between the two bodies.

The felt thus covered is in the form of a cone, and must be brought to the cylindrical shape in which it is worn by means of a wooden block of the requisite form. This operation, which is called blocking, is performed by working it with the hand on the block to which it is tied. It is then dyed in a bath composed of water, logwood, sulphate of iron, verdigris, and gall-nuts, in which the hat is boiled during some hours; it is then drained and dried. After this it is softened by steam, the crown is strengthened by placed it in a disc of scale-board, and linen is pasted over this. The nap is raised and a uniform direction given to its fibres by means of warm irons and hair brushes. The last processes are binding and lining, when the hat is ready to be worn.

It is not possible to form any correct estimate of the extent of the hat manufacture in this country. The quantity and value of felt hats exported in the ten years, 1827 to 1836, were as follows:—

Years.	Dozens.	Value.	Years.	Dozens.	Value.
1827	75,497	£175,462	1832	55,458	£144,596
1828	83,114	197,581	1833	43,138	130,232
1829	81,182	189,469	1834	40,155	125,970
1830	77,061	209,849	1835	46,849	135,800
1831	62,854	170,188	1836	53,894	148,282

The great bulk of these shipments are made to our own colonies and dependencies. The exports so made in 1836 amounted to 45,019 dozens, valued at 112,228*l*.

A duty of 10*s*. 6*d*. each is imposed on the importation of hats of foreign make, which operates as a prohibition.

HATCHETINE. *Mineral Adipocire.* This substance occurs in thin flakes in the cavities of the ironstone of South Wales. It is very soft, somewhat granular in appearance; translucent; colour yellowish-white or greenish; not elastic; inodorous; combustible. It melts at 170°, and is soluble in æther.

According to Professor Johnston it consists of—

One atom of carbon	85·910
One atom of hydrogen	14·624
	100·534

HATFIELD. [ESSEX.]

HATHERLEIGH. [DEVONSHIRE.]

HATTERAS, CAPE. [CAROLINA, NORTH.]

HAUKAL, ABUL KASEM MOHAMMED IBN, a celebrated Arabic traveller and geographer. The few particulars we possess concerning his life are derived from his own work. From this we learn that he paid great attention to the study of geography from his earliest years, and collected all the books he could obtain which treated of foreign nations; that partly with a view to obtain farther information, and partly to avoid the tyranny of the reigning sultan, and to improve his own fortune by trade, he set out from Bagdad, A.H. 331 (A.D. 942-3), in order to visit foreign countries. He does not tell us into what countries he travelled: but we learn from his own account that he was in Mesopotamia A.H. 358 (A.D. 968-9); in Africa A.H. 360 (A.D. 970-1); in Sicily A.H. 362 (A.D. 972-3); and in Mecca A.H. 364 or 5 (A.D. 974-5 or 975-6).

Haukal's work on geography is entitled 'A book of Roads and Kingdoms.' He states in the preface that he composed the work to give a description of all the countries in which the Mohammedan religion prevailed, together with the revenues, natural productions, and commerce of each. After giving a general view of tho earth, and a brief description of the nations which do not profess the Mohammedan religion, he first describes Arabia, since it contains Mecca and the Caaba, and afterwards the seas and other countries subject to Mohammedans. The description of each country is accompanied by a map; but Abulfeda, who frequently quotes Haukal in his treatise on Geography, complains that the names are inaccurately spelled, and that the latitudes and longitudes are not put down in these maps. Haukal mentions the names of other writers on Geography, from whom he derived great assistance; namely, Ibn Khordadbeh, Al Jihani, and Abul Faraj Kodama Ibn Jafar, whose works he always carried with him in his travels.

Manuscripts of Haukal's work on geography are rarely met with even in the East; there is a copy in the Bodleian Library at Oxford, and another at Leyden. From the latter MS. Uylenbroeck has given an interesting account of the work in his 'Iracæ Persicæ Descriptio; præmissa est Dissertatio de Ibn Haukali Geographi codice Lugduno-Batavo,' 4to., Lug. Bat. 1822; to which we are indebted for the greater part of the preceding remarks.

Ouseley published, from what he conceived to be a Persian translation of the Arabic of Haukal, a work entitled 'The Oriental Geography of Ebn Haukal, a traveller of the 10th century,' Lond. 1800; and De Sacy gave a further account of this work in the 'Magasin Encyclopédique,' vol. vi, pp. 32-76, 151-186, 307-333. But Uylenbroeck has shown, in the work already referred to, that the Persian treatise translated by Ouseley cannot be regarded as either a translation or an abridgment of the Arabic of Haukal, since, independently of other differences, it appears to have been written in the beginning of the 4th century of the Hegira, while Haukal's work was not composed till A.H. 366 or 367. But he considers it probable from many circumstances that the Persian work was one of those which Haukal made use of in compiling his Geography, and that it was written by Ibn Khordadbeh.

HAUKSBEE or HAWKSBEE, FRANCIS, was born in the latter part of the seventeenth century. The exact year of his birth is unknown, and also that of his death; but it appears from the minutes of the Royal Society that he was admitted a Fellow of that body in 1705, at which period it is probable he was appointed to the office of curator of experiments to the Society. Previous to the time of Hauksbee, electricity could not be said to exist as a science. Dr. Gilbert of Colchester had published a book on magnetism about the beginning of the seventeenth century, wherein he gave a list of certain substances which, when rubbed, acquire the property of attracting light bodies; and similar phenomena had likewise been observed by Boyle, but with the exception of these insulated facts nothing was known concerning electricity. Even the electrical discoveries of Mr. Hauksbee were not of any great importance in themselves, but, as Dr. Thomson observes in his 'History of the Royal Society,' 'they constituted the beginning of the science, and, by drawing the attention of philosophers to that particular subject, were doubtless of considerable service in promoting electrical investigations.' Between 1705-11, there appear several papers in the 'Transactions of the Royal Society,' giving a detailed account of his experiments. In 1706 he had recognised the electricity of glass by friction, and was thence led to the first rudiments of the electrical machine. In 1709 he published his 'Physico-Mechanical Experiments on various subjects; touching light and electricity producible on the attrition of bodies,' London, 4to., which was shortly after translated into Italian by Thomas Dereham. The work was also translated into French by M. Bremond, but the latter having died before completing the translation, the publication was delayed till 1754, when it was revised and edited by M. Desmarest, who added the more recent discoveries of Hauksbee, and tho yet more important ones of Mr. Gray. In addition to the works already mentioned, Hauksbee has left 'Proposals for a Course of Chemical Experiments,' London, 1731, 4to.; 'An Essay for introducing a Portable Laboratory,' London, 1731, 8vo.; besides numerous papers on various philosophical subjects in the Society's Transactions.

HAUTBOIS. [OBOE.]

HAUTES PYRENE'ES. [PYRENEES, HAUTES.]

HAÜY, RENE'-JUST, ABBE', a distinguished French mineralogist, was born February 28, 1743, at St. Just, in the present department of Oise. He commenced his studies at the college of Navarre, to which college he was appointed professor in 1764, and subsequently also to that of the Cardinal Le Moine. His attention was first drawn to tho subject of mineralogy by attending the lectures of M. Daubenton, but the accidental fracture of a beautiful specimen belonging to his friend M. France de Croisset is said to have led him to the discovery of the geometrical law of crystallization. Haüy was anxiously employed in collecting the scattered fragments of the crystal which he had broken, when M. Croisset, whom the accident had rendered almost inconsolable, desired he would not give himself that trouble, and directed a domestic to remove the pieces, which, in his own opinion, were no longer of any value. But Haüy, who regarded them with extreme attention, requested permission to remove them himself, remarking that the conformity of the superposed plates of crystalline matter with the planes of the central prism or nucleus had revealed to him a secret which he wished more fully to explore. From this moment he applied himself sedulously to the development of the truth which his genius had detected, and his efforts were rewarded with the success they merited. He was the first to show that the structure of crystalline substances was regulated by laws as invariable as thoso to which organized bodies are subjected, and thus crystallography for the first time assumed the character of a regular science. His theory rests upon the supposition that all the crystalline forms belonging to any single species of mineral are derivable from some one simple form which may be regarded as the type of tho species; it likewise supposes that the angles at which the planes of crystals can be inclined to each other are confined within certain limits, an erroneous supposition which may probably be attributed to the imperfection of the instruments employed to measure them. (See the article 'Crystallography' in the Encyclopædia Metropolitana.) In compliance with the request of MM. Daubenton and Laplace, Haüy communicated the result of his researches to the Royal Academy, and was elected a member of that society in 1783. During the Revolution he was thrown into prison for refusing to take tho oath of obedience required of the priest, but the exertions of Geoffroy Saint-Hilaire, one of his pupils, and the remark of a citizen, that 'it were better to spare a recusant priest, than to put to death a quiet man of letters,' obtained his release, and probably saved his life. In 1794 he was appointed conserver of tho mineralogical collections of the School of Mines, and the following year he received the appointment of secretary to the commission of weights and measures. Under the consulship of Napoleon he became professor of mineralogy at the Museum of Natural History, and professor of the Faculty of Sciences at the Academy of Paris.

Haüy died at Paris, June 3, 1822. Besides numerous memoirs upon mineralogy and electricity, inserted in the 'Journal des Mines' and the 'Annals of the Museum of Natural History,' he has left tho following works:—'An Essay on the Structure of Crystals,' 1 vol., 1784; 'Exposition of the Theory of Electricity and Magnetism,' 1 vol.; 'Treatise on Mineralogy,' 4 vols., 1822; 'Treatise on Physics,' 2 vols., 1821; 'Treatise on Crystallography, 2 vols., 1822; and some others.

HAÜYNE. *Latialite.* This mineral occurs in attached rhombic dodecahedral crystals, also granular and massive. The primary form is the cube. Cleavage parallel to the diagonal planes of the cube, indistinct; fracture uneven; brittle, hardness 5·5 to 6·0; sp. gr. 2·68, 3; colour when opaque, indigo blue, when translucent, blue or bluish-green; streak white; lustre vitreous. The massive varieties are amorphous; structure granular, compact. When heated in an acid it becomes gelatinous and transparent. Before the blowpipe it fuses with borax into a clear glass, which becomes yellow on cooling. This mineral is found in the cavities of lavas and in the fragments of rocks ejected from Vesuvius, and also embedded in pumice and lava near Andernach on the Rhine, &c. According to Gmelin, the mineral from Marino yielded—

Silica	35·48
Alumina	18·87
Potash	15·45
Lime	12·
Sulphuric acid	12·39
Oxide of iron	1·16
Water	1·20
	96·55

HAVANA, the capital of the island of Cuba, is situated in 23° 9′ N. lat. and 82° 2′ W. long., on the northern shore of the island. Its harbour, which is one of the most secure and commodious in the world, communicates with the sea by a channel little more than half a mile in length, and from 300 to 350 yards wide; its depth varies from 8 to 10 fathoms. The harbour itself is a basin, of an oblong form, measuring in length from south-south-east to north-north-west nearly two miles and a half, but its greatest width does not exceed one and a half. Its depth varies from five to six fathoms, except on the small shoal De la Luz, where it is less. This basin is surrounded by heights which shelter it from every wind. The town is built on the western side of the basin, near the channel, on a kind of promontory. The channel is protected by two strong fortresses, El Morro and La Punta, and a continuous series of batteries along both shores. The town is equally strong towards the land. A well-built wall runs across the isthmus of the promontory on which it stands, and at a distance of respectively 1240 and 660 fathoms from it are two fortresses erected, Del Principe and De Atures, both well fortified. The space between the walls of the town and these fortresses is occupied by the suburbs, six in number, Horcon, Jesus Maria, Regla, Cerro, S. Lazaro, and La Salud. The population of the town was estimated in 1827 at 39,980, and that of the suburbs at 54,043; the whole therefore was 94,023, of which number the whites amounted to 46,600, the free people of colour to 23,600, and the slaves to 23,800. In the same year there were also 18,000 foreigners in Havana, and the garrison consisted of 6000 men; the whole population consequently amounted to 118,000 souls. In 1828 it was estimated at 125,000 individuals.

The streets are narrow, crooked, and generally unpaved: in the rainy season they are full of mud. A few of them contain well-built houses, especially the Calle de los Mercaderes. There are several good buildings among the churches, one of which now contains the remains of Christopher Columbus, which were formerly at S. Domingo, but were removed to this place when that town was ceded to the French (1795). The other large buildings, as the palace of the government (casa del gobierno), that of the commandant of the marine, the arsenal, the post-office (correo), and the buildings used for the manufacture of tobacco, are less remarkable for their architecture than for their solidity. The town has a theatre, a circus for bull-fights, and two fine promenades, one called L'Alameda, within the town, and the other Passeo Extra Muros, without the town. There is a university, a seminary for Catholic priests, a patriotic society, and a botanic garden. Havana is the seat of the capitano-general, and of a bishop. The manufactures are not important, except those of cigars and chocolate. The commerce is very great and still on the increase, though several other ports of Cuba have been opened to foreign vessels. More than half of the produce of the island destined for foreign markets is shipped at Havana. [CUBA.] To what is said of the climate of the town under CUBA, we need only add, that it is very unhealthy, and that more than one-half of the Europeans who arrive there are carried off in the course of one year, mostly by the yellow fever. (Humboldt; *The Present State of Columbia, by an Officer*.)

HAVANT. [HAMPSHIRE.]

HAVERCAMP, SIGEBERT, was born at Utrecht, A.D. 1683. He studied philology at Leyden under Gronovius, whom he succeeded as professor of Greek. He was also appointed afterwards professor of history and eloquence. He died on the 25th of April, 1742, in the 60th year of his age.

He edited many of the classical writers with numerous notes, which were principally selected from former commentators, of these the most important are 'Tertulliani Apologeticus,' 8vo., Leyd., 1718; 'Lucretius,' 2 vols. 4to., Leyd., 1725; 'Josephus,' 2 vols. fol., Amst., 1726; 'Eutropius,' 8vo., Leyd., 1729; 'Orosius,' 4to., Leyd., 1738; 'Sallust,' 2 vols. 4to., Amst., 1742; 'Censorinus,' 8vo., 1743. He was also the author of many original works, of which the most important are, 'A Universal History,' fol. 1736, in Dutch; 'Introductio in Historiam Patriæ à primis Hollandiæ comitibus,' 8vo., Leyd., 1739; 'Sylloge scriptorum qui de linguæ Græcæ vera et recta pronunciatione commentaria reliquerunt,' 2 vols., Leyd., 1736-40; 'Dissertationes de Alexandri Magni Numismate,' 4to. Leyd., 1722; 'Thesaurus Morellianus,' 2 vols. fol., 1734; 'Introductio in Antiquitates Romanas,' 8vo., Leyd., 1740. The list of Havercamp's writings shows that he was a laborious scholar; but many of his works bear traces of having been written in a hasty and careless manner.

HAVERFORDWEST. [PEMBROKESHIRE.]

HÂVRE, LE, or LE HÂVRE DE GRACE (the Haven of Grace), on the right bank of the Seine, at its mouth, which is several miles wide, in the department of Seine Inférieure; 108 miles from Paris in a straight line north-west, or 127 miles by the road through Rouen, in 49° 29′ N. lat., 0° 6′ E. long.

Up to the time of Louis XII. Le Hâvre was a mere fishing town, having a small chapel, covered with straw and dedicated to Notre Dame de Grace. Louis XII. laid the foundation of the importance of the place: François I. surrounded it with walls; and Cardinal Richelieu in A.D. 1628 added to its fortifications a strong citadel, which has since been dismantled and converted into quarters for the garrison. In the reign of Louis XVI. and in that of Napoleon, Le Hâvre received considerable improvement and augmentation. The site of the town and the neighbourhood are for the most part low and flat, traversed by several water-courses, one of which formed the origin of the port, which is comprehended within the circuit of the town, and has communicating with it three basins capable together of receiving upwards of 500 vessels. At the entrance of the port is an old tower built by François I., from which signals are made to vessels out at sea. Connected with one of the basins is a canal from Le Hâvre to Harfleur. There are also two roadsteads. The rise of the tide at Le Hâvre is from 22 to 27 feet, and by taking advantage of it the largest merchantmen can enter the port.

The town is divided into the Old Quarter, of which the streets are tolerably regular but the houses ill built, and the New Quarter, skirting the basin of Ingouville, the buildings of which are regular and handsome; the streets are neat, well watered, and well lighted. There is an arsenal and a custom-house, which is a large building: the town-hall, the office of the sub-prefect, the exchange, and the two churches are insignificant. There is a handsome square planted with trees and forming a public walk; there is also a handsome modern theatre. The populous suburb of Ingouville contains many pleasant country-seats. At Cape La Hève, a headland about 130 yards high, at the mouth of the Seine, 2½ miles west of the town, are two handsome lighthouses about 50 feet high. There is also a brilliant harbour-light on the extremity of the western jetty, at the entrance of the port.

The population of Le Hâvre in 1836 was 25,618; but including the suburb of Ingouville, it may be estimated at upwards of 30,000. Several manufactures are carried on in the town—tobacco, soap, earthenware, starch, vitriol, pitch, cordage, paper, and cards. There are several breweries and sugar-refining houses, and building-yards for vessels. The wives of the sailors and artisans are much engaged in making lace. The whale and herring fishery, the curing of herrings, and the Newfoundland cod fishery are also carried on. But the importance of the place depends upon its commerce. It is the principal port of Paris, most of the foreign and colonial produce designed for the consumption of that city being imported into it. Beside colonial produce, as sugar, coffee, indigo, dyewoods, and spices, the imports chiefly consist of cotton (for the manufacturers of the district of which Rouen is the capital), tobacco, hides, iron, tin, dried fish, &c. The exports are silk and woollen stuffs, lace, gloves, trinkets, perfumery, wines, brandy, &c. Grain and flour are sometimes imported, sometimes exported. The value of the imports in the year 1829 was 250,000,000 francs, or above 10,000,000*l.*: of which the value of the cotton imported was estimated at 26,000,000 francs or nearly 1,100,000*l.*; that of the French colonial sugars 44,000,000 francs, or above 1,800,000*l.* Le Hâvre has regular communication by packets with Southampton (some of the packets on this station are steam-boats), New York, Vera Cruz, Bahia, Lisbon, and Hamburg. Steam and other boats ply between Le Hâvre, Rouen, and Paris, and between Le Hâvre and Honfleur, on the opposite bank of the Seine.

This town has a subordinate court of justice and a court for commercial disputes, a Calvinist church, a nunnery, a poorhouse, a foundling hospital, and three prisons. There are also a public library of 15,000 volumes, and other literary establishments; a museum of natural history, a high school, a school of navigation, and one of geometry applied to the arts. There is a military hospital; and a yearly fair, that of St. Michael, is held in a field belonging to this institution outside the town. Le Hâvre was the birth-place of St. Pierre.

Le Hâvre is the capital of an arrondissement which comprehends an area of 344 square miles, has 9 cantons and 121 communes, and had in 1836 a population of 142,292.

It was near the site of this town that Henry V. of England landed previous to the siege of Harfleur and the battle of Agincourt. In the year 1759 preparations were made at Le Hâvre for an invasion of England, which drew upon the town a severe bombardment from an English squadron under Admiral Rodney.

HAWARDEN. [FLINTSHIRE.]

HAWES, STEPHEN, author of 'The Pastime of Pleasure,' lived at the beginning of the sixteenth century, but the date of his birth and death are alike uncertain. He calls himself 'gentleman and grome of the chamber to the famous Prynce and seconde Salomon, Kynge Henrye the Seuenth.' He was a native of Suffolk, and refers in his poems to Lydgate as his master. His accomplishments made him a favourite with Henry VII., who had some taste in literature, particularly French, in which Hawes's travels had given him uncommon skill, and poetry such as that of Lydgate and Chaucer, in the repetition of which Hawes was a great proficient.

His 'Pastime of Pleasure' is an allegorical poem, 'containing the knowledge of the seven sciences and the course of Man's life in this world.' Graund Amour goes through the town of Doctrine, where he meets the Sciences, becomes enamoured of La bell Pucel, whom he marries, and with whom he spends his life.

It is by courtesy to metre, and scarcely for any other cause, that we call 'The Pastime of Pleasure' a poem. We have already endeavoured [EPIC] to point out what appears to us the natural order of poetical creation; and this work seems to belong to that period when the epic element (the poetry of action) had been worn out, but having long held undisputed sway in the romances, as action itself had in real life, compelled those who lived in a more thoughtful and therefore lyrical age to clothe their reflective poetry in an epical dress.

Another poem, 'The Temple of Glas,' is ascribed to Hawes, but there are almost equally strong reasons for believing it to be Lydgate's, as Hawes himself tells us that Lydgate composed a work under that name, and there is something about the run of the verses which reminds us rather of Lydgate than of Hawes. (Warton, *Hist. of Eng. Poet.*, ii. 210; Southey's *Brit. Poets;* Wood's *Ath. Oxon.*)

HAWFINCH. *Haw Grosbeak*, *Grosbeak*, of the modern British; *Gylfinbraff* of the Antient British; *Le Grosbek* and *Pinson Royal* of the French; *Frogione*, *Froccione*, *Frosone*, *Frisone*, *Friggione*, of the Italians; *Kernbeisser*, *Kirsch Kernbeisser*, *Kerschfink*, *Nusbeisser* of the Germans; *Appel-vink* of the Netherlanders; *Loxia Coccothraustes* of Linnæus; *Fringilla Coccothraustes* of Temminck; *Coccothraustes vulgaris* of Brisson.

Description.—*Rump*, *head*, and *cheeks* red-brown; edging round the *bill*, space between that and the eye, a line beyond the eye and throat, deep black; a large ash-coloured collar just below the *nape;* back and greater part of the *wings* deep brown, but there is an oblique white stripe upon the wing and beyond it a considerable space of a light whitish colour going off into chestnut; secondary quills as if cut off square at the ends, or, as Edwards says, with justice, like the figures of some of the antient battle-axes, glossed with rich blue, less conspicuous in the female; *Tail* feathers white within, of a blackish brown on the external barbs; lower parts of the bird vinous red; iris pale red (according to Temminck), feet and bill greyish brown. Length seven inches.

Female. Generally like the male, but with the colours much less brilliant.

Young of the year before the moult.—Very different from the adults and old birds. *Throat* yellow; face, cheeks, and summit of the head dirty yellowish; lower parts white, or whitish; sides marked with small brown streaks, with which all the feathers are terminated. *As the young bird advances in age* some red vinous feathers appear disposed irregularly upon the belly; the upper parts are of a tarnished brown, spotted with dirty yellowish; bill whitish brown, except at the point, where it is deep brown. (Temminck.)

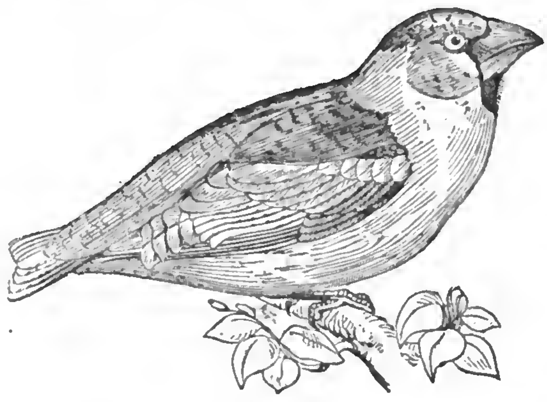
Mr. Gould (*Birds of Europe*) says that in the male the beak and feet in winter are of a delicate flesh-brown, the former becoming in summer of a clear leaden hue, the ends straw-colour, and in some instances white; the top of the head, the cheeks, and rump, of a chestnut-brown. The rest of the description does not differ much from M. Temminck's.

Varieties.—White, yellowish, or greyish. Wings and tail often white. Plumage often variegated with white feathers.

Food, Habits, Reproduction, &c.—Hard seeds and kernels form the principal food of the Grosbeak, but we have seen it feeding on the berries of the hawthorn (whence its name), and shot it when so employed; so that it is probable that the soft part of fruits is not disagreeable to it, although the bill is evidently formed for cracking the stony kernel. Willughby states that it breaks the stones of cherries, and even of olives, with expedition. The stomach of one which he dissected in the month of December was full of the stones of holly-berries. The majority of ornithologists give the Hawfinch credit for forming a nest beautifully constructed of lichens and vegetable fibres with a lining of feathers and other soft materials. But, according to Mr. Doubleday, who has thrown much light on the history of this bird, and discovered it breeding in Epping Forest in May and June, the nest, which is made in some instances in bushy trees at the height of five or six feet, and in others near the top of firs at an elevation of twenty or thirty feet, is remarkably shallow and carelessly put together, being scarcely deeper than that of the dove. In materials it resembles that of the bullfinch, but is not to be compared with it in neatness and compactness of construction. Eggs, from four to six in number, of a pale greenish white, varying in intensity, spotted and streaked with greenish grey and brown. Mr. Gould states that he has known the bird to breed near Windsor, and a few other places; but certainly nowhere so abundantly as on the estate of W. Wells, Esq., at Redleaf, near Penshurst, Kent. This gentleman informed Mr. Gould that he had, with the aid of a small telescope, counted at one time eighteen on his lawn.

Mr. Selby remarks that in the pairing season it probably utters a superior song, as Montagu says that even in winter, during mild weather, he has heard it sing sweetly in low and plaintive notes.

Geographical Distribution.—Plentiful in some districts of France; permanent and not uncommon in Italy; common in Germany, Sweden, and part of Russia. In Mr. Selby's 'Illustrations,' and indeed in most other English works, the Hawfinch is noticed as an occasional visitant. Dr. Latham says that 'the Hawfinch visits us chiefly in winter, but one was shot in the summer months near Dartford, in Kent.' He goes on to remark that White records another instance at the same season, and says that it had the kernels of damsons in its stomach. 'These,' continues Dr. Latham, 'might possibly have bred here, though we have no authority for its ever being the case.' This authority now exists in the observations of Mr. Doubleday. 'The Hawfinch,' says Mr. Doubleday, 'is not migratory, but remains with us during the whole of the year.' This observer sufficiently accounts for the rarity of its appearance,—'its shy and retiring habits leading it to choose the most secluded places in the thickest and more remote parts of woods and forests, and when disturbed it invariably perches on the tallest tree in the neighbourhood.'



Coccothraustes vulgaris.

HAWICK. [ROXBURGHSHIRE.]

HAWKESWORTH, JOHN, LL.D., was a successful writer of the last century. The date of his birth (1715 or 1719) and the occupations of his early life are variously stated: in so short a notice, all that is essential to record is that he was bred to some mechanical occupation, and therefore deserves the more credit for his talent and industry in supplying the defects of a rude and illiterate education. His first appearance was as a contributor to the 'Gentleman's Magazine,' in which he succeeded Dr. Johnson as compiler of the parliamentary debates in 1744. In 1752, encouraged by the success of the 'Rambler,' he undertook, assisted by Johnson, Warton, and one or two others, a series of essays, called the 'Adventurer.' They extended to the number of 140 (70 of which are ascribed to Hawkesworth himself), were received with great approbation, and contributed much to the increase of his reputation and friends. Herring, archbishop of Canterbury, was so much pleased with the work, that he procured a degree in civil law for the conductor. This compliment however produced a permanent alienation on the part of Johnson, who had not yet received the same distinction. He probably regarded the man so patronised as a mere imitator of himself; and in fact Hawkesworth's style appears to have been modelled upon Johnson's, though less remarkable for pomp and inflation of diction. In 1761 he published an edition of Swift, with a life prefixed, to the merits of which Dr. Johnson has borne handsome testimony in his 'Lives of the Poets.' On the return of Capt. Cook from his first voyage of discovery in the South Seas, it being thought desirable to entrust the task of compiling an account of the voyage to a literary man rather than to one of the travellers, Dr. Hawkesworth's reputation as an able writer obtained for him the commission. He completed the task in three vols. 4to., 1773 [COOK], illustrated with maps and plates at the expense of government, including the prior voyages of discovery of Byron, and of Wallis and Carteret, and received for recompence the liberal sum of 6000*l.* The work however did not give entire satisfaction: the warmth of his descriptions of manners, in some respects, was thought to verge upon immorality; and exceptions were taken to some religious speculations, which, right or wrong, were certainly out of place. The chagrin occasioned by these censures is said to have shortened the author's life, but as he died in November of the same year, the statement is probably incorrect; the effect of criticism on a practised author is seldom so rapid and deadly. The accounts of Cook's subsequent voyages were written by Cook himself, and gained more in simplicity and correctness than they lost in literary elegance. Dr. Hawkesworth translated 'Telemachus,' and wrote 'Almoran and Hamet,' an eastern romance, which was much admired. He was a regular contributor to the 'Gentleman's Magazine.'

HAWKING. [FALCONRY.]

HAWKINS, SIR JOHN, a distinguished seaman of the reign of Elizabeth, was born at Plymouth, about 1520. His youth was spent in trading to Spain, Portugal, and the Canaries; and the information and experience which he thus obtained made him well aware of the gain to be derived from supplying the Spanish colonies with slaves from Guinea. With the assistance of some merchants, he fitted out a small squadron in 1562, and obtained, partly by purchase, partly by force, a cargo of 300 negroes, whom he carried to Hispaniola, and there sold. This, we believe, was the first adventure of Englishmen in that inhuman traffic. He made a second voyage in 1564, and a third in 1567: the latter turned out unfortunately. All trade between the Spanish settlements and foreigners being prohibited by the mother-country, though often, from interested motives, connived at by those in power, he was at last attacked by the Spanish authorities in the port of S. Juan de Ulloa, and saved but two ships of his squadron, with which, after suffering great hardships, he returned to England in January, 1568. This seems to have been his last commercial enterprise. The queen's approbation of his services, and sanction of that abomination, which, after the lapse of more than two centuries, the tardy voice of Europe has branded as piracy, was conveyed in the expressive grant to wear as his crest 'a demy-moor in his proper colour, bound with a cord.' In 1573 Hawkins was appointed treasurer of the navy. In 1588 he served as rear-admiral against the Spanish armada [ARMADA]; and his bravery on this occasion was rewarded by Elizabeth with the honour of knighthood. Being sent with Frobisher in 1590 to intercept the plate fleet and harass the trade of Spain, he failed in the first object, but succeeded in the second. In 1595 he was appointed, jointly with Drake, to command a more important expedition against the Spanish settlements in the West Indies. This enterprise proved fatal to both these hitherto successful commanders. They disagreed upon the conduct of operations, and soon separated. [DRAKE.] Hawkins died November 21, 1595, chiefly, it was supposed, through annoyance and agitation; and Drake expired in the following month. Sir John Hawkins sat in parliament for Plymouth, and founded an hospital at Chatham for poor and sick seamen.

HAWKINS, SIR JOHN, the senior of the two chief historians of music, the friend and executor of Dr. Johnson, and a descendant of the Sir John Hawkins who commanded the Victory, as rear-admiral, at the destruction of the Spanish armada, was born in 1719. His father, a surveyor and builder, at first brought his son up to his own profession, but eventually bound him to an attorney, 'a hard taskmaster and a penurious housekeeper.' At the expiration of the usual term, the clerk became a solicitor, and by unremitting assiduity, united to the most inflexible probity, he, unfriended, established himself in a respectable business, while by his character and acquirements he gained admission into the company of men eminent for their accomplishments and intellectual attainments. He was an original member of the Madrigal Society, and at the age of thirty was selected by Mr. (afterwards Dr.) Johnson as one of the nine who formed his Thursday-evening Club in Ivy-lane; a most flattering distinction, which confirmed his literary habits, and powerfully influenced his future pursuits when, not many years after, he relinquished his profession. About this time he contributed much to the Gentleman's Magazine, and other periodicals of the day. He also wrote the poetry of the cantatas set by the blind composer, Stanley, from which he derived considerable profit.

In 1753 Mr. Hawkins married Sidney, the second daughter of Peter Storey, Esq., with whom he received an independent fortune, which was greatly augmented in 1759 by the death of his wife's brother. He then retired from all professional avocations, giving up his business to his clerk, Mr. Clark, who subsequently became chamberlain of the city of London. With this increase of wealth is connected an anecdote of far too honourable a nature to be omitted here. The brother of Mrs. Hawkins made a will, giving her the whole of his fortune, except a legacy of 500*l.* to a sister from whom he had become alienated, and communicated the fact to Mr. and Mrs. Hawkins, who, by representing the injustice of this act, and by adding entreaty to argument, prevailed on him to make a more equitable distribution of his property, and an equal division was the consequence. 'We lost by this (says Miss Hawkins, her father's biographer) more than 1000*l.* a-year; but our gain is inestimable, and we can ride through a manor gone from us with exultation.'

Upon retiring from the law Mr. Hawkins purchased a house at Twickenham, intending to dedicate his future life to literary labour and the enjoyment of select society. But in 1771 he was inserted in the commission of the peace for the county of Middlesex, and immediately became a most active magistrate. Among other useful acts, be wrote, 'Observations on the State of the Highways, and on the Laws for amending and keeping them in repair;' subjoining the draught of a bill, which passed into a law. In 1764 he successfully opposed tbe attempt made by the corporation of London to throw on the county two-thirds of the expense of building the gaol of Newgate. For tbis service he was, in 1765, elected chairman of the Middlesex quarter-sessions. Here again his independent spirit and charitable disposition were manifested. Acting as a magistrate, he at first refused the customary fees; but finding that this generous mode of proceeding rather increased the litigious disposition of the people in his neighbourhood, he altered his plan, took what was his due, but kept the amount in a separate purse, and at fixed periods consigned it to the clergyman of his parish, to be distributed at his discretion. When the riots at tbe Brentford election took place in 1768, ho was active in their suppression; and the dispersion of the Spitalfields weavers in 1769, who had collected in a very threatening manner, was mainly owing to his decision and boldness. For these services he received, in 1772, the honour of knighthood.

Sir John Hawkins now set seriously about finishing his great work. He went to Oxford, and there remained some time, to examine the books in the Bodleian and otber libraries, connected witb his inquiry. He was accompanied by an artist, whom he engaged to make drawings of the portraits in the music-school, all of which were engraved for his History. From the Rev. Mr. Gostling of Canterbury, whom he visited two years consecutively for the purpose, he also gained much valuable information, as well as from Doctors Boyce and Cooke, and others qualifiod to aid bim in his pursuit. In 1776 appeared, in five quarto volumes, the work on which bo had been 16 years engaged, under the title of 'A General History of the Science and Practice of Music,' which he dedicated to George III., and presented it to his majesty at Buckingham House, during a long audience granted for the purpose. Tbe king no doubt appreciated the work as it deserved; and the university of Oxford showed their estimation of it, by offering to confer on the author the degree of doctor-in-law, whicb he had reasons for declining: but that learned body paid him the compliment of requesting his portrait. With the public however the reception of tbe History was widely different. The best judges, it is true, discovered its value; its research and accuracy were obvious to those who were qualified to form an opinion on the subject; but five large volumes were alarming to tbe public, and, unfortunately for the work, he closed it at the death of Handel, leaving untoucbed those matters in wbich the living many were most interested. Moreover, on the appearance of tbe History, Sir John was immediately attacked in the *St. James's Evening Post*, by Steevens, the commentator on Shakspeare, in the most virulent and uncandid manner; and every engine was set in motion to damage the reputation of tbe work. Subsequently it was assailed by the ridicule of Dr. Lawrence, in the *Probationary Odes*. The consequence of these persevering efforts to destroy a very learned and most useful, though not well written history, was, that it fell nearly dead from the press. Stevens and Lawrence were the friends of Dr. Burney, which may account for, though it cannot palliate, their illiberal conduct: but it is to be hoped that tbe rival bistorian neither instigated nor sanctioned proceedings so unfair and so cruel. Time however has done that justice to tbe author which his contemporaries denied him. The work now fetches a price beyond that at which it was published; it is found in every good library, and the more it is read and known, tbe more it will rise in public estimation and demand.

While pursuing his historical inquiries, Hawkins accumulated a fine musical library; and it was his singular good-fortune to become possessed, by purchase, of several of the most scarce and valuable theoretical treatises on the science itself, which were collected by tbe celebrated Dr. Pepuscb, F.R.S. This collection he, after the completion of bis work, most liberally gave to the British Museum, where it remains.

In 1760 Hawkins published bis edition of Walton's Angler,' with notes, of which three or four editions have since appeared. On the death of Dr. Johnson, in 1784, Sir John undertook, in consequence, it is supposed, of some conversation between them, to write the life of his friend, and to become editor of a completó collection of bis works. In this task, as in his 'History of Music,' it was bis fate to meet with unexpected competition and unmerited criticism. But he had scarcely entered on the work when his whole library—a library which no expense could replace—was destroyed by fire. The blow was severe, though the sufferer never murmured, but began again to collect. In 1787 he closed his literary career, by the publication of his Life of Dr. Johnson, and an edition of his works.

In tho month of May, 1789, Sir John Hawkins suffered a paralytic attack, which from the first was considered of a fatal nature. It increased on the 21st of the same month, when be expired. His remains lie in the cloisters of Westminster Abbey, where, by his own direction, a simple tablet with his initials and tbe date of his death is tbe only monument to his memory. He left two sons and one daughter. The latter is well known in the literary world: her novels are too didactic for tho multitude, but tbe cause of virtue and right feeling has never found a more zealous advocate.

HAWKS. [Falconidæ; Falconry.]

HAWKSHEAD. [Lancashire.]

HAWKSMOOR, NICHOLAS, wbo, although not included in Cunningham's 'Lives of British Architects,' executed many buildings of note in the early part of the last century, was born in 1666, and at the age of seventeen became the pupil of Sir Christopher Wren. Beyond tbis we possess very few personal details relative to him. His works, if tbey do not display a very refined taste, give evidence of talent and a certain degree of originality. Like that of Vanbrugb, with whom be is said to bave been associated both at Blenheim and Castle Howard, his style partook of the massive and heavy, combined with a certain coldness and baldness. Of this we have proof in the churcb of St. George's in the East, Ratcliffe Higbway, commenced by him in 1715, which is no less ponderous in its ensemble than hard and dry in its details, besides being most extravagant and anomalous. That of St. Mary Woolnoth's in Lombard street is very much better; there is a certain degree of richness and picturesque cbaracter in tbe north side, which, until the late alterations, was tbe only one exposed to view. This façade is remarkable for baving no windows, but in lieu of tbem three large niches, decorated with columns and external rustics, and in themsolves not ill-imagined, although too much cut up by the smaller nicbes inserted between the pedestals of the columns; bad the rustics been continued uniformly below them, and the smaller blank windows or panels been entirely omitted, the effect of the whole would have been decidedly improved. The interior, which is lighted chiefly by a square dome or lantern extending over the centre above three Corinthian columns at each angle, and having a large semicircular window on each of its sides, is one of the best specimens of church arcbitecture of tbat day, though the effect is greatly impaired by the pewing and galleries. But it is chiefly as tbe architect of St. George's, Bloomsbury, tbat Hawksmoor is entitled to notice, that being a work whicb of itself ought to confer a lasting reputation. It is true, Walpole has stigmatised the steeple as 'a masterstroke of absurdity,' and adopting that smartly expressed opinion others have continued to repeat his censure. Malton was one of the first who ventured to express a contrary judgment, and it has more recently had ampler justice done to it by a writer in tbe 'Quarterly Review,' who very desorvedly gives it the preference over every other steeple in London. It is certainly the happiest as well as the most original in its idea; picturesque and graceful in outline; well combined together; consistent though varied; with a due expression of solidity, remote from heaviness on the one hand, and on the other from that species of lightness which, though a merit in Gotbic, becomes a fault in Roman architecture. One leading fault imputed to this steeple is that it is surmounted by a statue of George II., which gave rise to a paltry epigram that bad perhaps quite as much influence in exciting a prejudice against the structure as Walpole's dictum. Yet if there be any inconsistency or absurdity in terminating the steeple by a statue, it is assuredly equalled if not surpassed by that of erecting a column, for no other purpose than to elevate a statue upon it: because in the latter case the figure, though put almost out of sight, is presumed to be the principal object, while in the other it is intended to be no more than an ornamental accessary and termination to the structure. The portico of this church, which is, like that of St. Martin's, a hexastyle Corinthian, is very little inferior to it in execution, and displays itself still more advantageously, being considerably raised above the street by a flight of steps, enclosed by pedestal walls, which gives it an air of dignity beyond that of any other building of the kind in the metropolis. Besides which it possesses the further advantage of its roof not being interrupted by a steeple immediately behind the portico, the campanile spoken of being attached to the body of the church at the south-west angle. In short, if St. Martin's justly entitles Gibbs to the reputation he has hitherto maintained, St. George's, Bloomsbury, ought to acquire for Hawksmoor a much greater share of commendation than he has hitherto received. St. Anne's, Limehouse, is another church by him, which deserves more praise than has fallen to its share. With much that is incorrect, and with very little that is positively beautiful, its ensemble has an air of grandeur very frequently missed where it seems to have been more studiously aimed at.

Among his other works were Easton Neston, in Northamptonshire, and a mausoleum at Castle Howard. He was also employed to repair the west front of Westminster Abbey. The south quadrangle and street front of Queen's College, Oxford, have by some been attributed to him, though they are generally supposed to have been the work of Wren. That he did much at All Souls College, in the same university, is unquestionable, and Dallaway informs us that he had seen a very grand design by him for rebuilding Brazenose College, somewhat in the style of Greenwich Hospital, where he had at one time the appointment of clerk of the works. Besides this he gave a design for the Radcliffe Library, but that of Gibbs obtained the preference. He died in March, 1736, at the age of 70.

HAWKWOOD, SIR J. [CONDOTTIERI.]

HAWTHORN. [CRATÆGUS.]

HAYDN, JOSEPH, the father of modern orchestral music, the most original and imaginative of composers, was born at Rohrau, about fifteen leagues from Vienna, on the 31st of March, 1732. His parents were humble; his father was a small wheelwright, and his mother, previous to her marriage, was cook to the lord of the village; but both, true Austrians, were musical: the former had a fine tenor voice, and could play on the harp; the latter sang, and with the aid of a relation they got up little concerts on Sunday afternoons, in which the young Haydn, when five years of age, pretended to join them with two pieces of wood cut in imitation of a violin and bow. The accuracy with which his motions kept time with the domestic music attracted the notice of a cousin, a schoolmaster at Hainburg, and a good musician, who made an offer, which was readily accepted, to take the child into his house as a scholar. Under the friendly roof of that kinsman he learned music as an art, soon became capable of using a real violin, and acquired some knowledge of Latin. He was also taught to sing in the parish church, where he was heard by Herr Reuter,—Kapellmeister of the cathedral of St. Stephen at Vienna, who was travelling in search of boys for the use of his choir,—and immediately engaged as a chorister in the metropolitan church of the empire.

Under Reuter, Haydn continued till he arrived at the age of thirteen, practising almost incessantly, but receiving only such instructions from his master as qualified him for the duties of the choir. At that period failing, for want of sufficient knowledge, in an attempt at composition, and being utterly destitute of the means of obtaining the assistance of a master, he contrived to procure the well-known treatise on counterpoint by Fuchs, with one or two other works on the theory of music, by means of which, and his own indefatigable industry, he speedily surmounted the first difficulties encountered by a youthful composer. He now made himself known to the famous Porpora, who was living in the hotel of the ambassador from Venice, and by very assiduous attentions to the old musician gained much knowledge from him, particularly in singing, in which he made such progress that the ambassador, having heard him, took him into his service, and bestowed on him a trifling salary. But at the age of seventeen his soprano voice left him, and with it fled the present means of living. His father could render him no assistance, and, sorely distressed, he was offered an asylum in the house of Keller, a wig-maker, who had often been charmed by his vocal powers. The hospitality was accepted, and Haydn was, in obscurity, enabled to pursue his studies. But his residence with the friendly tradesman powerfully influenced his future domestic life. Keller had a daughter, who was offered to the young musician in marriage. He gave his promise to her, which after a time he honourably fulfilled; the union however did not contribute to the happiness of either party, and ended in a separation not very long after it had taken place.

By giving a few lessons in music, and occasionally performing in the orchestra for what he could get, Haydn supplied himself with absolute necessaries; and frugality being one of the German virtues, he managed to preserve a tolerably decent appearance; till fortune first began to smile on him, by leading him into the house of the Abate Metastasio, where he gave instructions to the poet's niece, and gained not only a thorough acquaintance with the Italian language, but a general knowledge of literature, and the most useful advice on the subject of setting words to music, from the imperial laureate. This connection also introduced him to the Count Martzin, a noble patron of music, into whose service he entered in 1759: and hence, in 1761, he passed into that of the rich Prince Esterhazy, to whom he remained attached, as *Maestro di Capella*, to the end of his life.

Comfortably settled in the palace of Eisonstädt, in Hungary, enjoying in moderation his favourite diversions of hunting and fishing, and relieved from care for the future, Haydn there composed all the great works which he produced prior to the year 1791, and under advantages which few, if any, have possessed:—he had a full, choice band, living under the same roof with him, at his command every hour in the day; he had only to order, and they were ready to try the effect of any piece, or even of any passage, that, quietly seated in his study, he might commit to paper. Thus at leisure he heard, corrected, and refined whatever he conceived, and never sent forth his compositions till they were in a state to fearlessly challenge criticism.

We now arrive at that period in the life of Haydn in which were produced most of those works that have raised his fame to the high point it has attained. In 1790 Salomon, the celebrated violinist, having determined to give a series of subscription concerts in London, went to Vienna to engage either Haydn or Mozart, not only to produce certain compositions in aid of his design, but to superintend in person the performance of them. It was mutually agreed by the three parties that Haydn should be the first to visit London, and that Mozart should follow the year after; but it was destined that the latter should not live to fulfil his part in the agreement. In 1791 Haydn arrived, and produced during that and the following year, at 'Salomon's Concerts,' in the Hanover-square Rooms, six of his *Twelve Grand Symphonies*, which immediately made an extraordinary sensation in the musical world, and have ever since rather increased than diminished in public estimation. Here also he composed, by agreement with Corri and Dussek, music publishers, his two sets of English canzonets, which for originality, for musical expression of every kind, and for richness and propriety of accompaniment, have no rivals. Besides these his prolific imagination gave birth to many quartets, sonatas, &c.

In 1794 Haydn accepted a second engagement from Salomon for the same purpose. He reached London in January, and in the course of that and the succeeding season brought forth the remaining six of his grand symphonies, with the same brilliant result. For these twelve symphonies, and for superintending their performance, he received a sum—including two benefit concerts, the profits guaranteed by Salomon—amounting to 1550*l*. To this is to be added, as the fruits of his visits to England, what he gained by his canzonets and other compositions: it was therefore with reason he declared that in London he discovered the real value of the reputation he enjoyed in Germany. His reception here was of the most flattering kind: the university of Oxford conferred on him the degree of Doctor in Music; at the tables of the prince of Wales and the duke of York he was a frequent guest; and nearly all classes vied in showing him attention. The satisfaction which he felt he gratefully acknowledged and evinced in a diary he kept while in England, a translation of a part of which (a curious document), with notes, appears in the fifth volume of the *Harmonicon*.

In 1798 Haydn gave to the world his oratorio *The Creation*, the greatest of his works, though composed in his sixty-fifth year. It is enough to say of this fine production of his advanced years, that it is the only oratorio, of many that have been produced, that can bear comparison with those of Handel. The design was suggested, his biographer, M. Beyle, tells us, by an English gentleman named Lidley (Liddell, we suspect, is the true name). The German text however, and the barbarous English translation (which to our shame is still in use), were furnished by the Baron Von Swieten. Two years after this he composed *The Seasons*, a work of as much originality as the *Creation*, but not exhibiting, nor intended to exhibit, the same depth of thought. The subject is not of so grave a nature, and is treated with more freedom. The last offsprings of his genius were two sets of quartets, 'which betray no abatement of his vigour; on the contrary, the second of his Op. 80 is perhaps the most original and exquisitely-finished of all the works of the kind that ever proceeded from his pen.'

'When Haydn's *Creation* reached Paris the *Institut National* elected him a member, an honour contested with him by some of the greatest men of the time in Europe: but the decision was just; for who among the candidates had contributed so much to the happiness of civilized nations? His few remaining years were spent in the enjoyment of a great and well-earned reputation, and a small independence created by his talents; and the last hours of his mortal life were crowned with honours.' (*Supplement to Musical Library*, i. 27.) His death is supposed to have been accelerated by the bombardment of Vienna, which powerfully agitated his weakened frame. Though it must be mentioned, to the honour of Napoleon, that he issued strict orders that the abode of Haydn should be respected; and when the troops entered the city a French guard was placed at his door to protect him from every kind of injury. He died on the 29th of May, 1809, and was privately buried at Gumpendorff, his country then suffering all the horrors of war, and the capital of the empire being in possession of the enemy. He left no children. His property, except about 500*l*. bequeathed to two faithful servants, came into the hands of a blacksmith, his distant relation. His works are astonishingly numerous, embracing every class. Among them are 116 symphonies, 83 violin quartets, 60 pianoforte sonatas, 15 masses, 4 oratorios, including the *Seven Last Words*, a grand *Te Deum*, a *Stabat Mater*, 14 Italian and German operas, 42 duets and canzonets, upwards of 200 concertos and divertissements for particular instruments, &c., &c. Many of these, but not the most valuable, were irretrievably lost in the fire which consumed the palace of his patron at Eisenstädt: the best are out of the reach of danger; they have been printed and reprinted in half the capitals of Europe.

HAYLEY, WILLIAM, best remembered as the friend and biographer of Cowper, during the end of the past and the beginning of the present century enjoyed a considerable reputation, less perhaps from his sterling merit as a poet, than from his combining a very respectable share of taste, talent, and devotion to art and literature, with an easy fortune, and a certain position in society. Of epitaphs and other occasional verses he was a frequent, willing, and elegant author; but the credit acquired by this ephemeral branch of composition is as fleeting as it is commonly excessive. Mr. Hayley was born at Chichester, in 1745, and studied in Trinity Hall, Cambridge, intending to practise as a barrister. Finding the law not to his taste, he settled on his patrimonial estate of Eartham, in Sussex, in 1774, a name memorable by its frequent occurrence in the history of Cowper, with whom the proprietor became acquainted in 1792. Hayley died November 20, 1820. Of his numerous poetic works, the 'Triumph of Temper,' 1781, has been the most popular, probably in consequence of the domestic interest of the subject. The 'Essay on Painting,' 1778, and 'Essay on History,' 1781, addressed respectively to his friends, Romney the painter, and Gibbon, rank among his best productions. We may add, as the most important of his other numerous works, the 'Essay on Epic Poetry,' 1782; 'Life and Poetical Works of Milton,' 1794-9; 'Essay on Sculpture,' 1800, addressed to his friend Flaxman; 'Life of Cowper,' 1802. (*Life of Hayley*, by himself, 1823.)

HAYTI. [HISPANIOLA.]

HAZEBROUCK, a town in France in the department of Nord, on the road from Paris to Dunkerque: distant from Paris 128 miles in a straight line almost due north, or 140 miles by the road: in 50° 43′ N. lat., 2° 32′ E long.

This town is situated in one of the richest and most delightful plains in France, devoted chiefly to pasturage, or to the raising of tobacco, hops, pulse, rape and colza for oil, and fruit. The streets of the town are well laid out, the houses handsome, and the place has the air of being inhabited by a wealthy and thriving population. There is a large and handsome market-place, in which is the town-hall, with a Doric colonnade, built of freestone. There are a subordinate court of justice, an agricultural society, a high school, and two theatres. The population in 1836 was 7674.

Hazebrouck is the capital of an arrondissement having an area of 267 square miles, and comprehending 7 cantons and 53 communes: the arrondissement had in 1836 a population of 105,879.

HAZEL-NUT, the fruit of the wild bush of Corylus Avellana, unchanged and unimproved by cultivation. It differs from the domesticated varieties only in being smaller and rather more hardy. [FILBERT.]

HAZLITT, WILLIAM, the son of a Unitarian minister of the same name, was born at Maidstone on the 10th of April, 1778. When he was five years old his father transferred the scene of his ministerial exertions to America, and remained with his family in the United States for two years. On his return to England the father became pastor of the Presbyterian congregation at Wem in Shropshire; and it is here that the work of Hazlitt's education was commenced. At the age of nine he was put to a day-school at Wem. Some letters written by him, between the ages of nine and twelve, which have been preserved, indicate a very forward mental development; and in addition to these specimens of private correspondence, there is a letter, which he published at the age of thirteen, in a newspaper, in defence of Dr. Priestley, which displays very considerable knowledge as well as literary skill. In 1793 Hazlitt was entered as a student of the Unitarian college at Hackney, in order to be educated for his father's profession. But for this profession he had no liking; and having devoted himself, while at the college, principally to moral and political philosophy, and having comparatively neglected theological pursuits, he returned home in 1795, having determined, much against his father's wishes, to change his profession.

Hazlitt had from a very early age shown a love of pictures and a taste for drawing, and it was now determined that he should follow the profession of a painter. He commenced with great ardour and assiduity, continuing to cultivate metaphysics in his intervals of leisure. We are told by his son that the first rough sketch of the essay on the 'Principles of Human Action' was thus begun at the age of eighteen. In 1802 he visited Paris for the purpose of studying the paintings in the Louvre; and on his return to England in the next year he made a professional tour through some of the midland counties and the manufacturing towns, and painted a considerable number of portraits; but he did not persevere. His notion of success was so exalted, and his fastidiousness so great, that he could never satisfy himself, and he determined on again changing his plans.

He now proceeded, in the autumn of 1803, to the metropolis to start as a literary adventurer. He commenced his almost endless series of publications with the essay on the 'Principles of Human Action,' and on which, we are told by his son, he always prided himself as much as on any other of his numerous works. As a metaphysical essay it is however of little value, though to a certain extent ingenious and acute; while, so far as the merits of composition are concerned, it is inferior to his writings on miscellaneous literary subjects. This essay was published anonymously in 1805, and was followed up quickly by other works. In 1808 he married a Miss Stoddart, the sister of Dr. (afterwards Sir John) Stoddart; and after his marriage retired into Wiltshire, where he continued without intermission his literary pursuits. In 1811 he returned to London, and we find his residence in a house in York-street, Westminster, which had been once inhabited by Milton, and which then belonged to Bentham. His admiration for genius led him to erect, in the garden of this house, a tablet 'inscribed to the Prince of Poets;' and he was afterwards much scandalized by a plan of Mr. Bentham's to cut down two beautiful cotton-trees which inarched this tablet, and to expose the garden and the tablet to the continual inroad of the members of a Chrestomathic school. The passage however in the 'Spirit of the Age,' in which Hazlitt speaks of this contemplated profanation, as he deems it, is perhaps not altogether free from an affected sentimentality, of which, it must be allowed, he is not often guilty.

In 1813 Hazlitt delivered a course of lectures at the Russell Institution, on the history of English philosophy; and subsequently he lectured on the English poets generally, the comic poets, and the poets of the age of Elizabeth, in separate courses, at the Surrey Institution. The three last series of lectures have been published, but not those on the history of philosophy. He acted for a short time also as reporter to the 'Morning Chronicle,' and after giving it up he still wrote occasionally in that paper, and also in the 'Examiner.' He was also, in the latter part of his life, a contributor to the 'Edinburgh Review,' and to some smaller magazines. His life was indeed one unintermitting course of literary exertion; and his labours brought him in a considerable income, which however his imprudence always quickly dissipated.

In 1822 he was divorced from his wife, and two years afterwards he married a second time. He died on the 18th of September, 1830, of cholera, and was buried in the churchyard of St. Anne's, Soho, where a friend has raised a monument to his memory. A long and eloquent inscription concludes thus: 'This stone is raised by one whose heart is with him in his grave.'

Hazlitt's principal works, besides those which have been already mentioned, are the 'Round Table,' in which he was assisted by Mr. Leigh Hunt, the 'Table-talk,' the 'Plain Speaker,' which three are collections of essays in two volumes each; the 'Characters of Shakspeare's Plays;' the 'Spirit of the Age,' which is a series of interesting sketches of his most distinguished contemporaries; his 'Political Essays,' which are collected from different newspapers and magazines, and published in one volume, with a preface, by Hone; and the 'Life of Napoleon,' which Hazlitt himself looked upon as his great work, and which was his last. The article 'Fine Arts,' in the 'Encyclopædia Britannica,' was also written by Hazlitt.

The principal merits of Hazlitt as a writer are force and ingenuity of illustration, strength, terseness, and vivacity. Another characteristic, which, by excess, often becomes a fault, is abundance of quotation. And while, as has been said, one good quality frequently exhibited in his writings is terseness, it often happens that he is chargeable with the opposite faults of verbiage and diffuseness. There is also a want of repose in his style, which prevents its pleasing for a long time, and which, despite the splendour of particular passages, tends to leave an unsatisfactory general impression. But in a number of fine passages which one would read, not only once, but again and a third time, or short, stinging, nervous sentences, which, without an effort, would impress themselves on the memory, there are few writers who can match Hazlitt. We hardly know, in the whole circle of English literature, not even Jeremy Taylor's writings being excepted, a finer specimen of accumulative eloquence than the account of the intellectual life of Coleridge in the 'Spirit of the Age.'

Hazlitt's chief title to fame is derived from his Essays on subjects of taste and literature, which are deservedly popular. For an historian he was too prejudiced, to say nothing of the unfitting luxuriance of his style; and he was not clear-headed enough for a metaphysician.

His personal qualities were doubtless not of that kind which gains the good-will or affection of men. Yet there was something in his moral conformation, and that not little, to be admired. If amiability was wanting, strength was there; and the regret with which one contemplates his irritable temper and its constantly distressing consequences is in some degree at least compensated by admiration for the moral courage with which he was ever ready to withstand the conventions of the world and despise the frowns of the great.

Since Hazlitt's death, two volumes of his 'Literary Remains' have been published by his son, with a short life, which shows much taste and good feeling, and to which we are principally indebted for the above account.

HEAD. [BRAIN; SKULL.]

HEAD, INJURIES OF THE. From the many peculiar and important features which they present, injuries of the head have properly received a separate consideration in all systems of surgery. For not only is the brain so essential to life that even its least injury must be regarded as serious, but the parts around and guarding it have many peculiarities. The skull, composed of two thin layers of bone, much exposed to external violence, and protected from it by only slight coverings, is extremely liable to fracture, and it is covered by a very dense and tightly applied membrane, the pericranium, of which the injuries and diseases exhibit all the peculiarities of those of other fibrous membranes. By the free communications of its vessels with those of the similar membrane (the dura mater) lining the interior of the skull, and less directly with those of the brain, disease is very liable to spread from the pericranium to these more important parts; and it is itself covered by firm unyielding muscles, and tendons, under which disease is always prone to extend widely. The injuries of the head are best considered as they affect the parts enclosing the brain or the brain itself.

In mere bruises of the scalp two circumstances are worthy of notice. A vessel of some size may be burst without the skin over it being wounded, in which case a most copious effusion of blood takes place, raising up the scalp from the skull, and producing rapid swelling of the whole of the upper part of the head. It needs however no particular treatment; no incision should be made into it, for if cold wet cloths be diligently applied, the blood will be again rapidly absorbed. If the effusion of blood from the bruise take place between the pericranium and the skull, the former is raised into a tumour, with sharp defined edges, and yielding to pressure in a manner so similar to that of fracture with depression of the skull, that the most experienced surgeon might be deceived and induced to apply the trephine, but for the rule that it should never be employed except in cases in which the brain itself is implicated.

A common superficial wound of the scalp needs no particular treatment. It should be closed with sticking-plaster after the hair around it has been shaved off, and it should be kept cool; but to guard against mischief to the adjacent parts, the patient should avoid all stimuli, and all exertion of either body or mind, till it is completely well. Not unfrequently a violent oblique blow will strip off a large flap of the scalp so as even to denude the bone. In cases of this kind, the part, after being carefully cleaned, should be accurately replaced: if absolutely necessary, a suture may be inserted to ensure more exact adaptation, and the rest should be closed by adhesive-plaster; the head around, being shaved, must be kept perfectly cool; the patient must be placed on a low diet, take aperient medicine, and remain quiet; on the first appearance of general excitement blood must be taken from the arm, and by leeches applied round the wound; under this treatment many cases get well with almost singular rapidity; but if irregularities be permitted, serious consequences may ensue even from the slighter injuries.

One of the most common of these sequels of injuries of the scalp is erysipelas of the head and face. It generally occurs in persons of an unhealthy habit, in hard drinkers, and in the full and plethoric. It commences about the third or fourth day after the injury; the patient begins to complain of headache and a feeling of general illness; he has a shivering fit, followed by nausea, thirst, and restlessness; a quick and hard pulse, and a thickly-coated tongue; he cannot sleep, and is perhaps slightly delirious. Soon after these symptoms have commenced the head and face feel very hot, and become red and swollen, appearances which increase, and after a day or two are accompanied with an eruption of small blisters, full of yellow fluid. There is no pain on touching the parts; but by the great swelling the eyes are often closed, and the features almost obliterated. Active reducing measures should, as a general rule, be early employed, and continued, if the disease does not yield, as far as the patient's strength will permit; and purgatives, with small doses of mercury, should be given, for the liver is very generally affected. After a period of from five to eight days the inflammation in most cases subsides, the cuticle scales off, and the wound, which had assumed an indolent unhealthy appearance, acquires a vigorous aspect, and rapidly heals. But in some cases the cellular tissue thus affected suppurates and sloughs, the scalp is separated, and there is profuse discharge from the wound. One or two incisions should in such case be made into the sloughing part, to admit of the free separation of the sloughs; but even with this the disease will sometimes spread and prove fatal.

Another affection which sometimes follows injuries (and especially punctured wounds) of the external coverings of the skull is inflammation and consequent extensive suppuration in the loose tissue connecting the tendon of the muscle covering the top of the head with the pericranium.

The general symptoms of fever are in these cases less severe than in erysipelas; the scalp is less hot and swollen, but more painful and very tender; the face is never affected. After a few days of general illness, a feeling indicating a collection of fluid may be perceived over some part of the head; and on making an opening into the swelling which has formed there, a quantity of matter may be pressed out of it from beneath a large portion of tho scalp. When this affection is suspected to be coming on, leeches should be put on the head in large numbers about the wound, and cold diligently applied; but if matter should form, one or more free incisions should be made through the scalp to let it out, and the part afterwards treated like a common abscess.

In cases in which the bone has been exposed, the same general and local treatment should be employed. The scalp when replaced may at once unite to the bone; or if it do not, granulations may spring up from the surface of the bone and close the wound: in worse cases, the outermost layer of the skull may die, and require a tedious process for its exfoliation and healing; in the worst, the whole thickness of the skull may perish, and the dura mater be exposed. In all these cases the mildest treatment is requisite, but as the disease is extremely liable to spread to the interior of the skull, the general health should be carefully watched, and if any indications of mischief arise, general or local bleeding should be at once employed.

When the bone itself is injured, no active treatment should ever be adopted, unless there are evident signs that the brain is suffering from compression or other palliable injury. These fractures of the skull get well even more rapidly than those of other bones; and in somo cases, especially in children, the skull may be forced in to some extent, but when it does not produce any derangement of the functions of the brain the injury will be repaired, and health perfectly restored. Cases of fracture of the skull in which the brain is not at first injured may be amongst either the most simple or the most dangerous in surgical practice—for the least intemperance or irregularity committed within some time after their reception may produce irreparable inflammation of the brain or its membranes.

Injuries of the dura mater (the membrane lining the interior of the skull) are of yet more importance, because they more immediately affect the brain. The dura mater is connected with the skull by a tissue in which numerous vessels ramify, and these may be ruptured by the jar from a blow which does not even break the skin. The blood that flows from them, accumulating between the dura mater and the skull, produces compression of the brain. The chief indication of this very dangerous accident having occurred is that the patient, who for some time after the blow had seemed only stunned, or had been even quite sensible, gradually becomes dull, sleepy, comatose, and at last totally insensible, just like one suffering from apoplexy. These symptoms supervene with a rapidity corresponding to the size and number of the vessels ruptured; the most rapid are those in which, by a blow on the side of the head, the main artery, supplying the dura mater and upper part of the skull, and which ascends just before the ear, is wounded. The only hope in these cases is to bleed the patient largely, to check the flow of blood in the head, and if that be not evidently beneficial, to apply the trephine wherever it is most probable that the blood may be found and removed. It must be confessed however that there is little prospect of doing good by trephining in these cases; it is seldom possible to decide at what part of the skull the blood is effused, or whether it may not be between the dura mater and the brain, or even in that organ itself. The symptoms in each case are the samo, but tho mechanical removal of the blood is possible only when the blood is immediately beneath the upper parts of the skull.

Instead of blood, purulent matter may collect between the dura mater and skull, and produce equally fatal results. This is indicated by the patient (usually some considerable time after the accident) complaining of headache, restlessness, and extreme languor; he has frequent irregular shiverings, his pulse is quick and hard, and he cannot sleep: if unrelieved by treatment, all these symptoms increase, and are shortly followed by delirium, convulsions, insensibility, or paralysis, which are no distant precursors of death. Early after their first appearance, a puffy, soft, but not very hot nor painful tumour, forms over the part struck. If this be opened, the pericranium will be found detached for some extent from the skull, which when exposed is seen to be dead, of a dull yellow colour, and covered by purulent fluid. In this case it may be expected that the dura mater is separated from the interior of the skull to the same extent that the pericranium is from its exterior, and the only hope of relieving the patient is to perforate the dead portion of bone with tho trephine, and let out the matter collected between it and the dura mater, and which compressed the brain.

The brain itself may suffer injury either from blood effused in it by rupture of its vessels, from compression by fractured portions of bone being forced down upon it, from wounds, from concussion, or from inflammation, and its various effects following any of these injuries. The first need not here be particularly treated of; it does not differ in its symptoms from the casos of common apoplexy with effusion of blood [APOPLEXY], and admits of no mechanical treatment. The second class comprehends the most important injuries of the head; those of 'fracture with depression,' as they are called, and those which occasionally happen in children, in which the skull is indented without being broken. The symptoms of such an injury are insensibility, generally in direct proportion to the degree of pressure; the breathing is slow, laboured, and snoring, and at every expiration the cheeks are puffed out and elevated; the pulse is slow and irregular; the pupil widely dilated and insensible to light; the patient neither feels nor moves, and lies as if in a fatal state of apoplexy. The part struck may of course present most varied characters: it may be *starred* from the centre of the blow, so as to have a shallow conical depression; it may be fissured, and one edge have passed under tho other; or it and tho scalp may be broken up confusedly, and the brain be protruding through the openings in them. It is worth remembering that the inner part of the skull may, in consequence of its brittleness, be much more widely fractured than the external, so that the degree of pressure on the brain is not always indicated by the depth of the indentation felt in the scalp. If unrelieved by treatment, the patient from the time of the accident grows more and more insensible; his pulse becomes more irregular, and he rapidly dies. The evident and indeed the only mode of affording relief is to remove the pressure from the brain, by exposing the fractured part of the skull by enlarging the wound in the scalp, or making a fresh one, and taking away or elevating all the portions of bone that are depressed. The mode of doing this will be determined in each caso by the form of the fracture and other circumstances; in some it may be sufficient to remove the loose pieces with forceps; in others, to saw off portions with a Hey's saw, or to apply the trephine and raise tho other depressed parts to their proper level with an elevator. These proceedings however must of course be limited to the cases in which the fracture is in a part within view; when it extends across tho base of the skull no mechanical means are applicable, and recovery is therefore extremely rare. Such cases, and all others in which compression cannot be mechanically relieved, can only be treated like common apoplexy, by bleeding the pationt, by cold sedulously applied, and by rigorous reducing measures. The after-treatment of cases in which the trephine or analogous means have been usod is nearly the same as in wounds of the skull and soft parts; the edges should be brought gently together, and slight pressure employed to support the dura mater where it is exposed by the aperture in tho skull; and the other usual precautionary and curative measures, as cold, local bleeding, &c., resorted to.

The immediate consequences of wounds of the brain vary greatly, and indeed unaccountably: in some cases a very slight injury is rapidly fatal, as in those (of which many are now recorded) in which a pointed instrument has passed in through the orbit, and produced almost instant death; whilst in others severe and extensive injuries, as from gun-shots, have been followed by serious symptoms at only a late period from their reception. In most of the cases whore the dura mater is perforated, whether by wound or by ulceration, the wounded or exposed brain protrudes through the aperture in the form of a darkish dirty-looking fungous mass, called 'Hernia Cerebri.' Its surface discharges purulent matter abundantly, and often bleeds slightly: pressure on it, as on tho brain itself, produces immediate insensibility; but the whole mass may be cut off without producing any pain or ill consequence. This is indeed the best treatment of it. If after having protruded to some distance it shows no disposition to decrease or to slough, it should be cut down to the level of the skull, and gentle pressure by compresses covered with the mildest ointment applied, so as to compensate, if possible, for the deficiency in the dura mater. Should the mass again sprout forth, the same treatment may be repeated. In a few cases the growth is checked, and the brain produces healthy granulations, which unite to the surrounding parts and skin over; in others the fungous mass sloughs and the remaining parts heal; but in the large majority the exposure of the brain and its irritation by surrounding parts produce such continued inflammation of it as proves fatal.

The last injury of the brain that needs particular notice is that called concussion or commotion. The exact nature of it is totally unknown; the name indicates only that which has been supposed, viz. a shaking or general disturbance of the minute parts of the brain. In its slightest degree it is merely a stunning, from which perfect recovery takes place in a few minutes; in its most severe, it is rapidly fatal; but even in these, a post-mortem examination discovers no alteration whatever in the structure of the brain. One of the most interesting points in surgery is the diagnosis of concussion from compression of the brain. As the latter seldom occurs without the former (for of course a blow which would fracture or indent the skull would violently shake the brain), compression has the symptoms of concussion, with the addition of some of the most severe which we have already mentioned. In concussion the patient is insensible only to slight impressions, for if he be loudly called to, he will wake up, answer a word or two, perhaps even rationally, and then relapse into the same state. If he be severely pinched or otherwise irritated he will withdraw the part so injured: he occasionally moves his limbs; he appears, in short, as if in a sound heavy sleep like that of a drunken man. The breathing is not stertorous, but generally quite natural; the pupil is contracted and irritable; the pulse is sometimes unaffected, but in severe cases small and weak; there is nausea or vomiting, and the extremities feel cold. If the case is about to terminate fatally, the whole body grows rapidly cold, the pulse becomes irregular and weaker, the breathing short and interrupted, and the insensibility increases. In treating cases of concussion much caution is needed: it has not appeared that bleeding, which is the remedy popularly expected for all such accidents, has at all diminished its primary symptoms, nor has the contrary treatment by stimulants been more successful. The patient, while suffering from the immediate stunning consequences of the blow, should merely be kept quite warm in bed, and carefully watched; if the pulse grow weaker, the extremities colder, and the other symptoms of sinking seem increasing, stimulants are first called for, and should be given till he is completely roused to his former state; but if, instead of being depressed, he remain stationary, no active means of any kind should be employed. Cases are not rare in which, after remaining in a nearly insensible state, as if in a sound sleep, for four, six, or eight weeks, with only very slight temporary alterations, the patient wakes, complaining of but little inconvenience, and rapidly recovers. If instead of waking nearly well, he is observed to grow restless, to seem suffering from headache, or should he be delirious or convulsed—if his pulse becomes quick and hard, and his eyes are hurt by strong light—he has in all probability inflammation of the brain, which is a most frequent consequence of concussion, and must be at once met by the active depleting and reducing measures necessary for its cure, from whatever cause it may arise. In some cases the symptoms of concussion gradually change into those of compression, which may then be suspected to arise from effusion of blood into or on the brain, as in the cases already mentioned.

The account here given is only a sketch of the most prominent and constant symptoms, progress, and treatment of the effects of injuries of the head. There are other symptoms that occur occasionally, and as it were accidentally, which it is necessary briefly to advert to. Furious delirium, lasting for some days and requiring active depletion, sometimes immediately follows concussion; violent convulsions also ensue, either on slight compression or on concussion; paralysis or hemiplegia is not unfrequently produced directly by compression, and they still more commonly occur as its sequels. Loss of memory, sometimes most singularly limited to particular classes of events or things; impairment of individual sensations, and various forms of insanity, are all the occasional consequences of these injuries, or of the inflammation and disorganization of the brain which follow them, and to the prevention or cure of which the chief attention is, in the majority of cases, to be directed.

HEARING. [EAR.]

HEARNE, THOMAS, an eminent English antiquary and editor of books and manuscripts, was born at White Waltham, in Berkshire, in 1678, where his father was the parish clerk. In 1692, under the patronage of Francis Cherry, Esq., of that place, with whom he had till then lived as a menial servant, he was placed at the free-school of Bray; and subsequently, in 1695, at that gentleman's expense, was entered of Edmund Hall, Oxford, where Dr. White Kennet, afterwards bishop of Peterborough, was his tutor. Dr. John Mill, who was principal of the hall, and Dr. Grabe, gave Hearne much employ in his younger days in the collation of MSS. He became B.A. in 1699. In 1701 he received his first employ in the Bodleian Library, of which Dr. Hudson had just been chosen keeper. He was afterwards made janitor of the library, and in 1712 succeeded to the place of second librarian. In January, 1715, he was elected architypographus and esquire beadle of civil law in the university, which post he held with his under-librarianship till the month of November following, when, finding the two places untenable together, he resigned the beadle's place, and soon afterwards his post in the Bodleian Library, on account of the oaths to the government, with which he could not conscientiously comply. He continued a non-juror to the last, much at the expense of his worldly interest. In the latter part of his life he resided principally at Edmund Hall, preparing and publishing his various works; but his constant recurrence to Jacobite sentiments, even in the prefaces to publications which could have no connection with them, kept him as constantly at variance with his neighbours in the university; and he underwent more than one prosecution. Hearne's temper was naturally irritable, and he was far from being either an amiable or a happy man. His life however was one of unwearied literary industry, and English antiquaries and historians will be for ever indebted to him. He died June 10th, 1735, in consequence of a cold, succeeded by a fever which was improperly treated.

Hearne's publications, almost exclusively printed by subscription at Oxford, were very numerous. Among the most valuable were an edition of Livy, 6 vols. 8vo., 1708; the 'Life of Alfred the Great,' from Sir John Spelman's MS. in the Bodleian Library, 8vo., 1710; Leland's 'Itinerary,' 9 vols. 8vo., 1710; Leland's 'Collectanea,' 6 vols. 8vo., 1715; the 'Acts of the Apostles,' in Greek uncials, from a very antient MS. in Archbishop Laud's Collection, 8vo., 1715; Livius Foro-Juliensis's 'Life of Henry V.,' 8vo., 1716; Alured of Beverley's 'Annals,' 8vo., 1716; Roper's 'Life of Sir Thomas More,' 8vo., 1716; Camden's 'Annals,' in Latin, 3 vols. 8vo., 1717; 'William of Neubridge,' 8vo., 1719; the 'Textus Roffensis,' 8vo., 1720; Fordun's 'Scotichronicon,' 8vo., 1722; 'History and Antiquities of Glastonbury,' 8vo., 1622; Heming's 'Chartulary,' 8vo., 1723; 'Robert of Gloucester's Chronicle,' 2 vols. 8vo., 1724; 'Peter Langtoft's Chronicle,' 2 vols. 8vo., 1725; 'Adam of Domerham,' 2 vols. 8vo., 1727; the 'Liber Niger Scaccarii,' 2 vols. 8vo., 1728; 'Hemingford's History,' 2 vols. 8vo., 1731; Otterbourne and Whethamstede's 'Chronicles,' 2 vols. 8vo., 1733; the 'Annals of Dunstaple,' 8vo., 1733; and 'Benedict, Abbot of Peterborough,' 2 vols. 8vo., 1735.

Hearne left his manuscript collections, by will, to Dr. William Bedford, of whom they were purchased by Dr. Richard Rawlinson for a hundred guineas, and by him bequeathed, together with his own manuscripts, to the Bodleian Library. Hearne's MS. Diary, in a hundred and fifty small paper books, is amongst them.

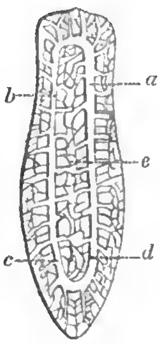
Several of Hearne's pieces were reprinted at different times, and in 1810 the project was entertained of reprinting the whole series in a uniform manner; but after the publication of four volumes, containing Robert of Gloucester and Peter Langtoft's Chronicle, the scheme was abandoned.

(*Lives of Leland, Hearne, and Wood*, 8vo., Oxford, 1772; Nichols's *Lit. Anecd. of the Eighteenth Century*; Chalmers's *Biog. Dict.*, vol. xvii., 275-284.)

HEART is the central organ of the circulation, and by its alternate contractions and dilatations exercises the principal power by which the blood is moved through the bodies of the higher animals.* Its anatomy and physiology will be made most easily intelligible by considering first the principal varieties of the circulation or other motion of nutritive fluid which occur in the animal kingdom; bearing in mind that the main objects for which such a motion is required are a constant supply of fluid adapted for their nutrition to all parts of the body, and its regular exposure to the influence of atmospheric air, that by the process of respiration it may be fitted for maintaining the life of the animal.

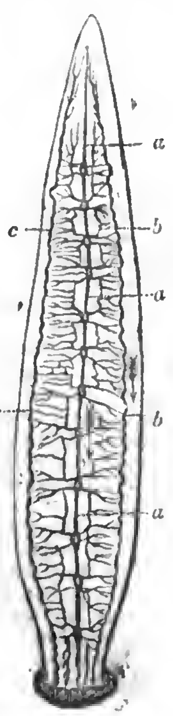
The simplest mode by which a distribution of nutritive fluid is effected is by means of ramifications proceeding from the stomach or intestinal canal to various parts of the body, which occurs in the polyps, infusoria, intestinal worms, echini, medusæ, and other zoophytes. In all these the digestive canal and the circulating system form but one apparatus: the food, which in the higher animals requires a complicated process of assimilation before it is fitted to move with the blood, is in them already adapted for nutrition. In most of them currents can be seen passing in opposite directions along the canals opening into the digestive cavity, exactly like those well known to exist in the stems of charæ, and probably produced by the motion of ciliæ which line the tubes, but are too minute to be discerned even with the microscope.

In the planariæ and some of the trematoda a separate vascular system has been discovered in addition to the ramified digestive tubes. In the former the main trunk has the shape of an oval loop (*a*, *b*, *c*, *d*), from which capillary networks arise and communicate freely together, and with a dorsal median vessel (*e*).



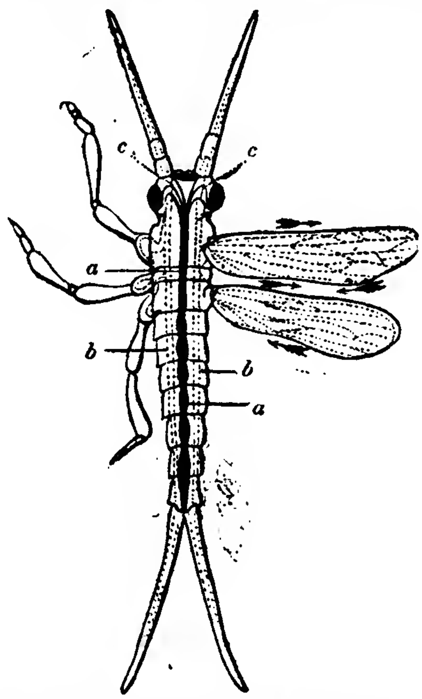
These vessels have been seen contracting and dilating, but no regular course of fluid has yet been discerned.

A more perfect form of circulation of this kind is found in the annelida, and it has been closely observed by Müller in the leech, as shown in the annexed drawing. There are



two main lateral vessels (*b*, *b*, *c*, *c*), communicating at their extremities and by transverse branches with each other, and with a third central vessel (*a*, *a*, *a*), which contains within it, bathed in its blood, the nervous cord, and presents knot-like swellings at the same situations as that cord does. Alternate motions of the blood may be seen in these vessels: at one moment the lateral vessel (*b*, *b*), and the central (*a*, *a*, *a*), with the communicating branches between them, are seen filled with blood; while the other lateral vessel (*c*, *c*) and its branches are empty. In the next moment *c*, *c* and its branches are filled, while *a* and *b* are empty; so that one lateral vessel, and the central one, are always opposed in action to the other lateral one. The central continues acting with one of the lateral for twenty or twenty-five pulsations, and then its relation changes and it acts in unison with the other. During the contraction of a lateral vessel the blood evidently flows from it through the middle transverse vessels over to the other side, and in the next moment returns. The contraction proceeds gradually from behind forwards, so that a wave (as it were) of blood is seen passing from one end of the lateral and of the central vessel to the other, and then returning in the contrary direction through the other lateral vessel. In this manner it is probable that a constant circulation is maintained along the sides of the animal, and its direction seems to be changed after every eight or thirteen pulsations. The same general type of circulating system is found in earthworms and all the other annelida.

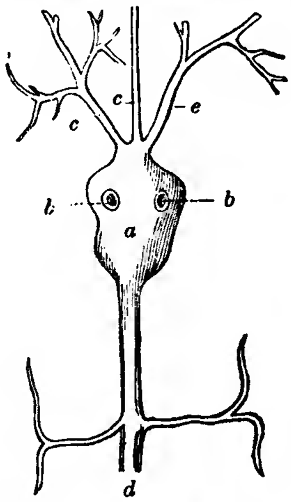
Hitherto nothing has been seen which could fairly be called a heart, nor have the vessels presented any characters by which they could be separated into systems of arteries and veins, for all alike seem to perform at different times the functions of both. A more distinct division of the parts of the circulating system is found in insects. They have a



large vessel (*a*, *a*) running along the back, divided by numerous constrictions into a series of communicating cavities, between which there are lateral openings through which the blood is received, and which are guarded by valves to prevent the blood from flowing out. Through this, which is commonly called the dorsal artery, but which may rather be regarded as a series of ventricles, the blood passes from behind forwards, diverging into small streams, one of which flows to each of the antennæ, feet, &c. No distinct vessels can be detected in which these minor currents may run; they seem simply to pass through the various tissues, and having arrived at their destinations, to form there into arches, and return and empty themselves into abdominal vessels, *b*, *b*, which may be regarded as veins, and through which the blood flowing from before backwards is returned into the dorsal artery through the communications which exist between them at the posterior part. This is also the plan of the circulating system which with various modifications prevails in the arachnida and the lower crustacea.

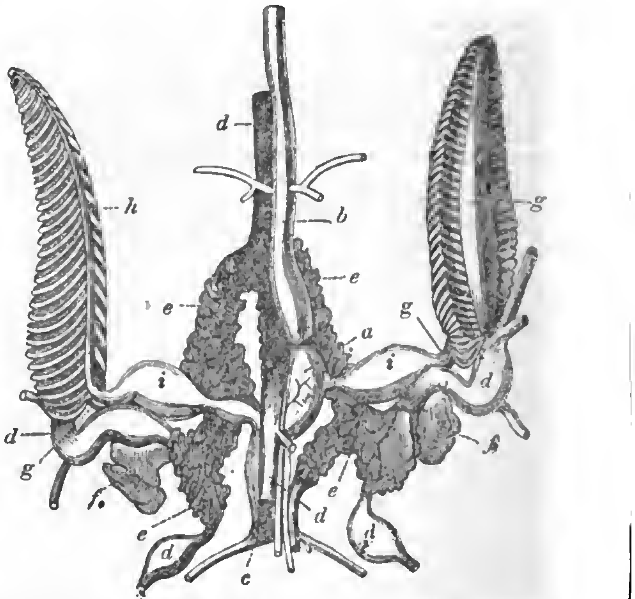
In the orders already mentioned no special arrangement of vessels has been found for the purpose of exposing tbe blood to the influence of the air. Either the whole or part of the blood undergoes respiration on the whole surface of the body, or at the tracheæ, or the vesicles arranged in especial systems for that purpose. In those which follow however, we shall observe a separate and complicated respiratory apparatus; and that the form of the heart and its large vessels are adapted in accurate correspondence with that of the gills or lungs, and according as the whole or part of the blood is required to be exposed at each round of the circulation to the influence of the air.

The simplest kind of a heart, forming a defined cavity, is found in the larger decapoda, and some other crustacea. The annexed sketch represents the heart and large



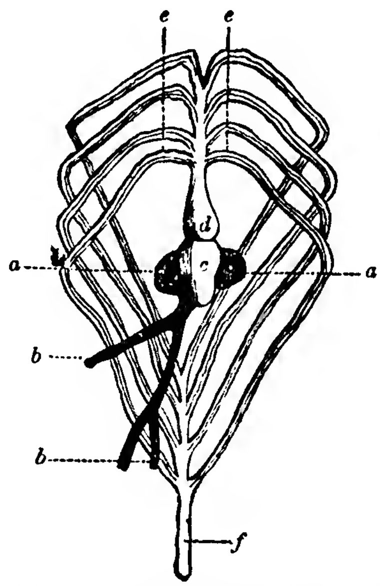
arteries of the lobster. There is a single cavity or ventricle (*a*), into which tbe arterial blood flows from the gills by vessels which unite into two trunks, whose orifices (*b*, *b*) are protected by valves. Six main arteries proceed from the heart; the three anterior (*c*, *c*, *c*) go to the head; two from its inferior part to the liver; and the largest of all (*d*) from its posterior part.* This last gives off a superficial and a deep artery to the tail, and then curving forwards under the sternum, gives branches to the feet and deep arteries to the head. From these the blood returns by veins into a number of venous sinuses which lie at the sides by the articulations of the legs with the chest, and all communicate together. From them branchial arteries proceed, which run on the outer edge of the gills, and pass through capillary vessels in them, terminating in branchial veins which unite into the two trunks that open into the heart.

In most of the mollusca the blood flowing through the branchial veins, instead of being poured directly into the ventricle, is received first into an auricle, presenting the first instance of a heart with more than one cavity. In most of the gasteropoda and pteropoda the auricle is single; in the bivalves the auricle is double. In the latter division, the blood, collected from the systemic veins into one venous reservoir, before going to the gills passes by numerous branches into a spongy tissue wbicb Bojanus calls a lung, and others a kidney, but whose real nature is as yet unknown. From this a few branches pass at once into the auricles, but the greater number go as branchial arteries to the gills. In the brachiopods the systemic ventricle is also double, each cavity giving rise to an aorta. But the most singular form of heart in this class, and one of much interest as presenting all the cavities separated, which in higher classes are united in one body, is tbat of the cuttle-fish. The blood passes in it from a systemic or central ventricle (*a*), through the aorta superior (*b*), and inferior (*c*), and is thence distributed throughout the body, whence it is collected into six venæ cavæ (*d*, *d*, *d*, *d*, *d*, *d*), which open into two branchial auricles (*e*, *e*), conducting into two branchial ventricles (*f*, *f*), by which it is forced through branchial arteries (*g*, *g*, *g*). From the extremities of these it is received into branchial veins, of which that of the left side (*h*) is here shown, which open into tbe two systemic



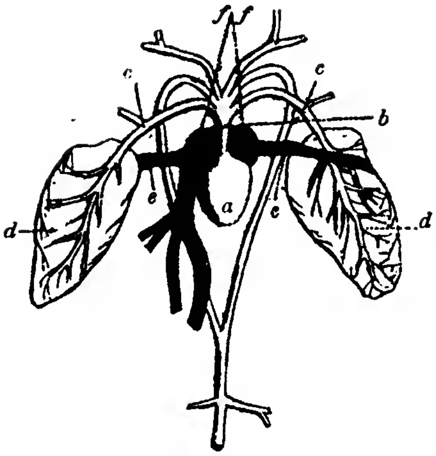
auricles (*i*, *i*), conducting again into the systemic ventricle (*a*). Here then we have the first appearance of a separate heart for the respiratory circulation, and the elements of all the compound forms which we have now to notice.

Among vertebrate animals the simplest form of heart is found in fish. They have a single auricle (*a*, *a*), which re-



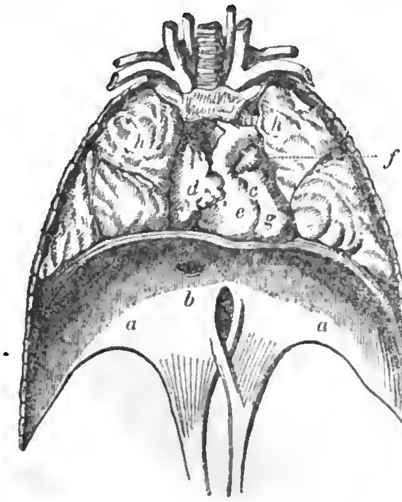
ceives the blood from the trunks of the veins of the whole body (*b*, *b*), and communicates with a single ventricle (*c*), which forces tbe blood into an arterial trunk with a contractile bulb (*d*). From this trunk all the branchial arteries (*e*, *e*) arise, and passing on each side in arches to the gills, divide there into capillary branches. The blood thus aerated passes on, and the arches again unite into a common trunk (*f*), the true aorta, which runs along the under surface of the spine, and sends the blood to all parts of the body. From these it collects again into the systemic veins (*b*, *b*), by which it is carried back to the auricle. The same type of formation is found in the reptiles which have gills, as in the proteidæ in their adult state, and in the larvæ of many which at that period also breathe by gills.

In fish all the blood is subjected to the respiratory process before it passes to the body: in tbe reptiles, which breathe in air, and have therefore a much more complete exposure of the blood to it than fish, who breathe only the air that is dissolved in the water, only a part is exposed before entering the general circulation, but the modes in which this is effected vary greatly. The annexed sketch represents the circulatory system of the frog in its perfect state. It has



a single ventricle (*a*), from which arises a single aortic trunk (*b*), from which proceed the two pulmonary arteries (*c, c*), conveying that part of the blood which is to undergo respiration to the lungs (*d, d*), whence it is returned by pulmonary veins (*e, e*). From the same aortic trunk four other arteries arise, two of which, forming arches, unite to form the dorsal aorta, while the two uppermost are distributed to the head and upper extremities. From the terminations of these arteries in all parts of the body the blood is collected into large venous trunks, which open into the double auricle (*f, f*), from which the aerated blood from the lungs and the impure blood from the system pass separately into the common ventricle, in which they are intimately mixed. In other reptiles the ventricle is more or less completely divided by a septum, which in the crocodilus lucius separates it into two distinct cavities, one connected with a pulmonary, the other with a systemic aorta; in some others the septum is nearly complete, and the mixture of the two kinds of blood is supposed to be prevented by a valve, but in the rest of the order the septum is so small that the blood must necessarily be mixed. In all of this order however the abdominal aorta, which runs along the spine, is formed, as in the frog, of two arches, and in those which have separate ventricles a branch proceeds from each to form it, so that while the head and upper extremities are supplied with pure arterial blood from the left side of the heart, the lower portion of the body receives a mixed blood from the left side and the right.

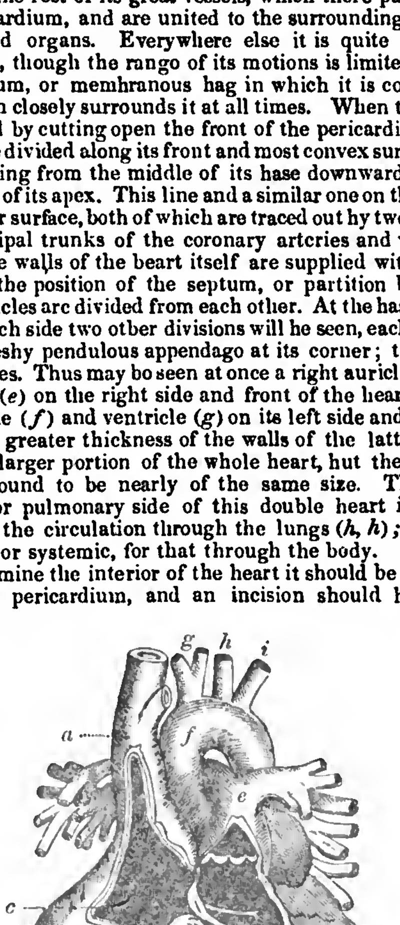
Lastly, we arrive at the complete double circulation of man, mammalia, and birds, to which some of the forms just described make very close approximations. In all of them the blood arrives at the heart from the veins of all parts of the body by two large trunks, the venæ cavæ, superior et inferior, from which it is received into the right auricle, and thence passes into the right ventricle. The right ventricle, by contracting, forces it into the pulmonary artery, in whose branches it is exposed to the air, and passes from them to the pulmonary veins, which open into the left auricle, from which it proceeds to the left ventricle, thence



through the single aorta into all parts of the system, and again into the veins and right auricle.

We may now consider the anatomy of the heart, and the chief phenomena of the circulation, in man.* The heart is of a somewhat conical form, having its base directed backwards towards the spine, and its point forwards, downwards, and to the left side, so that at each contraction it may be felt striking between the 5th and 6th ribs, about four inches from the middle line. It rests upon the diaphragm (*a, a*,) the muscular partition between the chest and abdomen, and the surface upon which it lies is much flattened. It is firmly attached to the diaphragm at its right side, and behind by the inferior cava, which passes through that muscle at the aperture *b*, and above and behind it is fixed, though more loosely, to the upper and back part of the chest by the rest of its great vessels, which there pass out of the pericardium, and are united to the surrounding cellular tissue and organs. Everywhere else it is quite free and moveable, though the range of its motions is limited by the pericardium, or membranous bag in which it is contained, and which closely surrounds it at all times. When the heart is exposed by cutting open the front of the pericardium, it is seen to be divided along its front and most convex surface by a line running from the middle of its base downwards to the right side of its apex. This line and a similar one on the under and flatter surface, both of which are traced out by two vessels, the principal trunks of the coronary arteries and veins by which the walls of the heart itself are supplied with blood, indicate the position of the septum, or partition by which the ventricles are divided from each other. At the base, above and on each side two other divisions will be seen, each having a little fleshy pendulous appendage at its corner; these are the auricles. Thus may be seen at once a right auricle (*d*) and ventricle (*e*) on the right side and front of the heart, and a left auricle (*f*) and ventricle (*g*) on its left side and behind. From the greater thickness of the walls of the latter, they form the larger portion of the whole heart, but the cavities will be found to be nearly of the same size. The right anterior or pulmonary side of this double heart is exclusively for the circulation through the lungs (*h, h*); the left posterior, or systemic, for that through the body.

To examine the interior of the heart it should be removed from the pericardium, and an incision should be made

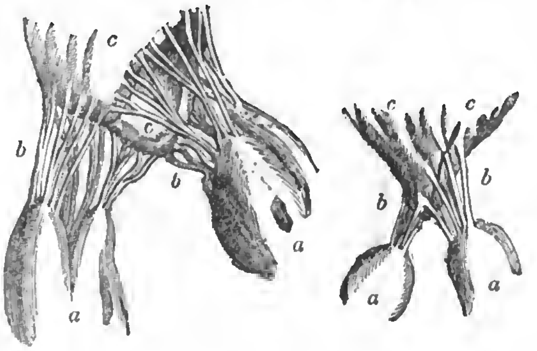


into the front of the right or front auricle, so that an angular flap may be cut out of its walls, and the whole view of the back part and sides of its interior may be exposed. There will then be seen, behind and to the right side, two large apertures; the upper leading to the vena cava superior (*a*), through which all the blood is returned from the head and upper extremities, and the lower leading to the vena cava inferior (*b, b*), by which all the blood is conveyed from the abdomen and lower extremities. These apertures will be seen to be surrounded by a few muscular fibres continuous with those of the auricle itself, and that of the inferior cava is partially guarded by a thin semilunar membranous fold, called the Eustachian valve, varying much in size, and often much torn. The left side of the cavity, on the partition which

* The heart and large vessels of any of the larger of our domestic quadrupeds may be used for popular dissection; their structure differs so little from that found in man, that the present description will almost exactly apply to them.

separates it from that of the right auricle, presents an oval depression (the fossa ovalis) surrounded by an elevated border, indicating the situation of the foramen ovale, through which, during the fœtal state, the blood, which was prevented by the Eustachian valve from passing into the ventricle, was conveyed directly from the right into the left auricle, and thence into the left ventricle. Lastly, at the anterior and left angle of the cavity another and the largest aperture *c* is seen, which leads into the right ventricle, and has attached to its sides a membranous curtain *d*, by which it is occasionally closed, and which is called the tricuspid valve. The general form of the cavity of the right auricle is that of a quadrangular sac, from the right and anterior part of which a small flattened triangular process stands out, from the remote similarity of which to the ear (*auris*) of a dog, the cavity has received its name. Its interior is tolerably smooth behind, by the orifice of the superior cava, on the partition, and about the opening into the ventricle; but to the right and front side, about the auricular appendage and the inferior cava, it is rendered uneven by prominent bands of muscular fibres (the *musculi pectinati*) which seem to radiate from the auricles.

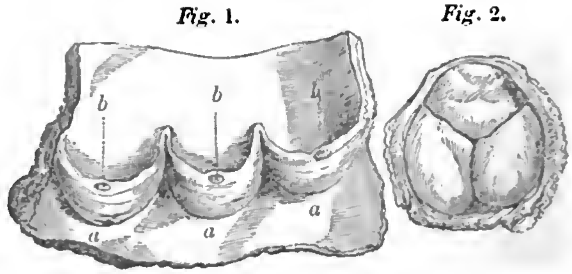
Proceeding in the course of the circulation, a cut should be made from the right auricle through the aperture leading from it into the right ventricle, and along the front of the heart nearly to its apex, and then another from the end of the first upwards into the pulmonary artery, as it arises from the front and upper part of the ventricle. By raising the portion thus cut out, a complete view of the cavity of the right or pulmonary ventricle, and of its communication with the auricle, will be seen. The cavity of the right ventricle has a somewhat conical form, with its base uppermost; that part of its walls which is formed by the septum projecting somewhat into it. Its walls are rendered extremely irregular by prominent bands of muscular fibres crossing each other in every direction, and enclosing spaces of various size and form, which after death are generally found filled with coagulated blood entangled in and adhering to them. Here and there stand out short columns of muscle projecting into the interior, and pointing towards the right auricle; these are called *columnæ carneæ*, and they have attached to their summits fine tendinous cords (*chordæ tendineæ*), which pass thence to be attached to the edges of the curtain-like membrane (the tricuspid valve), which guards the orifice between the auricle and ventricle. This orifice is of a broadly oval form, surrounded by a ring of firm dense tissue, to the whole interior circumference of which is attached the fold of membrane, strengthened by tendinous fibres, forming the valve. The edges of this valve are very irregular, but it may be roughly divided into three principal portions (whence its name), the largest of which lies so as to separate this orifice from that leading into the pulmonary artery. If this valve be pushed inwards towards the cavity



of the ventricle, as in the larger of these figures of the mitral valve, of which the construction though similar is more simple, it will lie nearly flat against the walls, and would in this position present no obstacle to the passage of a fluid from the auricle into the ventricle; but if, on the contrary, it be pushed from the ventricle towards the auricle, its edges will be found to meet so as to close the orifice as in the smaller figure: *a, a, a, a*, the columnæ carneæ; *b, b, b, b*, chordæ tendineæ; *c, c, c, c*, valves. This we shall see is the mode in which it acts during life.

From the front and upper part of the ventricle a smooth short passage leads to the origin of the pulmonary artery *e*, which is attached firmly to the dense ring to which many of the muscular fibres of the ventricle are affixed. At their

Fig. 1. *Fig.* 2.



union, and at the very orifice of the pulmonary artery, three little valves, *a, a, a*, *fig.* 1 (the semilunar, sigmoid or pulmonary valves) are seen, of a semilunar form, attached by the whole length of their convex edges to the walls of the artery, and hanging loosely in it with their free festooned edges directed upwards, enclosing behind them three small spaces, where the artery bulges somewhat outwards. If one looks from the cavity of the ventricle along the interior of the artery, and blows gently into it, the valves will be seen to lie nearly flat against its walls, as in *fig.* 1, and will offer no obstacle whatever to the passage of any fluid in that direction; but if one looks and blows in the opposite direction, from the artery down into the ventricle, the valves will fall inwards, so that their edges will meet, and they will completely close the tube of the artery, as at *fig.* 2, so that unless driven with force sufficient to rupture them, no fluid could pass into the ventricle. It is evident that if the artery be circular, the edges of these semilunar membranes could not exactly meet to close it, but would leave a little space, of a triangular form, between them. This is filled by three little bodies, *b, b, b*, Corpora Arantii, one of which is attached to the middle of the edge of each valve, and which, at the same time that they effect this, afford a strong point of attachment for the tendinous fibres by which the valve is strengthened. The pulmonary artery proceeds upwards, and to the left, in front of the other vessels, and, after a course of about an inch, divides into two branches, one of which turns sharply round to go to the right lung, while the other goes straight onwards to the left. In these organs each artery divides into numerous branches, which become smaller as they become more numerous, and terminate in a most delicate network of vessels, ramifying on the walls of the air-cells, from which, after the blood which they contain has been exposed to the air, it is received into equally delicate pulmonary veins, and through them conveyed in gradually increasing branches to the four main trunks of the pulmonary veins, which open into the left auricle.

It would be useless repetition to describe in detail the left posterior or aortic ventricle and auricle, which differ in no important particular from the right. The walls of both cavities on the left side and all the parts contained in them are thicker and stronger than those on the right; the orifice between them is guarded by a valve which has only two principal divisions, and is therefore call the mitral valve; and the aortic semilunar valves have larger and more prominent bodies (Corpora Arantii) on their edges. The aorta, *f*, proceeds upwards, and to the right side, then arches backwards and to the left, and, turning over the main air-tube of the left lung, passes down along the spine, at the lower part of which it divides into two large arteries (the common iliacs) which supply the pelvis and lower extremities. From the upper part of its arch it gives off the main trunks of the head and upper extremities in three large trunks—that most to the right, called arteria innominata, *g*, is the common trunk which divides into the right carotid for the right side of the head, and the right subclavian for the right arm and side of the neck and chest. Next to it is the left carotid, *h*, and next the left subclavian, *i*, of which the distribution is similar to that of those on the right side.

During life the blood, returning from the whole body by the veins which unite to form the two venæ cavæ, enters the right auricle and gradually distends it, at the same time that the blood returning from the lungs by the pulmonary veins enters the left auricle and distends it; when completely filled a kind of vermicular motion is seen commencing at the point of each auricle, which is rapidly propagated along their walls, and simultaneously empties the contents of the one into the right, and of the other into the left ventricle. The ventricles are no sooner completely filled than they contract suddenly and with much greater force than the auricles, and propel the blood into the pulmonary artery and aorta. They drive it indeed in all directions, but in each ventricle there is but one orifice into which it can find a passage, for that by which it entered is closed by the valve surrounding it. The same contraction of the walls of the heart which propels the blood serves to raise and fix the valves by which its regurgitation into the auricle is prevented; for as soon as any blood is forced under their edges they are lifted up and pressed towards the auricles; and they would be forced into them, but that when they have arrived at such an elevation as to close the orifice they are restrained from passing further by the cordæ tendinæ, which are attached at one end to the edges of the valves, and at the other to the summits of the columnæ carneæ—those muscular pillars, which we have described as standing out into the cavity of each ventricle. The length of these little tendons is exactly measured to the distance to which the valves may be allowed to flap back, and as the carneæ columnæ contract so as to narrow the cavity of the heart, and force the blood out of it, they tighten and fix the edges of the valves against which some of the blood is forced, and thus keep them steady, till the ventricles being emptied their walls relax and permit the valves to be forced down again by the next current coming from the auricles. The blood forced into the artery pushes on that which was already there (for the whole circulating system is throughout life completely filled) and distends the lower part of the vessel, which, by its elasticity, recoils, and contracting would tend to force the blood as well back into the ventricle as forward into the branches. It would accomplish both, and half the power of the ventricles would be thus wasted, but that the semilunar valves, which are prevented from adhering to the walls of the arteries as well by their form as by the little projecting bodies on their edges, as soon as any blood gets behind them, are pushed down and close the passage into the ventricle. The whole of the blood is therefore driven on along the arteries, displacing that which had just before been thrown into them by the ventricles, and itself in turn displaced by the next succeeding wave.

Through the arteries it is distributed to all the body, and returned by the veins; but the veins of the intestinal canal and the organs connected with it unite into a large trunk, the vena portæ, which, instead of at once entering the heart with the others, passes into the liver, and there again divides into minute capillary vessels, from which the bile is secreted, and which pass into the ultimate divisions of a series of hepatic veins, which collect into three or four large trunks which open into the vena cava inferior just before it passes through the diaphragm to enter the right auricle.

A point of much interest is the consideration of the changes which the circulating system of man and the higher animals undergoes in the various periods of their life in the fœtal and in the perfect state. At the very earliest periods, it has been clearly proved that in the embryos of both man and the higher animals the first appearance of the motion of any nutritive fluid is in the form of a circular canal running round the edge of the area in which the future development of the animal is to be effected, an arrangement in some measure analogous to that of the planariæ, and those of the lowest animals, in which a circulating system is first added to the digestive. The first appearance of a heart is in the form of a long tubular pouch, lying beneath the spinal cord, analogous to the dorsal vessel of the insects. The first trace of a separate respiratory system is in that of gills, for at very early periods of fœtal life fissures may be seen by the sides of the neck, in birds and many mammalia, and therefore in all probability they exist in man, beneath which arches of vessels run from the anterior part of a single heart, and collect at their opposite extremities into a single aortic trunk; an arrangement most closely analogous to that of fish. After this, and to the end of fœtal life, the arrangement is adapted to the respiration by a placenta, previous to the possibility of the action of the lungs, which are only formed for respiration in open air. The purified blood coming from the placenta circulates in great measure through the liver, before it enters the right auricle by the inferior cava; from this cavity it passes straight through the foramen ovale, over the Eustachian valve, into the left auricle, whence it is conveyed into the left ventricle, and by it forced through the aorta and its three principal branches to the head and upper extremities, from whence it returns by the superior cava to the right auricle, and passes through it (without mingling with the other current going through it from the inferior cava to the left auricle) to the right ventricle. From this it is carried into the trunk of the pulmonary artery; but as the lungs are at present incapable of performing their functions, it is conveyed through a direct passage, the ductus arteriosus, from the pulmonary artery into the aorta, just below the origin of the left subclavian artery, and from this part it passes along the aorta through the chest and abdomen, and is conveyed through the trunks of the iliac arteries to the placenta, to be again purified. Thus there is a single auricle, but through the right side of it two currents are constantly running in opposite directions; and two ventricles, one forcing the blood to the head and upper extremities, of which the former is at this time peculiarly active in development, while the other forces the blood through the ductus arteriosus to the placenta, and therefore now, as during perfect development, may be regarded as the respiratory portion of the heart. At this time the two ventricles, having nearly equal extents to force the blood through, are of nearly equal size. After birth the left becomes much larger, and is thus enabled to accomplish the more extensive purpose of propelling the blood through the whole body. Directly after birth changes commence which in a few days convert the arrangements for the fœtal circulation into those adapted for the circulation of the completely formed animal: the foramen ovale is completely closed; the ductus arteriosus becomes consolidated; the branch of the umbilical vein, which had passed directly into the inferior cava, is obliterated; and the terminations of the iliac arteries, which had carried the blood to the placenta, contract, gradually close, and are ultimately traceable only in the form of dense solid cords.

We may now consider the powers by which the motion of the blood is effected in man, and the chief phenomena of the circulation in the various parts through which it takes place.

When the ventricles of the heart contract, they are shortened, and become narrower, harder, and firmer. The heart lying loosely in its pericardium, and fixed only where the great vessels pass out of that cavity, recoils from the blood which the ventricles force out; its point is tilted up, and strikes at each ventricular contraction, or *systole*, as it is called, against the wall of the chest, producing that impulse which may be felt by the finger or hand placed just beneath the left breast, and which is almost exactly coincident with the pulse felt at the wrist. At the relaxation or *diastole* of the ventricles they regain suddenly and forcibly their previous conditions. These actions are accompanied with certain sounds. If the ear be placed directly, or on a stethoscope, on or near the part where the heart is felt beating, a sound like that of a gentle breathing is heard coincidently with the impulse of the heart. This is immediately followed by a second sound, which is shorter, sharper, more defined, like the falling back of a light valve, coincidently with which the heart seems to fall back from the wall of the chest. A short pause of perfect silence succeeds, and then the first long sound is again heard. They take place in regular rythm. Dividing the whole period occupied between each two impulses of the heart into four parts, the first sound would occupy two, the second one, and the pause one.

It is unnecessary to allude to various explanations given of these sounds; the most probably correct is that founded on an extensive series of experiments made by a committee of the British Association, and reported at their meetings in 1836 and 1837, viz.:—that the first sound is produced by the vibrations of the muscular fibres of the ventricles during their contraction, assisted in a very slight degree by that of the heart striking against the chest, and that the second is in all probability the result of the falling back of the semilunar valves when the blood just expelled from the ventricles regurgitates. The succession of actions in the heart has been described: the contraction of the auricles is coincident with the pause, for their vermicular and slight contraction does not produce any audible vibrations; the pause lasts till the ventricles are completely distended by the contraction of the auricles: then comes the first sound coincidently with the ventricular contraction, the forcing of the blood into the arteries, the elevation of the valves to prevent the blood from going into the auricles, and to permit it to go into the arteries, the impulse of the heart against the wall of the chest, the pulsation of the great arteries, and followed after a scarcely appreciable period by the pulse at the wrist and other parts distant from the heart. Lastly, the second sound is heard coincidently with the relaxation of the ventricles, the falling down of the valves to permit the blood to pass from the auricles into the ventricles, and to prevent its passing from the arteries back into the ventricles; and the rush of blood from tho auricles into the ventricles, which continues through the whole time of the second sound and the pause.

At each contraction of the ventricles a very large proportion of the blood which they contained is expelled into the arteries, and a very little may flow back into the auricles, especially tho right, before the valves are completely closed, producing the slight dilatation of the venæ cavæ which may often be seen at each contraction of the ventricles. At each contraction of the auricles also it is probable that some blood flows back into the cavæ and pulmonary veins, for they are seen distended rather more suddenly at this time than can be explained by the mere arrest and consequent accumulation of blood in them. However, so large a portion of the heart's power is exerted in propelling the blood into the arteries, that these slight influences in the contrary direction need scarcely be taken into account in calculating its amount. At each contraction of the ventricles about an ounce and a half of blood is forced into each artery, with such force, that Hales found that the blood as it rushed from the open main artery in the thigh of a horse would rise 8 or 9 feet in a glass tube of the same size as the vessel, while in the temporal artery of a sheep it rose 6½ feet, and in those of dogs from 4 to 6 feet. Poiseuille (Magendie's *Journal de Physiologie*) also calculated, by deductions from accurate experiments on animals, that the force of the blood as it streams in the human aorta was sufficient to support a weight of 4lb. 3 dr. and 43 grains. Now if the quantity of blood in the whole body be assumed to be 30 (tr. wt.) pounds, which is probably about an accurate average, and if 1½ oz. be forced from the ventricle at each pulsation, of which, on an average, there are 70 per minute, a portion of blood will go the complete round of the circulation in about 3½ minutes, which is however a somewhat slower rate than we might deduce from the experiments of Hering (Tiedemann's *Zeitschrift*, t. 3), who found that substances injected into the veins of horses could be detected in distant arteries in half a minute.

Harvey considered the heart to be the sole agent by which the circulation is effected, but it is certain that several other agents exercise auxiliary powers. That the heart has however an influence on all parts of the circulation is quite evident. In the larger arteries its effect is seen in the increase of the current which it had set in motion, in exact coincidence with the contraction of tho ventricles; in the smaller ones, by the same increase at a scarcely appreciable interval; in the capillaries, by the occasional pulsatile motion which may be seen in them, when, after an animal has been largely bled, its transparent parts are examined with the microscope, and this though the heart is acting very weakly. Lastly, in the veins we find its influence still exerted; for if the main artery and vein in a limb be exposed and isolated, and the latter be wounded, the flow of blood from the orifice may be exactly regulated by compressing the artery, that is, by preventing, to a greater or less extent, the blood from flowing to the vein with the impulse given to it by the heart. There are cases again in which the veins have distinctly pulsated, and the pulsations have been clearly proved to have been communicated from the heart through the capillaries. To these we may add that the rapidity of the current in the arteries, veins, and capillaries, is always in direct proportion to the strength and frequency of the ventricular contraction, and always more rapid in the parts near them than in those remote from the heart; that it ceases in all the instant the heart is removed, or its influence on a part cut off by dividing the main artery; that in old persons, in whom the whole arterial system of the lower extremities is sometimes ossified and rendered incapable of contraction, the heart alone is sufficient to maintain the circulation through the affected parts; while on the contrary, when the heart's power is by any cause weakened or interfered with, partial stagnation and an extremely languid motion of the blood is found in all the organs. In cases of suspended animation no motion of the blood can be produced till the heart begins to act; but when this is the case, it has of itself sufficient power to set all the blood of the body in a current.

These are so many proofs that tho contraction of the ventricles has a share in propelling the blood throughout the whole course of the circulation; but the heart also assists, by the enlargement of its cavities after their contraction, which, whether it be the effect of mere elasticity, or of an active power of dilatation, certainly takes place with great force. The heart, in short, acts at once as a forcing and as a sucking-pump. The proofs of this are, that the auricles, and still more the ventricles, dilate, not gradually, but suddenly, and with more force than they could be distended by the blood being impelled into them; that the currents observed in living animals aro often seen to be increased coincidently with the dilatation of the auricles; by the velocity of the flow of blood from the auricles into the ventricles being disproportionate to the degree of contraction of the former. This part of the heart's action will be further illustrated in speaking of the influence of atmospheric pressure.

From the heart the blood is poured into the arteries, a series of ramifying tubes through which the current is distributed, divided into a gradually increasing number of streams, which progressively diminish in size, till it arrives at a net work of the most minute canals, the capillaries. As a general rule, when an arterial trunk divides, the sum of the diameters of the branches is greater than the diameter of the trunk—thus in the annexed diagram (in which the arrows indicate the course of the blood), the sum of the diameters of the branches 2 2 is greater than that of 1, and the sum of those of 3 3 3 greater than that of 2, from which they arise. Hence the arterial system has been

1, Trunk of the artery; 2, large branches into which it subdivides; 3, small branches, successively becoming smaller and smaller until they terminate in 4, the capillary branches.

compared in form to a cone, of which the heart is at the apex—and tho stream of blood will be like a current gradually growing wider, so that if no additional impulse be given to it, it will become slower as it becomes more distant from the heart, an effect to which the friction of the blood against the walls of the vessels will also contribute. The effect of both these causes however is so slight that M. Poiseuille has found that the force of the current of blood in all arteries sufficiently large to be experimented on is relatively the same; that in the aorta, for example, bears the same relation to its diameter as that in the artery at the wrist does to its diameter. Thus the diameter of an artery may be taken as a measure of the force of the current of blood in it. It does not appear moreover that the direction in which a branch is given off from the trunk has any appreciable influence on the velocity of the current in it—most frequently the branches of arteries are given off so as to form an acute angle with the continued trunk as 2, from 1 2,—but often they separate at right angles, and less frequently so as to form obtuse angles. Neither can the effect of the tortuosity of an artery be calculated, though there can be little doubt that, *cæteris paribus*, the current in it will be slower. An important point in the arrangement of arteries is the frequent union, or anastomosis, of branches with each other. The purpose of this is evidently to prevent any part being cut off from its supply of blood, by the compression or obliteration of one of its arteries. Hence it is that even when the main artery of a limb has been tied, the nutrition has still been amply effected by the current of blood being diverted into the collateral channels, which subsequently become enlarged. [ANEURISM.]

The chief property of the arteries by which they affect the circulation is their extreme elasticity. It is by this that when dilated they contract on the blood that had been forced into them, and propel it in every direction—and that when elongated they again shorten, and that when empty they remain open and tubular. The chief effect of the action of this elasticity is the gradual conversion of the jetting pulsatile motion which the blood receives from the forcible and successive contractions of the ventricle into an even and steady current. The elastic contraction of any part of an artery after its distension can have no general influence to accelerate the blood, for it would press that fluid equally in all directions, and thus would retard the current coming from the heart to any part to exactly the same degree that it accelerated that passing from that part towards the veins—the one influence exactly nullifying the other.

To convert the pulsatile motion however into a uniform one no more admirable property could have been imagined than this elasticity, which by continually acting to contract the arteries (which are always during health in a state of slight distension) maintains a propelling force upon the blood during the intervals in which the ventricles are at rest. If the elastic power were not exercised, we should see, on opening an artery, a jet of blood, and then a pause, then another jet, followed by a second stoppage of the current, just as when by the successive strokes of a piston we force water through a rigid tube—the jets of blood being coincident with the contractions of the ventricles, and the pauses with the intervals of their dilatation and rest. But the arteries being elastic, when the impulse of the ventricles, which at the same time distends them and forces a jet of blood through an orifice in them, ceases, their elasticity, making them contract, forces some more blood out of the orifice, and thus makes the stream from it continuous. In the arteries near the heart indeed the force of the ventricular contraction is so great that it predominates over that of the elastic contraction; and the current, though continuous, is irregular, presenting a succession of jets—but as we recede from the heart, this predominance becomes less, the succession of jets becomes less distinguishable, and in the veins we find a perfectly equable stream. An artificial contrivance for effecting the same object, viz. the conversion of a series of motions of a fluid into a continuous one, may be seen in an organ. The air is forced into the wind-chest by a series of strokes of the bellows, and if the walls of that chest were fixed it would issue from it into the organ-pipes in the same intermitting manner; but the top of the chest is movable, and is loaded with weights (proportioned to the size of the instrument), so that it maintains a constant and steady pressure on the air below it, which therefore, though driven in by a succession of small forces, passes out into the organ-pipes under the influence of the single force from the top of the chest in a continuous steady current. A similar arrangement is employed in fire-engines, where the elastic power is the air which partly occupies the chest into which the water is forced. [FIRE-ENGINE.]

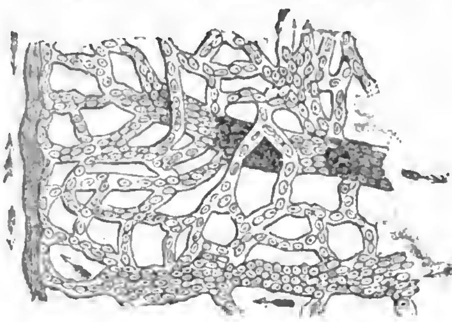
We have said that the arteries are dilated slightly by each column of blood poured out by the ventricles: from this arises their pulse, which may be said to be owing to the dilatation of the arteries produced by the wave which is propagated along the column of blood contained in them. One may form an idea of what is here called the *wave* by observing a ripple in a running stream. There are in that case two different motions of the particles of the fluid: they move all together, with an absolute change of place, and this constitutes the stream; but again, they move separately; one particle or series of particles rises, and the next falls, and as the first falls again, the second rises—this constitutes the ripple or wave. In it the particles undergo only a relative and temporary change of position, for they all return to rest in their former places, as is shown by any light body that may be floating in them, which merely rises to the top of the wave, and again descends to precisely the same place as it had before the wave arrived. So in the circulation there is a constant stream running through the vessels, and at every contraction of the ventricle an impulse is given to that part which is next the heart, producing a wave which is propagated with incalculable rapidity through all the arteries, and causes at each part of them a slight dilatation as it passes within them. The repeated contractions produce a series of such impulses, waves, and dilatations, and when a finger slightly compresses an artery, it feels the tendency to dilatations, in what is called the *pulse*. The degree of dilatation is so slight that its existence was much disputed; but M. Poiseuille has proved that in the larger arteries it is equal to about 1-11th of their average diameter. In feeling the pulse however we perceive a greater impulse than so slight a dilatation could produce, because the finger flattens the artery, and therefore we feel the force of the wave over a large part of its circumference, and we increase its velocity by diminishing the size of the channel. From this description it will be evident that the characters of the pulse by which the conditions of health or disease in any person are decided will depend on two circumstances—the state of the heart, and that of the artery itself. The frequency of the pulse will depend entirely on the number of contractions of the left ventricle in a certain time, and hence the varieties of frequent, slow, irregular, and intermitting pulses are entirely referrible to the heart. The size and degree of contraction of the artery will produce the fullness or smallness, the hardness or softness, and all the other characters which are determined by the touch rather than by mere counting.

But the arteries have another power besides that of their elasticity, by which they influence the circulation, though the mode and extent of its operation are less clear. This is the power of contraction which they possess during life, and which is sometimes, but erroneously, called muscular. The vital contraction of the arteries differs from the muscular contraction, in being slow and gradual, in not being at all times excitable by any of the stimuli that excite the muscles to contract, as mechanical irritation, electricity, &c., but following generally some peculiar influence, as that of cold, or some particular local excitement, as inflammation, &c. From elastic contraction it is distinguished by being exercised only during life, and then tending to reduce the artery often to a smaller calibre than its elasticity would, so that on the complete cessation of life the artery dilates to the size which its elasticity, the consequence of its mechanical structure, would in any circumstances tend to give it. It must be regarded as an instance of that vital contractility which is observed in many tissues quite distinct from the muscular, as in the skin, the dartos, &c. It is best seen by exposing an artery during life, and cutting it directly across; the orifice will then contract slowly, but powerfully, till it is completely closed, either at its very extremity or at a short distance within the tube; if the animal be killed the artery will remain closed for some time, but will then again gradually dilate under the influence of its elasticity.

It does not appear certain that this vital contractility of the arteries exercises any constant influence on the circulation; but, on the contrary, the immediate cessation of the flow of blood from a vein and in the capillaries, when the influence of the heart is cut off by tying the main artery (after separating the collateral vessels), or by removing the heart, and the possibility of exactly regulating the velocity of the current in the vein of a part by permitting or preventing the supply from the heart, seem sufficient to prove the reverse. There are many occasions however in which it evidently acts, and in none more importantly than in cases of wounded arteries, in which it is among the most effectual means of arresting hæmorrhage. [HÆMORRHAGE.] It is shown also in the paleness and shrinking of a part when exposed to cold, and in the smallness of the pulsations then felt in the main artery; and Schwann has seen the diminution in size of the arteries in the mesentery of a frog, when cold was applied. It is probably the principal cause of the emptiness of the arteries after death; for as they will contract long after the heart has ceased to act and to force blood into them, they will pour much of that which they contained into the veins, in which it will be retained by the valves. Hales found that this power of contraction resisted the passage of stimulants during life through the arteries; for a much larger quantity of water could be driven with a given force through the vessels of a part than of brandy, though the latter passed most easily after death. For some time too after the heart has ceased to act, this power is sufficient to resist the injection of fluids into the vessels, and hence in making preparations it is advisable to wait a few hours after death, that the fluids may run with more ease along the arteries.

It is probable that the vital contractility of the arteries is principally useful by regulating, according to their need, the supply of blood to certain organs, for it seems to exist in the greatest degree in arteries which run most tortuously and which are distributed in parts requiring occasionally increased supplies or velocity of blood, as the spleen, &c.; perhaps too it is exerted in maintaining the portal circulation, which can receive but little assistance from the heart, whose influence must be nearly expended in forcing the blood through the capillaries of the digestive apparatus. However, it must be acknowledged that at present we only know that such a power exists; the amount and manner of its action are quite problematical.

Much has always been said of the influence of the capillaries on the circulation, but little has yet been proved. They form a dense network of extremely minute tubes, in which the arteries seem to terminate and the veins to arise, for their delicacy prevents the possibility of discovering any such structure as could decide to which set of vessels they belong, and indeed it is only by observing that the currents of blood-globules pass in regular directions, that we can prove that they are canals with definite membranous walls. When the circulation is examined in the web of the foot of a frog (from which the annexed highly-magnified sketch is taken), or in the transparent parts of other animals, as the fins, tails, or lungs of fish, frogs, lizards, &c., we see



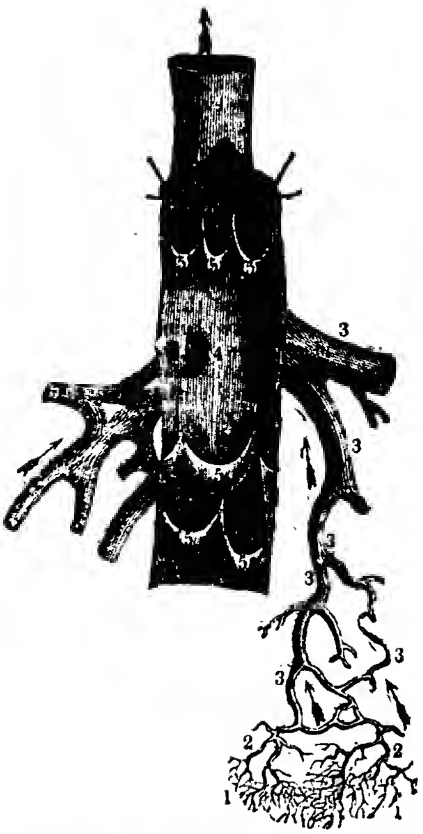
a number of minute globules coursing along in little streams, in some parts in a confused multitude, as in the vessels which are sufficiently large to admit several to pass together, at others in only a single line, where the vessel is but little larger than the globule itself. Here and there a globule is seen to be checked in its course, as if the canal were too narrow for its passage; then it turns a little, and again rolls on. The currents run generally in the same direction in the same vessels, all tending to a larger branch, which may be regarded as the commencement of a vein, and setting out from the minutest termination of the artery. The capillaries are the most delicate of all organic tissues, measuring from $\frac{1}{2000}$ to $\frac{1}{3000}$ of an inch in diameter; they exist in all tissues of the body, varying in arrangement only in the greater or less closeness of the network which they form, and of which the meshes are in some organs so fine as not to exceed in width the diameter of the capillaries themselves, as is the case in the iris and lungs. It is through these vessels that all the important processes of secretion, nutrition, and absorption are effected, for there is no sufficient evidence for believing in the existence of a still more minute series traversed only by the colourless parts of the blood, and which some have described as vasa serosa, vasa exhalantia, &c. But hitherto no observations have been made which can give any idea as to the precise manner in which these processes are performed; no pores can be discovered at the sides of the capillaries for the passage of fluids, which it is therefore probable is effected by simple transudation; nor can any open terminations be seen, for all appear to arise from arteries and terminate in veins.

The influence of the minutest arteries and veins, and of the capillaries, on the circulation, is best seen in the phenomena of local action, as inflammation, blushing, turgescence, &c. If the web of a frog's foot placed in a microscope be irritated, the capillaries are seen slowly contracting, so as sometimes to prevent the flow of blood through them, and if the stimulus be so great as to produce inflammation, then they dilate, and a larger number of globules is seen passing along them with great rapidity. The same may be seen in the human eye, the vessels in the front of which are so minute that they give no colour to it; but if they be irritated by a particle of dust, at once they dilate, and more blood-globules entering them, they are seen as tortuous canals filled with blood. On a larger scale one sees, after a wound or other injury, the parts around grow redder, and swell from the afflux of blood to its capillaries, and if the inflammation arise in a part which can be compared with another similar one, as in the hand, one feels that the pulse is fuller and stronger on the injured than on the sound side, indicating that a larger quantity of blood is passing through it. A still more evident accumulation of blood is shown in blushing, in which, from a mental impression, in an instant all the minute vessels of the face, neck, head, &c., become distended with blood. The paleness of fear is produced by the opposite condition, and we have other cases in which a decrease of the quantity of blood in a part is seen in the deficient nutrition and shrinking of parts which have become useless, as in the gills of tadpoles, the horns of deer, &c. All these circumstances are clearly sufficient to prove that, independent of any influence extending from the heart or arteries, there is in the very minute vessels of all parts a power by which the supply of blood passing through them may be either increased or diminished, whether it be effected by an alteration in the propelling power of the vessels themselves, or, as some imagine, by an increased attraction or repulsion between the tissues and the blood. In any case, we have only proofs of its occasional influence, and that in many it is intimately connected with the nervous system, for it constantly follows pain or mental excitement; but we have no evidence that it exercises any constant influence on the course of the blood.

Following the course of the circulation we come now to the veins, which may be regarded as the most passive of the parts engaged in it, though they are constructed so as to permit many important external agencies to act upon the motion of the blood. While the arteries form a series of branching canals in which the main current is diverted into streams whose number increases as their individual size decreases, the veins are made up of a series in which a vast number of currents gradually unite into others whose number decreases as their size increases (as shown in the following figure), and which all at last meet in two great trunks, the venæ cavæ. In addition to other peculiarities of structure the veins have valves, 5, 5, 5, very similar to those at the origins of the arteries, which are arranged in pairs, or in 3's, at different distances, in the course of nearly all those veins in which the blood has to rise against the power of gravitation. Their simple use is evident; the blood, returning slowly through the capillaries, and much of the force of the heart being expended in propelling it so far, would be apt to retrograde, or remain stationary, if the weight of the whole column in the veins bore down upon the arteries, and through them on the heart. As soon however as a portion is raised into a vein, when it tends to return to the arteries it forces down the valves, which close the canal of the vein and support the blood above them, till another portion rising sends it onwards. Thus while they permit the blood to pass without obstacle towards the heart, they entirely prevent it from retrograding; and if it were stationary, the column of blood would be like a stream branching out, and divided by a number of closed locks in which the portion of fluid between any two is prevented from exercising any influence on the portions adjacent to it.

The veins, like the arteries, are elastic, and this power is occasionally exerted in recovering them from too great distension; they too have a vital contractility whose influence is remarkably shown in their shrinking when cold is applied, but its effects have been even less calculated than in arteries.

We have seen that pressure exerted equably on all parts of the walls of an artery would force the blood as much in one direction as the other, so that it could be of no use in



1, capillary venous branches; 2, small branches formed by the union of the capillary; 3, larger branches formed by the union of the smaller and gradually increasing in size, to form the great trunk, 4, a portion of which is laid open to show its inner surface and the arrangement of 5, the valves formed by its inner coat.

accelerating the circulation; hut from the arrangement of the valves equal pressure on the veins has a very different effect, for it will be prevented by them from producing any retrograde current towards the extremities of the arteries, and thus the greater part of the power exerted will be gained in favour of the flow of blood towards the heart. Such pressure is exercised by the muscles surrounding the veins; as they contract they compress the veins, and thus force the fluid to flow in the only possihle direction, viz. towards the heart. Their influence in this way is shown in the greater tendency to diseased and permanent dilatation of the veins immediately under the skin and other parts remote from the muscles, than in the deep-seated branches in which this varicose state (as it is called) very rarely occurs, although the number of valves in the former is always much greater; in the henefit derived hy supplying the place of muscles by artificial pressure on the veins by bandages, &c.; by the increased fullness of the veins, and velocity of the current commonly seen in bleeding when the bleeding-staff is compressed and moved about in the hand; hy the general acceleration of the circulation by muscular exertion; and, on the contrary, hy the tendency to stagnation and swelling of tho veins in the indolent, or those whose muscular systems are greatly debilitated.

But a still more important influence which is permitted by the presence of the valves is that of atmospheric pressure. It acts principally in respiration. When the chest is expanded for the purpose of inspiration, it is evident that the atmosphere will press with equal weight on all parts to fill up the vacuum thus produced. From without it will pass at once into the most open course through the trachea into the lungs, which it distends; but at the same time the hlood will he forced towards the heart and the great vessels contained in the chest, and will assist in filling up the vacuum to a degree directly proportionate to their volume as compared with that of the lungs. An experimental proof of this influence in the veins (for in the arteries its effect is prevented hy the valves at their origins) is afforded by introducing a tube into the jugular vein of an animal, and placing its opposite extremity in a vessel full of fluid. At every inspiration tho fluid will be seen to rise, and at every expiration to descend a little, indicating first a suction towards the heart, and next a slighter expulsion of fluid from it. It is seen also in cases in which the brain is exposed by removing a portion of the skull; and in cases of Hernia Cerebri [HEAD, INJURIES OF THE], in which, in addition to its slight elevation by the pulsation of tho arteries at its base, the brain is seen to enlarge and rise at every expiration and to become flattened at every inspiration. All these phenomena are still more evident when a strong inspiratory effect is made, as in sighing.

As inspiration draws the blood into the chest, so expiration acts hy compressing all the large vessels to force it out of that cavity away from the heart. Its principal influence must be exerted on the arteries, for the blood would be prevented from passing far along the veins by their valves. In the arteries (and to a less extent in the veins) it is seen to act in the increased velocity of the current that issues from a wound; in the fullness of the vessels of the face and other parts during a strong expiration, or when holding the breath, coughing, or sneezing, actions which are sometimes the causes of rupture of the smaller vessels, and produce an evident alteration in the pulse.

Atmospheric pressure on the veins must also act to some extent in filling up tho vacuum which the sudden contraction of the ventricles must produce in the pericardium. Of course the lungs will expand, and in part effect this by pressing the pericardium towards the heart; but at the same time the blood will tend to rush towards the auricles and dilate them, so that they may fill up the vacant space. Dr. Barry proved this further, by shewing that if a tube be introduced into the sac of the pericardium, without allowing any air to entor with it, a fluid placed in it will be seen to he drawn towards and driven from the sac, at each contraction and dilatation of the ventricles.

Such are the powers concerned in the circulation, and the principal effects which they produce. The influence of each is certain, but what is its extent, and what are the circumstances under which it is chiefly exercised, cannot be accurately determined. In order of importance, the contraction of the ventricles must undouhtedly be placed far highest; then would come the auricular contraction, the ventricular dilatation, the auricular dilatation; then inspiration, expiration, and the cavity in the pericardium when the ventricles contract. All these assist at all times in moving the blood; the elasticity of the arteries tends at all times to equalize the velocity of the current, while their vital contraction and that of the veins, the action of the capillaries, and the muscular pressure on the veins, influence it only at particular periods. It is probable that one of these powers may sometimes replace another whose influence is prevented, as in the lungs on which muscular and atmospheric pressure can have no influence, but in which many circumstances prove an intimate relation between the hlood and the action of the capillaries; and in the liver, in which the ventricular contraction can have little power, but in which the constantly patulous state of the hepatic veins would make them peculiarly fitted for the influence of pressure.

HEART, DISEASES OF THE. When we consider the compound, or rather the mechanically complicated nature of the heart; its constant action, from the hour of hirth to the hour of death; the extent to which every organ depends upon it for power to perform its functions in the animal economy; and the frequent derangement of some one of these organs, which tends to impede or render more laborious the heart's unceasing action—we cannot be surprised at finding that this central organ of life is subject to many diseases, and that there is great difficulty in assigning to each unhealthy state its peculiar cause.

In giving some account of the disorders to which the heart is liahle, it would perhaps be best to arrange them according to their causes; but as it is much easier to obtain a knowledge of the structure of this organ than of the remote causes of its several diseases, we shall here enumerate and describe first those lesions which occur in its investing membrane; secondly, those which affect it as a whole; and thirdly, those met with in its various parts. Those who desire to be further acquainted with this subject are referred to the works of MM. Corvisart, Laennec, Cruveilhier, Bouillaud, Bertin, and Drs. Elliotson, Hope, &c.

Diseases of the investing Membrane of the Heart, the Pericardium; Absence.—The pericardium has been reported as absent in a case published by Mr. Robinson in the 'American Journal of the Medical Sciences,' February, 1833; but the evident exaggerations of his account render it unsafe to give credit to any portion of it.

Pericarditis, Inflammation of the Pericardium, resembles much, in its pathological conditions, inflammation of other serous membranes, and is induced by similar causes, as exposure to damp and cold. It of course presents peculiar symptoms, arising from the situation and nature of the individual organ; thus the patient will complain of tenderness over the region of the heart, amounting, when pressure is made, to acute lancinating pain, which prevents him from lying on the left side, and is much increased by drawing deep inspirations or coughing, this latter symptom frequently depending on the pleura being involved in the inflammatory attack. This pain however is not always so severe; frequently only a sense of oppression is felt. The pulsations of the heart are frequent, sometimes regular, but at other times intermittent, and so strong as to constitute palpitations; but still, if much effusion has taken place into the pericardium, the hand when applied to the chest will have difficulty in perceiving them. The præcordial portion of the thorax is often bulged out by the forcible action of the heart and the quantity of fluid effused into the cavity of the pericardium. This effusion varies much in quantity and consistence at different periods of the disease; thus in many cases only a little bloody serum will be found; in others, pus in large quantities, coagulated lymph, bands of fibrinous matter uniting the two layers of the serous membrane, and even cartilaginous or osseous deposits. The dull sound discovered by percussion in the præcordial region of a person in health is always, in this disease, increased in proportion to the quantity of fluid in the pericardium, and in proportion as this fluid becomes organized sounds will be heard by the application of the stethoscope, and often of the unassisted ear, varying in their nature according to the state of the organizing process, and resembling at one time the creaking of new leather, at another the rubbing together of paper or parchment, the noise made by a file, &c. Other sounds also are frequently heard, which depend upon the disease being accompanied by lesions within the heart itself. Although at the commencement of the disease the patient may have symptoms of acute inflammation, the accompanying fever having a type sufficiently tonic, this state does not endure long; the effusions into the pericardium hinder the heart's action; the free passage of the blood through its cavities becomes further impeded by various internal parts of the organ sharing in the inflammation; and, the circulation being no longer vigorously and equably carried on, a crowd of distressing symptoms, such as inability to sleep, startings, faintness, shortness of breath amounting to suffocation, dropsies, &c., render life almost insupportable, and if not speedily relieved, soon put an end to existence. It is worthy of remark that this disease frequently accompanies acute rheumatism, particularly of the joints; and also that patients, when apparently recovering from acute rheumatism, are sometimes suddenly attacked and carried off by inflammation of the pericardium. So marked is this latter occurrence, that many distinguished physicians have considered that the pericarditis takes the place of the rheumatism, constituting what is termed a 'metastasis.'

The serious nature of this disease and the rapidity of its progress demand very prompt antiphlogistic treatment; but on the contrary some physicians exhibit tonic medicines. A distinction ought to be drawn however between recent acute cases and those in which, from previous attacks, the constitution is weakened, and the heart's action impeded by old adhesions and deposits between the two layers of the pericardium, and perhaps within the organ itself.

Hydro-pericardium; Dropsy of the Pericardium.—In addition to the morbid effusions which may occur in the pericardium, as the result of inflammation of that membrane, it is found in some few instances distended, and sometimes to an enormous degree, by an increase of its internal lubricating secretion: this constitutes dropsy of the pericardium. The fluid may vary in quantity from a few ounces to several pounds; it differs from the effusion of pericarditis in being merely a morbid increase of the natural secretion, not separating into a fibrinous clot, or forming false membranes, like the pericarditic effusion which is the result of inflammation.

The sounds of the heart will in this disease appear to be removed from the surface, and dull in proportion to the quantity of the effusion, but no abnormal sound is produced, unless, by the amount of pressure, some obstruction to the circulation arises in the interior of the heart. The action of the lungs becomes much impeded when the pericardium is greatly distended with fluid, and when this obstruction to the breathing is conjoined to pressure on other neighbouring organs many very distressing symptoms are produced.

The treatment resembles much that of other dropsics; and it has been a question whether or not the operation of puncturing the membrane might be practised.

Diseases of the Heart itself; Absence.—Though the circumstance may seem rather to belong to a treatise on monstrosities, we may remark that this organ has been found wanting in some acephalous beings who have shown, for a short time, evident signs of life.

Displacement.—The heart is not always found in its usual situation at the time of birth, there being cases on record where it occupied the right instead of the left side of the chest, the other organs of the body presenting at the same time a relative change of position without any disturbance of their functions. It has also been found pushed out of the left into the right side of the chest by tumours, or, what is more common, by extensive effusion of fluid into the pleura of the left side of the chest. The whole heart has been found hanging without the thorax, also in the abdomen, and forming a portion of a tumour projected beyond the abdominal parietes, constituting what are termed hernias of the heart. For a more elaborate account of these last-mentioned anormal conditions the reader should consult a memoir on this subject by M. Breschet.

Carditis; Inflammation of the Heart.—The proper muscular structure of the heart is not free from the attacks of inflammation, though whether the morbid action commences in this structure, or in the membranes, is difficult to determine. This however is certain, that when inflammation of the muscular structure exists, there will also be found traces of it in the pericardium, or in the lining membrane of the heart, or in both; and we cannot point out symptoms of the one distinct from those of the other disease: the treatment consequently will be similar in both. The progress of this inflammation may be traced at its different stages. Thus we shall find at one period the muscular structure softened and of a deeper colour than usual, at a further period presenting a greyish or yellowish softened mass; pus also may be found, or abscesses, which will so thin the walls of the heart as to occasion perforations.

Cancerous and Tubercular Development.—In the heart these deadly changes of structure are not of frequent occurrence; still, in support of the fact that they do occasionally occur, we have the authorities of MM. Andral and Laennec.

Hypertrophy of the Heart.—Independently of any morbid process existing in itself, the muscular structure of the heart is often greatly increased in bulk, as if the nutritive process were too active in proportion to the absorbent, and new matter were deposited more rapidly than the old could be removed. From the peculiar nature of the functions of the heart this disease becomes very important, and its effects not less dangerous than manifold. It is usually divided into three kinds; namely, simple hypertrophy, the least common, in which the parietes are thickened without any change of capacity in the cavity; excentric or aneurismal hypertrophy, the form most frequently met with, in which the parietes are thickened and the enclosed cavity or cavities proportionally enlarged; and concentric hypertrophy, where the cavity is diminished in proportion to the thickness of the parietes. Any one of these kinds of hypertrophy may affect the parietes of either cavity of the heart, or the whole organ. The extent to which this increase of size may proceed is enormous; hearts have been found weighing upwards of twenty ounces, whereas the average weight of a healthy heart is from seven to nine ounces. In hypertrophy the shape of the heart is often much altered, the transverse often exceeding the vertical diameter; but these changes must depend upon whether the whole organ, or only a part, be implicated in the disease. The chest is often bulged out towards the left side, the sound produced by percussion more dull than in the healthy state, and the pulsations very strong; indeed the bed-clothes are often visibly raised and the head or hand of the observer when applied to the chest forcibly repulsed, yet the pulsations are for the most part regular, unless palpitations be induced by over exertion. The sounds perceived by auscultation will be found very loud, but not otherwise unnatural, if the disease be not combined with some obstruction to the passage of the blood; and unless some obstruction exists, the functions of other organs will not be much deranged, provided that the hypertrophy be not of great extent; but it seldom does exist to considerable extent without the simultaneous occurrence of some impediment to the passage of the blood, already circulating with extraordinary force.

The accidents referrible to hypertrophy of the left ventricle of the heart are apoplexy and hæmorrbages; it will also contribute to the production of aneurism of the aorta. It frequently happens that the rupture of vessels in the brain by the too forcible expulsion of blood from an hypertrophied left ventricle is materially facilitated by an earthy or osseous state of the coats of those vessels. When the right ventricle, being hypertrophied, sends its blood too forcibly through the lungs, there will be a disposition to congestion of those organs. These effects will be combined when the whole heart is hypertrophied.

This is a disease in which great perseverance is required on the part of the patient and the practitioner, but with proper care it frequently admits of much alleviation. Rest, abstinence, sedative medicines, and more or less depletion, according to the circumstances of the case, are the most efficacious plan of treatment.

Atrophy of the Heart is a wasting of the heart's structure, dependent on deficiency of the nutritive process. This disease is the reverse of hypertrophy, and, like it, may affect the whole organ or only parts of it; its extent is often such that the heart does not exhibit more than half its ordinary weight. Like hypertrophy, it has been divided into simple atrophy, when the walls of one or more cavities are thinned without any change of capacity in the cavity itself; excentric or aneurismal atrophy, when the enlargement of the cavity keeps pace with the thinness of the walls; and concentric atrophy, where the cavity is diminished, but the walls maintain their usual thickness. This state of the heart is usually accompanied by general emaciation, and the pulsations and sounds of the organ will be found feeble in proportion to the extent of the atrophy. In concentric atrophy however the pulse will be firm and resistant, though small, whilst in the excentric form of the disease it will be proportionally soft, feeble, and large.

In atrophy the powers of the patient are all below par, and the proper treatment will be to support the system by wholesome, generous, but unexciting diet, and a salubrious atmosphere. Medicines may be prescribed as auxiliaries, when any additional symptoms appear indicating obstruction to the nutritive functions.

With respect to the causes of hypertrophy and atrophy we can only say that everything which increases the nutritive process in the one case and diminishes it in the other may be considered respectively as causes of either disease.

Dilatations of the Heart.—It has been shown that the heart may be increased or diminished in substance, or, in other words, may be hypertrophied or atrophied; it is also found that the whole organ, or either of its cavities singly, or the orifices of these cavities, may be dilated, the solid parietes being merely extended, without any increase of substance, and the contained cavities proportionally enlarged. As in hypertrophy, so in this disease, according to its extent, the shape of the heart will be much changed. The muscular parietes being thinned and feeble, the circulation of the blood will not be carried on with vigour, and the patient will be weak and unfit for exertion, easily exhausted by small losses of blood, and sometimes carried off by what under ordinary circumstances would be deemed a trifling hæmorrhage. Partial dilatations sometimes occur after carditis; the muscular structure being thinned at some spot by ulceration, the parietes give way, and form a dilated aneurismal pouch. This disease, though it doubtless does sometimes occur in persons of relaxed muscular fibre without any pre-existing impediment to the circulation, is most frequently the consequence of some obstruction to the free passage of the blood from the dilated cavity, and is the natural effect of distension from within. It however not unfrequently happens that when the obstruction occurs at the orifice situated between the ventricle and artery the corresponding auricle will be the cavity dilated, its parietes being so much less strong than those of the ventricle. When the orifice of either of the cavities of the heart is dilated to such extent as to preclude its proper closure by the valves, a reflux of blood will be the result, causing the anormal bellows sound, and a sensation of purring, or of vibration such as would be produced by putting a chord in motion; and should this defective closure exist in the right auriculo-ventricular opening, it will give rise to a fluctuating motion in the jugular vein, called 'venous pulse.' Excessive exertions and strong passions seem to be exciting causes of this disease, and from the influence of these causes the patient should be sedulously guarded, and at the same time every remedy must be adopted which may contribute to equalize the circulation.

Endocarditis; Inflammation of the interior lining membrane of the Heart.—This disease, frequent in its occurrence and productive of consequences distressing and fatal to the patient, was little known prior to the year 1824, when some excellent observations on the subject were published by M. Bouillaud. Subsequently that active and accurate observer has written more largely on this disease, the nature and effects of which he has minutely described, not however without having been considered by many physicians, both of this country and the Continent, to have ascribed to its influence some organic changes, such as cartilaginous and osseous formations, not strictly speaking referrible to it. A recent acute case of endocarditis is not very frequently met with uncombined with some other inflammatory disease; rheumatism, pericarditis, carditis, or inflammation of the internal coat of some of the veins, will be usually found, if not to accompany, at least to have preceded it.

The symptoms of endocarditis are more or less fever and anxiety; some bulging of the præcordial region, if accompanied by pericarditis; an extension of the dull sound heard on percussion in the healthy state; the pulsations of the heart unusually strong, and sometimes very rapid and intermittent, repulsing the hand when applied to the chest, and producing a peculiar vibratory sensation. Upon auscultation the bellows sound will be heard, masking one or both of the normal sounds, and sometimes, during the ventricular contraction, a metallic tingling is heard, resembling the sound produced by dropping sand into a bell of metal. The pulse as felt at the wrist will not always accord with the beatings of the heart; often whilst the latter are very forcible, the former will be found small and weak, and sometimes less frequent: this indicates some obstruction to the free passage of the blood from the heart, notwithstanding the forcible contractions of that organ to propel it, and the patient will exhibit symptoms of much distress, as great anxiety of countenance, restless tossings of the body, dazzlings of the sight, and faintings; if the obstructions in the right side of the heart are extensive, as they often are from fibrinous concretions, thickenings, and other morbid growths of the valves, the venous circulation will be affected, as indicated by the livid bloated state of the countenance, and serous effusions into the extremities; various apoplectic symptoms seem to be sometimes induced by the same cause. The breathing is not affected generally beyond a sense of oppression, unless a considerable impediment is experienced by the circulation, but then the distress and restlessness of the sufferer is often extreme, accompanied by an inability to lie down, and a state of alarm and wandering amounting almost to delirium.

The causes of this serious malady are similar to the causes of pericarditis, and the treatment, which should be actively antiphlogistic, must not be deferred if the practitioner be desirous of saving his patient.

In giving this slight sketch of endocarditis, allusions have been made to effects produced by obstructions to the circulation; the nature of these obstructions should therefore be explained. Upon examination after death there will often be found, particularly in the right cavities of the heart, and entangled in the muscular fibres, clots or concretions of fibrinous matter, which, according to M. Bouillaud, are not only caused by stagnation of the blood at the time of death, but also by inflammation of the internal lining membrane. This membrane is also often thickened, especially at the valves; and after repeated attacks, or a long chronic form of endocarditis, the valves will not merely be thickened, but will become the seat of a variety of warty excrescences, or even cartilaginous and osseous formations of considerable size, extending into the cavities of the heart. This ossification is most frequently met with in old persons, and especially those who have been addicted to a too generous mode of living. The morbid sounds produced by these obstructions at the various orifices will resemble those of the bellows, file, or saw, according to the degree of the obstruction; and sometimes a triple or even a quadruple sound will be perceived instead of the two normal sounds. The effects of these obstructions will be sanguineous and serous congestions, oppressions of the breath, apoplectic seizures, and other symptoms of embarrassed circulation.

Ruptures of the Heart.—Ruptures are sometimes found to occur, not only in the valves and columns of muscular fibres within the heart, but also in its parietes. The effect of such injuries will depend upon their extent and situation. A valve or one of the bundles of muscular fibre cannot be broken through without causing much inconvenience to the free circulation of the blood; but it seldom happens that the parietes of either cavity of the heart are sufficiently injured to allow the free passage of blood into the pericardium without instant death being the consequence.

Pressure from without and pressure from within will both give rise to these accidents. Under the first head may be included all wounds, whether produced by cutting or pointed instruments, by falls from great heights, or by violent contusions of the chest. Pressure from within will operate whenever an orifice of the heart is so narrowed or blocked up by thickenings or adhesions of its valves, or diseased deposits, as to prevent the blood from passing freely through it; there will then be a tendency in the cavity to dilate in proportion to the extent of the obstruction, and this dilatation may end in rupture. Under such circumstances violent exertion or a previous thinning of the parietes by abscess will greatly promote the rupture.

Persistance of the Foramen Ovale.—It is by no means very uncommon to meet with cases in which the opening leading from the right to the left auricle of the heart has not been properly closed up at the time of birth. According to the extent of the communication thus remaining, a greater or less proportion of venous blood will pass into the left side of the heart, and being there mixed with red blood circulate through the arterial system. The arterial blood being adapted to produce in the animal economy certain effects and changes necessary to life, and the blood of the veins being unable to produce these effects until it has in its turn been submitted to the action of air in the lungs, the health of every individual in whom the mixture of arterial and effete blood occurs will suffer in proportion to the extent of that mixture.

The symptoms of this disease are blueness of the skin, lips, and nails; a temperature of the body below that which is natural and healthy; shortness of breath, palpitations, faintings, a sense of suffocation induced by slight exertion, and sometimes a great disposition to hæmorrhage and depression from small losses of blood. This disease has from the colour of the skin been named 'blue disease,' 'morbus caeruleus,' or 'cyanosis.' The persistance of this opening between the two auricles is not the only though the most frequent cause of this disease; sometimes the partition between the two sides of the heart is ruptured or ulcerated through, and at others the duct communicating between the aorta and pulmonary artery has remained unclosed; indeed any anormal state of the cavities of the heart, or of the great vessels proceeding from it, which gives rise to an extensive admixture of venous and arterial blood, will produce the disease. Hypertrophy of the right side of the heart, with or without dilatation, and contraction or obstruction of the orifice of the pulmonary artery, and of the right auriculo-ventricular opening, frequently occur at the same time with persistance of the foramen ovale, and increase all the painful symptoms produced by it. Little in the way of treatment can be done in these cases, but every cause of excitement should be carefully avoided, and during the attacks of suffocation and faintness small doses of diffusive stimulants, as æther and ammonia, may be advantageously employed.

Nervous Diseases of the Heart.—The last class of diseases affecting the heart which remains to be noticed differs from all the preceding in not presenting any organic changes. They are met with chiefly in women suffering from anæmia, chlorosis, hysteria, and other nervous symptoms; and in men in whom a naturally nervous temperament has been rendered more irritable by the too free use of stimuli or by depressing passions. In these cases strong pulsations of the heart are experienced, increased by exertion to such an extent as to produce palpitations, a sense of faintness, and shortness of breath amounting to suffocation. Sometimes a slight bellows sound is heard at the heart, and in patients labouring under anæmia and chlorosis this is frequently accompanied by a noise like snoring, heard chiefly in the carotid and crural arteries. In all these cases great attention should be paid to the general health; in the cases of anæmia and hysteria, iron medicines and the shower-bath will be of the greatest service; and, as far as possible, sources of anxiety should be removed. The morbid sounds will all disappear as the mind and body of the patient are restored to their healthy condition, but it must be borne in mind that the heart is essentially a muscular organ, and by severe exercise it may be increased in bulk like other muscles; consequently if these nervous states which give rise to so much action of the heart be not removed, they may in process of time lay the foundation for more permanent and serious disease.

HEARTSEASE, or PANSY, is the cultivated state of the plant called Viola tricolor by botanists, improved by crosses with V. altaica and other allied species.

Several hundreds of beautiful varieties are now common in gardens. Although they will all grow in almost any kind of soil, yet, in order to bring the finer sorts to any degree of perfection, a loam, mixed with sand, and highly manured, is absolutely necessary. By proper treatment they may be had in full flower at two different seasons—from April to June, and from September until the frost destroys them. The ground chosen for the first planting should not be fully exposed to the mid-day sun, as the plants are liable to be scorched by it, but should be open to the east or west; the second planting must be in ground fully exposed, as the influence of the sun is not so powerful as to injure them at the later season of the year.

The original species from which all these varieties sprang are easily preserved; but this is not the case with many of the finer sorts, which, as in animals and in other plants, the higher they are bred, and the finer the kinds, are in proportion difficult to keep in health. The principal causes which affect them are excessive heat in summer, and wet and cold in winter. They are however easily propagated, and only require to be looked over frequently, when, if any of them are found damping or decaying at the bottom of the stem, the top must be taken of, and struck. When there is danger of losing any of the sorts during winter, the best way is to strike a quantity in autumn, and to place hand-glasses over them until spring; at that time those which are alive may be soon multiplied in abundance.

Where fine large flowers are wanted, the plants should always be struck from cuttings the same season, and grown rapidly. In striking them, artificial heat is altogether unnecessary, unless when the operation is performed early. All that is required for the purpose is a small hand-glass to place over the cuttings, and a mat to shade them during bright sunshine. After they are well rooted, they must be taken carefully up, and planted in a bed previously prepared for them. They will then flower in great profusion from April to June.

At this period other plants must be propagated for the autumn flowering: they must again be kept in a shaded situation, until the intense heat of summer is over, when advantage must be taken of dull rainy weather for planting them out in beds, where, if the soil and situation be good, they will soon flower, until destroyed by frost.

Varieties are obtained from seed. In order to have them fine, considerable care is requisite in selecting the seed. It must always be gathered at those seasons when the plants flower in the greatest perfection, and from the best formed and largest blossoms. They will generally be found in this state in the early part of the season, from April to June, or in autumn, after the greatest heat of summer is past; at other seasons the flowers are smaller, and it is found that this affects the seed. The seed should be sown in spring, in light soil, with the protection of a cold frame. When the plants are very young, they must be removed from the frame, and planted thinly under hand-glasses, where they will remain until they are sufficiently strong to be planted out in the flower-garden. At every shifting they must have plenty of water, and be carefully shaded during bright sunshine.

Like all other florists' flowers there are certain characters which are deemed indispensable to the formation of a good bloom. Mr. Gorrie (*Gard. Magazine*, vol. viii., p. 573) thus defines it—'Large and round petals, the flower forming nearly a circle, not much undulated—($1\frac{1}{4}$ inch across is large enough, but some are broader); colours brilliant, distinct, and permanent; eye rather small, and not deeply pencilled; flower-stalk strong and upright; and the stigma filling the open part of the eye.'

HEAT. This great natural agent, which is universally diffused, becomes sensible to us in the first instance by our bodily sensations, but we find afterwards its effects in the various changes which it is capable of producing on all substances. Expansion, fusion, evaporation, thermo-electric currents, and various physiological phenomena, are effects of heat, or at least accompany its absorption.

Every existing substance may be regarded as a source of heat. In this respect the sun is the most important natural source which our system possesses, its heat when condensed in the focus of a lens being exceedingly intense. When concentrated by a number of powerful lenses on one scale of a balance of extreme sensibility, no derangement of equilibrium ensues; as far therefore as experiment can inform us it is imponderable, and the increase or diminution of heat in any body is therefore unaccompanied by any alteration of weight.

Heat may be produced artificially by any means which propagate agitations internally in bodies: hence friction, hammering, percussion, sudden condensation, chemical combination, and electrical discharges, are all proper to produce or rather to develop heat.

As to the nature of heat, whether it should be regarded as a substance or an accident, has been discussed from the time of Bacon to the present day. Those who regard it as having a material existence suppose that a subtle fluid, called caloric, capable of permeating the densest substances, is universally diffused; that its parts are mutually repulsive, but are attracted by the material particles of bodies, and hence they account for the expansions and contractions of bodies, while the effects of radiant heat are explained on principles analogous to those on which the undulatory theory of light is founded.

Those who regard heat as only accidental to matter rest their opinion on the fact that the artificial production of heat is accompanied by vibratory motions in the material molecules of the heated substances. The measure of the quantity of heat produced mechanically would on this hypothesis have a direct connexion with the sum of the *vis viva* of the system of vibrating particles. Hence the communication of heat by contact would be the same as the propagation of vibratory motions from the system of particles composing the heated body to that of the touching body. This hypothesis is liable to a great objection; for heat is propagated through a vacuum, and if even we suppose all space filled with some fluid, in order to explain solar radiation, the hypothesis loses its simplicity, and differs from the former principally by its greater vagueness. It has been suggested by Brewster, that the solar rays are nothing more than heated light, but this opinion is open to several objections founded on the different laws by which heat and light are transmitted and modified.

It is of greater advantage to study the properties of heat, and make those properties the ground for its measurement and the calculation of its effects, than to speculate on the nature of an agent intimately connected, not only with light and electricity, but with the absolute nature of the material molecules.

Heat radiates from all bodies in straight lines and in all directions, and in the law of its emanation it resembles light, its intensity diminishing in the same proportion as the sine of the angle of emanation. If we conceive two balls which are heated unequally to be enclosed by a concave surface which by any means is preserved at a uniform temperature, the radiation of heat from the warmer ball, directed on the colder, being more copious than the radiation from the latter on the former, the temperature of the hotter will sink, and of the cooler rise, in proportion to the difference of radiations, and this will continue until the temperatures become permanent, in which case the radiations are necessarily equal. In the same manner, when the different parts of a room in which there are one or several sources of heat have acquired a permanent temperature, that temperature for each part will then be such that the heat which it emits by radiation must be equal to the quantity absorbed, and which it has received by radiation from all other parts of the room.

One consequence of the free radiation of heat in open space is that its intensity must vary inversely as the square of the distance from the origin. Hence every portion of space has a determinate temperature due to the amount of radiation, not only from the sun and fixed stars, but also of the non-luminous bodies of each system. It seems however difficult to conceive with Poisson, that in addition to such temperature from heat emitted, it can have any temperature peculiar to its locality; in fact, that vacuum can possibly have any proper heat.

But though the laws of the free emanation of heat and light are similar, those of their transmission through substances are very different. When a metallic body is but a little heated in a fire, we have heat unaccompanied by sensible light; and in the lunar rays the light, though originally transmitted from the sun, arrives at our planet without any sensible heat, even when collected in the focus of a burning-glass. Again, a plate of glass placed before a common fire will intercept the heat until it becomes itself sufficiently heated to radiate. When however the source of heat is more intense, a small portion will be directly transmitted; while for the solar rays we find the heat is transmitted as well as the light. It is still more remarkable that when the solar rays are decomposed by transmission through a glass prism, the differently coloured rays of the spectrum have each a different intensity of heat, the least refrangible possessing the greatest portion; the greatest heat is found at the place occupied by the extreme red rays, or even a little beyond them.

Not only may radiant heat be collected in a focus by refraction through a lens, but also by reflexion from a polished concave mirror. If we employ a pair of mirrors, and if a heated body be placed in the focus of one, and a thermometer in the other, the reflected heat falling on the bulb of the instrument will cause the mercury to rise; and conversely, a colder body will make the column of mercury descend, for the excess of radiation proceeds in this case from the thermometer. Recent experiments on heat show that the analogy of the laws of heat and light extends even to polarization.

The experiments of Leslie have shown how greatly the quantity of radiant heat may be affected by the state of the surfaces from which they finally emanate. The method adopted by Leslie for examining the powers of radiation possessed by different substances was extremely simple and ingenious. Having employed the system of two specula above mentioned, he placed a tin canister filled with hot water in the focus of one, and a differential thermometer [THERMOMETER] in the other focus. The four sides of the tin canister were covered with the substances of which he proposed to seek the radiating powers; when three of the sides were respectively covered with lamp-black, paper, and crown-glass, and then turned so as to radiate directly on the speculum, the heat reflected by the other raised the thermometer accordingly to 100°, 98°, and 90°; but when the fourth side, which was uncovered, was similarly directed, the thermometer fell 12°. Thus it appears that polished metallic substances are bad radiators, which may be attributed to the internal reflexion of the heat from their surfaces, for the sources of radiation must evidently be at some small depth below the geometrical surfaces. A similar apparatus served to measure the absorptive power of different substances, by covering the bulb of the thermometer as uniformly as possible with an envelop of the substance to be examined; this power is thus found to be nearly in proportion to that of radiation. The maximum effect of the reflected heat was not however in the strict geometric focus, but, in consequence of aberration, it was found to be a little beyond it.

The power of radiating heat is certainly the most universal mode of its propagation between different particles of matter as well as through considerable spaces. However, it is usual, for greater simplicity, to designate this propagation through solid bodies as *propagation of heat by contact*. Poisson has shown in his memoirs on that subject that the general equations which express the law of the distribution of heat in solids may be derived from the internal radiation of the particles which compose them. Whichever of these two views may be adopted, we are led to important physical distinctions between different homogeneous substances, viz. their conducting powers internally and externally. If we take two substances, as a piece of metal and of wood, at the same temperature as indicated by the thermomoter. when held in the warm hand the metal will feel colder than the wood, the heat of the hand being more rapidly absorbed by the metal, as being the better conductor of heat. Or if we place the extremities of a rod of copper and of glass in a fire, and hold with the hands the other extremities, the heat will be found to ascend rapidly through the metal and very slowly through the glass rod. Though such plain observations are sufficient to give a general idea that bodies conduct heat differently, yet, to obtain exact measurements of conducting powers, it will be necessary to have a more precise idea, since such power is a constant coefficient belonging to every body in particular, and without the knowledge of which it would be impossible to compare the result of theory with observation.

Newton remarked that, when two substances of unequal temperatures were placed in contact, the colder received from the other in a given small time a quantity of heat proportional to the difference of their temperatures. This simple law has recently been found not strictly correct, but is sufficiently so when the difference of temperatures is inconsiderable. If t, t' represent the temperatures of two bodies of the same physical nature placed in contact, and if we leave out of consideration the heat escaping by radiation from their surfaces, the quantity of heat communicated may, by Newton's law, be represented by $h\,(t-t')$; where the coefficient h is a constant peculiar to the given substance, and is proportional to the interior conductibility.

If now we conceive the surface of the body to be of a uniform temperature, and subject to a current of air also of a uniform but inferior temperature T, the loss of heat by a unit of surface in a unit of time indefinitely small will, by the same law, be represented by $H\,(t-T)$, where the coefficient H is proportional to the exterior conductibility under such circumstances.

The exterior conductibility may be very different in the same body by slight alterations in the smoothness or even colour of the surface; it is by this antagonist principle that heat acquires a permanent state corresponding to the different positions of the parts of bodies relative to the sources of heat and the dispersing surfaces.

The mathematical theory of the distribution of heat is founded on the principle that when a body has arrived at a permanent state of temperature the quantity of heat given out by any particle to the adjacent colder region must be equal to that received from the warmer particles near it, and conversely. For example, suppose a solid body to be contained by two parallel planes of indefinite extent, the lower plane being preserved by any means at a uniform temperature represented by o, and the upper likewise preserved at a uniform temperature. In this case it is easily seen that the temperature would be uniform in any section of the body parallel to its bases, but would increase from the lower plane in an arithmetical progression to the upper, for with this law the temperature of any point of the body taken in the transverse direction will differ by equal quantities from the temperatures of any two points which are at equal distances, the one above and the other below it; hence the flux of heat from the warmer region to this point is equal to that from this point to the colder. Though there is therefore a constant flux of heat from the upper to tho lower plane, the distribution of heat has then acquired a permanency.

In the above instance we have had no regard to the external conductibility through the sides by supposing the planes of indefinite extent. A simple instance will now be adduced in which we can show the manner in which this consideration may be introduced into the calculus.

Suppose a thin cylindrical rod to be placed in a medium of which the temperature is constantly zero, whilo its extremities are maintained at constant but different temperatures; in this case the distribution of heat will follow, at equal distances along the rod, a geometrical progression increasing from the colder extremity to the hotter, for on this supposition the heat which would be retained by any section in consequence of the unequal differences of its temperature with those of sections similarly placed above and below it, if there were no radiation, will be exactly lost by the external means of conduction, for it is a property of the terms of a geometrical progression that the second differences are proportional to the terms thomselves; the heat which would be retained is proportional to this second difference, and the heat externally emitted is proportional to the temperature itself. Thus this law, which renders the internal gain of heat equal to its loss externally, represents the law of its permanent distribution. Those who are acquainted with the calculus of partial differences may find these principles applied, not only to tho permanent distribution of heat, but to the laws of cooling in bodies warmed from any sources, and bounded by any surfaces, in the excellent work of Fourier (*Théorie de Chaleur*), and in the memoirs of Poisson, Libri, and others.

The propagation of heat in liquids depends very little on any communication by contact. If we place a heated plate on the surface of water in a vessel, but so as not to touch tho edges, a thermometer placed in the water will indicate little or no alteration of temperature; liquids are therefore heated by the transposition of their parts. Thus, if with a blowpipe we apply heat to the bottom of a vessel containing water, in which are floating some small particles of dust, a current will be perceived of the warmed liquid rising from the point to which heat has been applied, and another descending current of the colder parts, which being heated in turn rise also; in this manner the heat is distributed through the wholo liquid, for as the heat expands the particles of liquid which it first meets, they become specifically lighter than the adjacent fluid, and they must therefore ascend by the laws of hydrostatics, while the heavier take their places.

Little as is the conducting power of liquids, that of gases is probably much less, if any; but there would be great difficulty in establishing this experimentally. The effect of heat on gases is to increase proportionally their elasticity, and this disturbing force produces violent motions in their parts, so that the whole shortly acquires a uniform temperature, when other forces, such as gravity, are not taken into consideration, and when the bounding surfaces are not essentially subjected to constant unequal temperatures.

These three modes of the propagation of heat exist in our globe, and are the cause of important phenomena in the distribution of climate.

First, the great mass of the earth, considered in reference to its solid parts, has an external source of heat in radiation principally from the sun. The maximum quantity of this heat is bestowed on the region between the tropics, while the poles are at a temperature which, but for the action of the sea and atmosphere, would probably be that of space; the internal heat of the earth would in a homogeneous sphere be distributed symmetrically relative to its centre, diminishing towards the surface, which would lose heat by external radiation; but the external source of heat alluded to, by producing a flux from the equator to the poles, forms a permanent compensation for this radiation.

If we suppose the mass of the earth to have been at any remote period at a very high temperature, of which, besides its general form, there are many striking geological proofs, the effect of the radiation of its heat through the colder surrounding space would be to cool first the superficial strata, and successively, though in a less degree, the internal strata, until a permanent state was reached, when the diminished radiation would be exactly compensated from external sources. Hence, on descending below that comparatively shallow envelop affected with diurnal or annual variations of temperature, we ought to find a continually increasing temperature towards the centre, a result which has been verified in the mines in several countries in Europe. Poisson deems these experiments inconclusive, in consideration of the small depth which we are able to penetrate; for without assuming any increase of heat towards the centre, the same superficial phenomenon would occur on the supposition that the whole solar system had been transferred into a region of space possessing a different temperature from that in which it formerly moved; but this view, which is purely speculative, cannot be verified by facts.

The propagation of heat by motion in fluids has an immense tendency to equalise the temperatures of different latitudes, and the unequal depths of different places in the bed of the sea would, from the same cause, produce currents warmer than the adjacent water. The elasticity acquired by portions of the air in contact with the warmer regions of the globe destroys the equilibrium of that fluid, and generates winds of which the heat is communicated to the districts traversed, while the counter-currents, or cold winds, rush forward to occupy the abandoned spaces. The earth having always had a rotation, a limiting surface necessarily existed beyond which the centrifugal force prevailed; hence if the surface of the earth has ever had a temperature of

212° Fahrenheit, the waters now occupying the bed of the sea, being in a state of vapour, could have filled no more than the space between that limiting surface and the surface of the earth; but the greater cold would necessarily convert the vapour in the upper regions into water, which, descending in rain, would be again vaporised, and this reciprocal action going on during the process of cooling, would be capable of producing immense alterations on the earth's surface. It has been suggested by Mr. Babbage that a cause of a similar nature may have led to the rings and belts of the superior planets.

Most of the instruments constructed to measure heat are founded on its general tendency to produce expansion, but a few of them on other properties of heat. Beside the various thermometers, we may notice the calorimeter of Lavoisier and Laplace, in which an internal chamber of a box is preserved at the temperature of melting ice, being constantly surrounded with that substance, guarded against the contact of the air: in a division of this chamber, a cell furnished with a stop-cock, a body is plunged at any temperature, and remains until it ceases to melt the ice, when the quantity of melted water conducted through the stop-cock is taken as a measure of the quantity of heat given out by the body. This instrument is of use in determining the specific heats of substances, and the calculation of latent heat; but this subject more properly belongs to heat regarded relatively to its chemical effects. For the measurement of high temperatures, see PYROMETER.

The dilatation of substances by heat is nearly proportional to the increase of temperature, except when they are about to change their physical or chemical states; thus water near the freezing-point expands when the temperature is diminished, which is probably owing to the different arrangement assumed by its constituent particles preparatory to crystallization. From the experiments of Dulong and Petit, the pure gases appear to afford the most strictly proportionate expansions, and to correspond to mercury between the freezing and boiling points. Water and alcohol, when near boiling, have very irregular expansions; and crystallized bodies expand unequally in the directions of their different axes: the slow propagation of heat in glass causes very unequal expansions, and consequently fractures. In gases the law of Gay-Lussac is very simple; their expansion (even when containing vapour) is 0·375 of their volume at the freezing-point, when their temperature is raised to the boiling-point; and is equable during the interval. [GAS, p. 84.]

Experiments by Fresnel, Trevelyan, Powell, Forbes, and others, have greatly tended to prove that a repulsion due to heat exists between particles at small distances. If a heated poker be laid slantingly on a block of lead at the ordinary temperature, it will commence to vibrate, first slowly, and will increase with such rapidity as to produce a musical note, which continues for some time, at the termination sometimes changing to an octave. Though a different hypothesis may partly explain this circumstance, yet the number of phenomena of a similar nature adduced of late years render the hypothesis of repulsion extremely probable.

The following table gives the dilatation of a unit length of different solids from the freezing to the boiling point, and is a *mean* taken from several observers:—

Glass tube	·00083	Copper	·0017
Crown glass	·00089	Brass	·0018
Platinum	·00093	Silver	·0020
Palladium	·0010	Tin	·0022
Cast iron	·0011	Pewter	·0023
Steel	·0012	Grain tin	·0025
Do. Tempered	·0013	Lead	·0028
Gold	·0015	Zinc	·0030
		Glass	·00009

Reflecting Powers. (*Leslie.*)

Brass	10	Steel	7
Silver	9	Lead	6
Tin foil	8½	Glass	1
Block tin	8		

Chemical Agency of Heat.—The agency of heat in promoting chemical action is important and extensive; in some cases no combination can take place without it, and in others it greatly facilitates chemical combination, while in some instances it decomposes compound bodies and resolves them either into simpler or elementary forms of matter. If we add any salt to water at common temperatures they will combine and the salt will be dissolved as long as their mutual affinity exists at the degree of heat employed; but if we increase the temperature we augment the affinity, and thus it is that most salts and other substances are more soluble in hot than in cold water, the increased affinity subsiding as the temperature falls; this however is true of fixed bodies only, for gaseous substances, such as ammonia and carbonic acid, are much more soluble in cold than in hot water, and at high temperatures the gases are totally expelled.

In the above cases of solution of salts in water, heat merely increases affinity, but is not requisite to the production of chemical action; if however we mix oxygen and hydrogen gases, they will remain diffused throughout each other for any length of time, unless heat be applied to them, and they then readily combine, with the formation of water. In other cases, as those of some solids, it is probable that heat increases affinity only by rendering the bodies fluid; thus lead and sulphur do not combine at common temperatures, but if we render them fluid by heat, they readily unite; whereas mercury being a fluid metal, although there is no reason for supposing that its affinity for sulphur is greater than that of lead, yet when triturated at common temperatures with powdered sulphur readily combines with it.

Again, some metals unite with oxygen at common temperatures, especially if moisture be present, but there are others which require the application of heat to cause any notable combination to take place between them; thus tin and lead at common temperatures are but little acted upon by exposure to oxygen gas, but if we heat them in it, the oxides of these metals are readily procured.

There are some gaseous compounds which can scarcely be procured by the direct action of heat on their elements: thus oxygen and azote do not unite, even when strongly heated, so as to form nitrous acid or any other compound; but the heat which accompanies the electrical spark seems capable of producing this effect. On the other hand, ammonia cannot be obtained even by the heat so generated, when the gases which form it are subjected to it.

Although the instances are not so numerous, yet there are many cases in which heat by direct action and without the aid of any intervening affinity is capable of decomposing compounds; thus when ammonia is heated in earthen tubes it is resolved into its elementary gases by the mere action of the heat, unaided by any affinity between the gases and the material in which it is heated. With water the case is different: it is not decomposed by heat, unless exposed to some substance capable of uniting with its oxygen, so that when its vapour is passed through an ignited earthen tube it suffers no change; but if we substitute an iron one, then this metal at a high temperature takes its oxygen and evolves the hydrogen.

In other instances heat is capable of decomposing compounds when they consist of two substances of very different degrees of volatility: thus when phosphate of ammonia is heated the alkali is expelled and the acid left; but when the volatility is nearly equal they then rise in combination: this is the case with muriate and carbonate of ammonia.

Heat has also great power in modifying as well as in causing chemical action, and different degrees of it produce very opposite effects in some cases. If we heat mercury to about its boiling point exposed to the air, it becomes peroxide; but if we expose this product to a higher temperature than required for its formation, it is then again resolved into metallic mercury and oxygen gas. At common temperatures sulphur retains three equivalents of oxygen, and does not yield even one equivalent to copper; sulphuric acid is constituted of the above numbers of equivalents, and on putting a piece of copper into it no change occurs; but if the mixture be heated the order of affinity is to a certain extent reversed; the copper takes one equivalent of oxygen, and becomes black oxide, while the sulphur united with the two remaining equivalents of oxygen is expelled in the state of sulphurous acid gas.

It is impossible to refer to or peruse any account of a chemical investigation without perceiving the important and widely extended range of the chemical agency of heat, from which we have selected a very few, and those perhaps not the most striking cases, by which this subject might have been illustrated.

HEAT OF VEGETABLES. That plants possess a temperature higher in winter than that of the air which surrounds them is known by the obvious fact that snow melts at the foot of a tree sooner than at a distance from it; that the temperature is lower in summer is equally well proved by the coldness of the fluid which is discharged from many vines and vine-like plants when cut across. These phenomena have been examined with care by several observers: John Hunter found that a thermometer whose bulb was plunged 11 inches deep in the trunk of a walnut tree generally indicated in the autumn a higher temperature than that of the external air by 2° or 3°; Schöpf at New York, and Bierkander in Sweden, Pictet, and Maurice, and various other observers, have obtained similar results; they have found even tubers and bulbs with a temperature higher in winter than that of the external air by 6° or 7° Réaum., while on the other hand from the spring to the autumn it is lower.

The former fact accounts in some measure for the power possessed by some plants of resisting cold in winter, and for the protection given to the upper parts of trees by heaping straw up against their trunks in winter. During every season of the year trees are absorbing water from the earth; water when absorbed parts with its heat very slowly through the carbonated matter of a trunk; in winter the temperature of the earth, which determines that of the water it contains, is uniformly higher than that of the atmosphere, and consequently the temperature of the interior of a tree is also higher, in proportion to the difference between the heat of the soil and that of the air. In the spring and summer, on the contrary, the earth is cooler than the air, and the temperature of trees is cooler also.

These considerations throw some light upon the effects of frost upon trees. A young tree is, *cæteris paribus*, affected more than an old one of the same species; either because its roots derive their food from a smaller distance under the soil, or because the heat obtained from the soil is sooner parted with on account of the thinness of the bark and the smallness of the whole mass. Unhealthy trees, which also suffer in like manner, may be supposed to do so in consequence of the weakness of their power of pumping warmer fluid up from the soil in winter.

Independently of this source of heat in vegetables, there is another that deserves attention. Whenever oxygen combines with carbon to form carbonic acid, an extrication of heat takes place, however minute the amount; such a combination occurs much more extensively during the germination of seeds and the impregnation of flowers than at any other time. At the first of these periods extrication of heat takes place to a considerable amount, as is remarked in the germination of barley heaped in rooms, previously to being manufactured into malt: in the latter it also occurs, but in consequence of flowers not being confined in close cases, the heat is lost as soon as it is disengaged, and never accumulates, except in a few special instances. Saussure found the temperature of the male flowers of the common gourd, at between seven and eight o'clock in the morning, half a centigrade degree higher than that of the air; and those of the tuberose 9-10ths of a similar degree. It is however only when large quantities of flowers expand within close cases that this phenomenon is particularly remarkable. Accordingly, in the spathe of araceous plants it has been remarked at its greatest intensity. Lamarck, Senebier, and De Candolle, found the flowers of Arum maculatum, between three and seven o'clock in the afternoon, as much as 7° Réaum. warmer than the external air. Schultz found a difference of 4° to 5° between the heat of the spathe of Caladium pinnatifidum and the surrounding air at six to seven o'clock P.M. Hubert and Bory de St. Vincent assert that at sunrise the spathe of Arum cordifolium acquires in the Isle of France an elevation of 30° R. above the atmosphere. Finally, Messrs. Vrolik and Vriese at Amsterdam, and Adolphe Brongniart at Paris, have confirmed the fact by new observations in the hothouses of those cities.

Hence it appears that plants not only have, under all circumstances, a temperature different from that of the external air, being warmer in winter and cooler in summer, but that under particular circumstances the heat of certain parts is elevated in a very remarkable degree. We know that heat is necessary for germination and for vegetable impregnation. May we not therefore conclude that nature has given to plants the power of extricating for themselves an additional supply of caloric at these important periods?

HEATH. [ERICA.]

HEBERDEN, WILLIAM, M.D., was born in London in 1710. In 1724 he was sent to St. John's College, Cambridge, of which, six years afterwards, he was elected a Fellow. He studied medicine in Cambridge and London, and after taking his degree practised as a physician, and delivered an annual course of lectures on materia medica in that university. In 1746 he was elected a Fellow of the Royal College of Physicians, and soon after left Cambridge, and commenced practising in London, where he at once met with the greatest success, and obtained the highest reputation. After thirty years' extensive practice, finding his health declining, he gradually withdrew himself from his profession to retirement in Windsor, where he died in 1801. In 1750 he was elected a Fellow of the Royal Society, and in 1778 an associate of the Royal Society of Medicine in Paris.

It was at the suggestion of Dr. Heberden that the publication of the Medical Transactions of the College of Physicians was commenced. He contributed many valuable papers to the first volume, which appeared in 1768, and to two succeeding volumes: among them may especially be noticed his paper on the Angina Pectoris, a disease not previously described, and that on the Chicken-pox, which he first distinguished from the Smallpox. He contributed also some papers to the Transactions of the Royal Society; but his principal work was the 'Medical Commentaries,' which he wrote in 1782, and which was published after his death. It contains the practical results of his lengthened experience, and was compiled from observations which he had always been in the habit of writing by the bedside of his patient. It was written in very elegant Latin, and affords sufficient evidence of an accomplished and observing mind, and of very extensive practical knowledge. (Memoir prefixed to the *Commentaries*.)

HEBRADENDRON. This is a new genus of the natural family of Guttiferæ, established by Professor Graham of Edinburgh, for the gamboge tree of Ceylon, to which reference was made from GARCINIA. Under the article GAMBOGE, the two commercial varieties of this substance, known by the names of Ceylon and Siam gamboge, were mentioned; the plant yielding the former has been clearly made out, that producing the latter is still unascertained.

The gamboge of Siam is in cylinders, either solid or hollow, usually called *pipes:* it is supposed to have this form from being so rolled, or from being poured into the hollow of bamboos, according to Lieutenant White, in his 'Visit to Cochin China.' It is usually of the best quality, but Mr. Pereira has shown that some very impure is occasionally in the form of pipes. As this pipe gamboge is usually exported from Singapore, it has been doubted whether it was actually the produce of Siam; but we have specimens from Mr. G. Swinton, which were sent to him direct from Siam when he was chief secretary of the Indian government, as the produce of that country, and which are identical with the best pipe gamboge of commerce. The only information respecting its preparation which we possess is that given to Kœnig by a Catholic priest, who officiated as such to the Catholics of Cochin China, and who stated that the inspissated juice obtained from breaking the leaves and young shrubs, as well as the fragrant lignum aloes, is given as a tribute to the king of Siam by the Christians residing there. The tree must therefore be common, and probably near inhabited places, and therefore very likely to be Oxycarpus cochinchinensis of Loureiro (now referred to the genus Garcinia), who names it from its acid fruit, and describes it as cultivated in Cochin China. We have specimens of a plant something similar to this in the form of its leaves from Mr. Malcolmson, collected by him in Rangoon, which he thought might be the gamboge plant, as it contained a yellow purgative juice in the rind of its fruit. Dr. Graham thinks that the Siam plant may be a nearly allied species of the same genus as the Ceylon plant.

The Ceylon gamboge is usually considered inferior; that which forms an article of commerce no doubt is so, and we have been informed by one of the principal merchants of Ceylon that finding the gamboge there very cheap, he had been induced to purchase and send it to England, but had not been able to sell it from its inferior quality. No doubt however some of very excellent quality is produced in Ceylon by the tree which has been called *Hebradendron cambogioides*, and Mrs. Colonel Walker describes it as 'brilliant and excellent,' and 'as good for water-colour drawings as any she ever used.' Dr. Graham ascribes its inferiority to want of care in preparing the article for market; though it is yet doubtful whether the Ceylon gamboge of commerce is all yielded by this tree; but Mrs. Walker on one occasion, in passing through a forest of these trees, saw all of them with the bark cut off in various places. Dr. Christison has shown that there is all but an identity of composition with that of Siam; and its medicinal effects are precisely the same as proved in Ceylon by Dr. Pitcairn, and by Drs. Graham and Christison in Edinburgh.

This plant, though new named, is far from being new. Dr. Graham considers it to be identical with the Carcapuli of Herman, the Cambogia gutta of Linnæus, the Garcinia Morella of late authors, and the Stalagmitis cambogioides of Moon's 'Catalogue of Ceylon Plants.' The last name might have been retained, as it was originally intended for it, had it not been discovered by Mr. Brown that the specimens in the 'Banksian Herbarium' collected by Kœnig, and from which Murray's character of the genus and species was established, consist not of one, but of two distinct plants, the flowers of Xanthochymus ovalifolius being stuck by sealing-wax upon a branch of what appears to be this Ceylon plant. The genera Stalagmitis and Xanthochymus are therefore one genus, as was previously inferred by Cambessedes, who has retained for it the former, as the prior name.

The genus Hebradendron has diœcious flowers; the male having the calyx membranaceous, four-sepalled, persistent; corol four-petalled; stamens monadelphous; column four-sided; anthers terminal, opening by the circumcision of a flat and umbilicate terminal lid. The inflorescence of the female tree is similar to that of the male, the flower white and a little larger, with a germen precisely in miniature of the fruit, and surrounded (like it) with several (ten?) abortive stamens. The berry is many (four) celled; cells one-seeded, surrounded at the base with some free abortive stamens, crowned by a lobed and muricated sessile stigma; cotyledons fleshy, united; radicle central, filiform; trees with entire leaves.

1, a flowering branch of Hebradendron cambogioides; 2, a flower seen from below; 3, a flower seen laterally; 4, anther with its umbilicate lid.

The species called H. cambogioides forms a moderate sized tree, with the leaves obovate, elliptical, abruptly subacuminate; the male flowers clustered in the axils of the petioles, on short single-flowered peduncles; sepals yellow on the inside, yellowish-white externally; petals yellowish-white, red on the inside near the base; berry about the size of a cherry, round, with a firm reddish-brown external coat, and sweet pulp; ripe in July. It is called in Ceylon *kana* (eatable) *Goraka*. G. cambogia is called simply Goraka. The gamboge is used by the natives both as a pigment and medicinally. Mrs. Walker describes it as being collected by cutting pieces of the bark about the size of the palm of the hand early in the morning. The gamboge oozes out in a semi-liquid state, but hardens on exposure to the air, and is scraped off by the collectors next morning.

This tree is found in various parts of Ceylon, but not very abundantly near Colombo. In a tour through different parts of the island, Mrs. Walker writes, 'We found the Ceylon gamboge tree several times in forests distant from the habitation of man, which proves the tree to be indigenous.' Colonel Walker writes to Dr. Wight, that 'it is found in great abundance along the western and eastern coast in the neighbourhood of Battocola; but it also grows inland, where it could not have been planted by the Dutch. Its favourite abode seems to be low sandy ground, as about Kanderaane, Negombo, and towards Chilaw; also, 100 miles inland, at so high an elevation as 2000 feet above the sea.' Garcinia elliptica, a native of Silhet, and G. pictoria of the Wynaad district, are thought to be other species of this genus.

We are indebted to Dr. Graham's papers in the 'Companion to the Botanical Magazine' and the 'Edinburgh Philosophical Journal,' and to Dr. Wight's letters in the 'Madras Journal,' for most of the above information; and to Dr. Lindley for the accompanying figure.

HEBREW LANGUAGE forms a branch of that extensive family of languages which are known by the name of Semitic; a name which is derived from the real or supposed descent of the people who speak these languages from Shem the son of Noah. The Semitic languages may be divided into three branches: the Arabic, to which the Ethiopic is closely allied; the Aramæan, consisting of two dialects—the Babylonian or East Aramæan (sometimes but erroneously called Chaldee), and the Syriac or West Aramæan; and the Hebrew, to which the Phœnician and Punic are closely related. Of these languages the Arabic is the most copious, and the Aramæan the poorest and least developed; the Hebrew holds an intermediate rank between these, being more perfect than the Aramæan, and inferior to the Arabic.

The Hebrew language derived its name from the Hebrews, who date their origin from Abraham, who is called 'the Hebrew' (הָעִבְרִי) in *Gen*. xiv. 13. The etymology of this word is doubtful. According to the Jews it is derived from Eber (עֵבֶר), an ancestor of Abraham (*Gen*. x. 24, 25; xi. 15); but Gesenius and many other critics maintain that Eber cannot be regarded as a historical person, and that his name has been invented in the same manner as the names of Ion, Dorus, Æolus, &c., by the Greeks, to account for the origin of the people. It has been supposed with some probability that the name of 'Hebrew' was originally applied to designate all the Semitic nations west of the Euphrates, which appear to have emigrated from Mesopotamia. According to this etymology, the word 'Hebrew' is derived from the root עָבַר, 'to pass over.' This appears to have been the opinion of the translators of the Septuagint, who render *Gen*. xiv. 13, 'Abram the Hebrew,' by Ἄβραμ τῷ περάτῃ, that is, 'Abram, the passer-over.' All the descendants of Abraham were, according to this view, originally called Hebrews; and the name was only restricted afterwards to the inhabitants of Palestine. (See Ewald's *Hebrew Grammar*, § 3; and Gesenius, *Hebrew Lexicon*, under עִבְרִי.) This name is never applied to the language of the Hebrews in the Old Testament; in *Isaiah*, xix. 18, it is called the language of Canaan (שְׂפַת כְּנַעַן); and in *Is*. xxxvi. 11, 2 *Kings*, xviii. 26, 2 *Chron*. xxxii. 18, and *Neh*. xiii. 24, the Judaic or Jewish language (יְהוּדִית). The language spoken in Palestine in the time of Christ is frequently called Hebrew (Ἑβραϊστί) in the New Testament (*John*, v. 2; xix. 13; *Acts*, xxi. 40; xxii. 2; xxvi. 14); by which the Aramæan is probably intended. In the writings of the Rabbinical Jews the Hebrew is generally called the 'holy language' (לְשָׁן קֻדְשָׁא).

The Hebrew language appears to have been formed in Palestine by a union of the antient Aramæan, which was brought by the Abrahmites from Mesopotamia, with the Phœnician or Canaanitish, the language of the original inhabitants of the country. That the Phœnician and Hebrew languages were very closely allied is evident from the Phœnician names of persons and places, and from the specimens of the Phœnician language which we possess in coins and inscriptions. (Bochart, *Geographia Sacra*, b. ii. cc. 1—7; Bellermann, *Handbuch der Bibl. Lit.*, vol. i. sect. 56; Bellermann, *Versuch einer Erklärung der Punischen Stellen im Pönulus des Plautus;* Dessen, *De Phœnicum et Pœnorum inscriptionibus*, Berl. 1810; Dessen, *Bemerk. über Phönizische und Punische Münzen;* Gesenius in an Excursus entitled *Uber die Phöniz. und Punische Sprache und ihr Verhältniss zur Hebraischen*, in his *Geschichte der Hebr. Sprache;* Gesenius, *Versuch über die Malthesische Sprache*, 8vo., Leip. 1810; and *Paläographische Studien, über Phöniz. und Punische Schrift*, 4to., Leip. 1835.) The long settlement of the Hebrews in Egypt, and their forty years' wandering in the wilderness, must have had an important influence upon their language; but the number of Egyptian words received into it appears to have been small.

Many critics have divided the history of the language into four periods:—I. From Abraham to Moses. II. From Moses to Solomon. III. From Solomon to the Babylonish captivity. IV. From the Babylonish captivity to its final extinction as a spoken language. But there are in reality only two periods in which any difference can be traced in the language; the first extending from the time of Moses to the reign of Hezekiah, and the second from the reign of Hezekiah to its final extinction as a spoken language. The language in which the Pentateuch is written differs so little from that of David, Solomon, and Isaiah, who lived many centuries after the time of Moses, that many critics, supposing it impossible that a language should have remained stationary for so many centuries, have maintained that none of the books of the Old Testament were written previous to the time of David and Solomon. It is not very easy to disprove this opinion; but the remarks of Ewald on this subject appear worthy of attention. He observes in his 'Hebrew Grammar,' § 7 (Eng. trans.), that 'the Hebrew language in the first four books of the Pentateuch, which contain records of unquestionable antiquity, partly by Moses or from his time, appears already, a few minutiæ excepted, fully developed.

'From Moses until about the year 700 it underwent two changes: for as the structure of the Semitic language is in general more simple, so also is it less changeable than that of languages of greater development, as Sanskrit. To which is to be added, that in that period the Hebrews did not experience those influences which materially affect a language; they did not advance much in civilization, were never long subjected to nations of foreign tongue, and lived almost entirely separated from all nations, especially from nations of foreign language. Their language therefore advanced little in development, but it also suffered little from corruption. There are however in those books of the Pentateuch some certainly important differences which afterwards disappear, and many differences of that kind have become less distinguishable by us, because the more modern punctuation has treated all words according to one standard, and that the standard of the language at a late period.' The study of the Hebrew language appears to have been greatly promoted by the schools of the prophets, which were founded by Samuel; and it is to the influence of these schools that we are probably indebted for the lyric poems of David and the didactic and amatory poetry of Solomon.

The conquests of the Assyrians and Chaldæans from about B.C. 720 tended to introduce the Aramæan language into Palestine. It appears from Isaiah (xxxvi. 12) that the principal people in Judæa, even in the reign of Hezekiah, found it necessary to study Aramæan. The Aramæan colonies (2 *Kings*, xvii. 24), which were planted in the kingdom of Israel to supply the place of the Israelites who had been carried into Assyria by Shalmaneser, must have caused the spread of the Aramæan language in the northern parts of Palestine even before the destruction of the kingdom of Judah. The long residence of the Jews in Babylon after the destruction of Jerusalem by Nebuchadnezzar caused the extinction of the Hebrew as a spoken language, at least among the common people. After their return to Judæa, according to the edict of Cyrus, it appears from a passage in Nehemiah (viii. 8), that the common people did not understand the Scriptures when read to them in the Hebrew language. But Hebrew continued to be spoken by the upper classes for a considerable time after the Babylonish captivity. The prophecies of Haggai, Zechariah, and Malachi, who lived in the latter part of the sixth century, are written in tolerably pure Hebrew. The inscriptions of the coins of the Maccabees are in Hebrew; and the Hebrew language does not appear to have been discontinued in writing and conversation among the upper classes till the century preceding the birth of Christ.

But the Hebrew, from the period of its extinction as a spoken language, has been always more or less cultivated by the Jews. After the destruction of Jerusalem by the Romans, numerous schools were established by the Jews, in which their language and literature were taught. Of these schools the most celebrated were those of Tiberias and Babylon. The Mishna, which contains the traditions of the Jews and interpretations of the Scriptures, is supposed to have been compiled in the latter part of the second or the beginning of the third century, by Rabbi Jehuda. The Mishna was considered from this period one of the principal works of Hebrew literature, and the Rabbis of Tiberias and Babylon wrote numerous commentaries upon it. These commentaries were at length collected into two separate works, and entitled the Jerusalem and Babylonian Talmuds. The Jerusalem Talmud appears to have been compiled in the third or fifth century, by Rabbi Jochonan; and the Babylonian Talmud in the sixth century, by Rabbi Asci. Each Talmud is divided into two parts, the Mishna, or text, and the Gemara, or commentary. The 'Mishna' has been edited by Surenhusius, 6 vols. fol., Amst., 1698; the Babylonian Talmud was published at Berlin and Frankfort, 12 vols. fol., 1715; and the Jerusalem Talmud at Amsterdam, fol., 1710. To the same schools we are also indebted for the system of punctuation and accents which we have in the Hebrew Bible. This system, which no doubt represents faithfully the traditional interpretation of the Scriptures and pronunciation of the language by the Jews, is entitled Masora (מָסוֹרָה), that is, 'tradition.'

It is uncertain how long the school of Tiberius lasted; but the Babylonish school was broken up by the Arabs, A.D. 1040, after a long period of prosperity, and most of the scholars took refuge in Spain, where they founded schools in most of the principal cities. These schools produced a succession of writers; of whom the most celebrated was MAIMONIDES, who lived at the latter end of the twelfth century. After remaining in Spain for nearly four centuries they were banished by the Christians in 1492.

The Christians paid very little attention to the Hebrew language before the Reformation. The publications of the Buxtorfs in the seventeenth century tended to diffuse the language among Christians, but their works contained no philosophical views of the language, since they implicitly followed the decisions of the Masorites. The Grammar of Schultens, which appeared in 1731, and which may still be consulted with great advantage by Hebrew scholars, contained a much clearer development of the principles of the language than the Buxtorfs had given. His knowledge of Arabic enabled him to compare the forms of that language with the Hebrew, and thus to draw the attention of scholars to the important fact that the study of the cognate languages is necessary to obtain an accurate knowledge of Hebrew. But the publications of Gesenius and Ewald in the present century, which are enumerated at the end of this article, have done more to facilitate the acquisition of the language than the works of all preceding writers.

It appears probable that the language of a country, which was divided both physically and politically into several parts, must have contained various dialects; but this cannot easily be proved, since almost all the Hebrew writers belonged to the kingdom of Judah. The language of Galilee and the northern parts of Palestine appears at all times to have inclined to the Aramæan; in the time of Christ, the Galilæan dialect differed from the language spoken in Judæa. (*Matt.* xxvi. 73.) In the book of Judges (xii. 6), the pronunciation of the Ephraimites is distinguished; and many critics think that they can discover traces of the northern dialect in the song of Deborah (*Judges*, v.)

Few literary subjects have occasioned greater discussion than the letters, vowels, points, and accents of the Hebrew language. But with regard to the letters it appears probable, that the present square characters in which Hebrew is written were not employed previous to the Babylonish captivity, but that the Phœnician letters were used, which are still preserved with a slight alteration in the Samaritan alphabet. According to the Jewish tradition, the present square characters, which belong to the East Aramæan language, were first introduced by Ezra when he revised the canon of Scripture; but they could not have been universally adopted till a later period, since the Samaritan Pentateuch, which was not introduced into Samaria till after the Babylonish captivity, was written in the antient character, and the coins of tho Asmonæans in the second century before Christ also employ the same character. It is difficult to say when the change was introduced. It has been conjectured that the square characters were in use in the time of Christ, from his referring to the letter *yod* as the smallest letter in the alphabet; a fact which is true of the present Hebrew alphabet, but would not apply to the antient Hebrew or Phœnician alphabet.

It is a characteristic of the Hebrew language, according to the system of most modern Hebrew grammars, that the alphabet consists only of consonants, and that the vowels are expressed by means of small points placed above and below the letters. The antiquity of these points has occasioned great controversy among the learned. Some have maintained that the points are as antient as the letters, and that both the points and letters were taught Moses by God himself; others, that the points were first introduced by Ezra when he transcribed the Scriptures in the present square characters; others, that the Hebrews had originally three vowel points, *a*, *i*, and *o*, answering to the three letters א, י, ע, and that the present system of punctuation was not introduced till the time of the Masorites; but it is now generally considered by eminent Hebrew scholars, Gessenius, Winer, Ewald, &c., that the whole system of punctuation was first introduced by the Masorites, of whom some account has been given above, perhaps as early as the sixth or seventh century, and certainly not later than the tenth or eleventh. It appears certain from many circumstances that the Hebrew letters were originally written without points. They are not found in antient Jewish coins and inscriptions; they are not once mentioned or alluded to in the Talmud; they appear to have been unknown to Origen and Jerome; the antient versions, such as the Chaldee paraphrases of Jonathan and Onkelos, and the Greek translations of Aquila, Symmachus, Theodotion, and the Septuagint, must have been made from Hebrew MSS. without points, since they frequently give a different interpretation to the words from that which they must mean according to the present system of punctuation; and it is allowed that all the other Semitic languages had antiently no points. The best arguments on both sides of the question are given in Buxtorf's 'Tiberias, sive Commentarius Masorethicus,' 4to., 1620, in which the antiquity of the points is maintained, and in Capellus's 'Arcanum Punctationis revelatum,' 4to., 1624, in which their antiquity is denied. Further information on the subject will be found in most of the grammars which are mentioned at the end of this article. The system of accentuation depends on that of points, and was in all probability introduced at the same time. The accents mark the relation of one word to another in a sentence, and thus serve an important purpose in the syntax of the language. Many scholars have considered the accents almost useless; but one of the most eminent Hebraists of the present day remarks (Ewald, 'Hebrew Grammar,' § 642, Engl. transl.), 'We everywhere find a beautiful harmony between the accentuation and the syntax, so that they mutually support and explain each other. Whether we set out from the syntax, and learn to comprehend it without knowing any thing of the accentuation, or whether we proceed from the accentuation to the syntax, an accurate investigation will always lead to the same results, so that he who thoroughly understands the syntax is for the most clearly possessed of the accentuation also, and he who understands the latter becomes throughout more easily at home in the former. This is however at the same time the best commendation of the accentuation.' We must distinguish however the accentuation of the historical and poetical books. The remarks of Ewald apply only to the accentuation of the historical books. Many of the accents in the poetical books serve the same purpose as those in the historical; but the greater part were intended to indicate the tone according to which the Scriptures were chanted in the synagogue. Tho accents aro explained with great clearness in Stuart's 'Hebrew Grammar.'

Further information respecting the Hebrew language and literature is given in Hezel's 'Geschichte der Hebr Sprache und Litteratur,' 8vo., Halle, 1766; Kopp's 'Bilder und Schriften der Vorzeit,' 1820-1; Gesenius's 'Geschichte der Hebr. Spracho und Schrift,' 8vo., Leip., 1815; Lowth's 'De Sacri Poesi Hebræorum;' best edition by Michaelis, 2 vols. 8vo., Gött., 1768-9: this work has been translated into English by Gregory; Herdor, 'Geist der Hebraïschen Poesie,' best edition by Justi, 2 vols. 8vo., Leip., 1825: this work has been translated into English by Marsh, Burlington, U.S., 1833; Bellermann, 'Versuch über die Metrik der Hebräer,' 1813: Saalschütz, 'Von der Form der Hebr. Poesie,' 8vo., 1825; the introductions to the Old Testament by Eichhorn, Jahn, De Wette, and Augusti; Hurwitz, 'Hebrew Tales, selected and translated from the Writings of Antient Hebrew Sages; to which is prefixed an Essay on the Uninspired Literature of the Hebrews,' 12mo., Lond., 1826; the article Bible, in this work.

Grammars.—The following list is only intended to direct tho attention of the student to the principal grammars. Buxtorf, 'Thesaurus Grammaticus Linguæ Sanctæ Hebrææ,' 8vo., Basel, 1615: this work is taken from the Hebrew grammar of the Rabbi David Kimchi, and is the best grammar according to the Rabbinical System; Schultens, 'Institutiones ad Fundamenta Linguæ Hebrææ,' 4to., Leyden, 1731; Robertson, 'Grammatica Linguæ Hebrææ,' 8vo., Edinb., 1758; Jahn, 'Grammatica Linguæ Hebraicæ, Leip., 1788; Gesenius, 'Ausführliches Grammatisch-kritisches Lehrgebäude der Hebr. Sprache,' 8vo., Leip., 1817; but his smaller grammar, forming the first volume of his 'Hebräisches Elementarbuch,' is better adapted for beginners. The Hebrew grammars of Gesenius formed the basis of a very good Hebrew and English grammar by Stuart, published originally at Andover, U.S., in 1821, and reprinted at Oxford in 1831. The 'Elémens de la Grammaire Hebraïque,' by Cellerier, 8vo., Genève, 1820, is also formed upon the Hebrew grammar of Gesenius. The grammars of Ewald contain the most philosophical exhibition of the language that has yet appeared: his larger grammar, entitled 'Kritische Grammatik der Hebr. Sprache,' was published at Leip., 1827, 8vo. The writer of a review of this work in the 13th No. of the 'Journal of Education' remarks that 'the reader will not expect to find in the work of Ewald the *elementary* parts of Hebrew grammar entirely different from those which were stated by the Buxtorfs, and by Gesenius and his followers in Europe and America. The characteristics of Ewald's grammar consist in his manner of accounting for the general rules, and in his attempts to refer the rules and their apparent exceptions to more general principles. But this laudable aim leads Ewald into a number of new conjectures, which in his Critical Grammar he pronounces authoritatively against his predecessors. The conjectures of Ewald were however generally supported by independent investigations.' A smaller Hebrew grammar was published by Ewald in 1828, which has been translated into English by Nicholson, 8vo., Lond., 1836. Lee's 'Grammar of the Hebrew Language,' 2nd ed., 8vo., 1831, contains many excellent observations, but it is deficient in clearness of arrangement, and cannot be recommended to beginners. Hurwitz, 'Grammar of the Hebrew Language,' 8vo., Lond., 1831, is well calculated for beginners, but it does not give a philosophical development of the language. Those who wish to use a small grammar will find the following works useful:—Yeates, 'Hebrew Grammar,' which has been frequently printed, and Hincks, 'Grammar of the Hebrew Language,' Belfast, 1832. In the schools and universities of Holland the two following works are principally used: Schroeder, 'Institutiones ad Fundamenta Linguæ Hebrææ,' reprinted at Glasgow, 1824, 8vo.; and Roorda, 'Grammatica Hebræa,' 2 vols. 8vo., Leyd., 1834. Stier's 'Neugeordnetes Lehrgebäude der Hebr. Sprache,' 2 vols. 8vo., Leip., 1833, is said by the writer of a review in No. 13 of the 'Journal of Education' to be the 'best work now extant in any language on the elements and what is usually called the etymology of the Hebrew language.'

Grammars without vowel points:—Masclef, 'Grammatica Hebraica,' 2 vols. 8vo., Paris, 1731; Parkhurst's 'Methodical

Hebrew Grammar,' prefixed to his Hebrew and English Lexicon; Wilson's 'Elements of Hebrew Grammar,' 4th ed., 8vo., 1810; Newton's 'New and Easy Introduction to the Hebrew Language,' 12mo., Lond., 1806.

Lexicons.—Buxtorf, 'Lexicon Hebraicum et Chaldaicum,' 8vo., Basel, 1634; reprinted at Glasgow in 1824; Stock, 'Clavis Linguæ Sanctæ Veteris Testamenti,' 8vo., Jena, 1753 (best ed.); Winer's edition of 'Simonis Lexicon Manuale Hebraicum et Chaldaicum,' 8vo., Leip., 1826: this work is said by the writer of a review in No. 11 of the 'Journal of Education' to belong 'to the most useful works of its kind, especially for students who have overcome the first difficulties of the language;' Leopold's 'Lexicon Hebraicum et Chaldaicum,' 12mo., Leip., 1832, a useful lexicon for beginners; Gesenius, 'Thesaurus Philologico-criticus Linguæ Hebrææ et Chaldææ,' 4to., 1828-35, of which two parts have as yet only appeared. Gesenius's first work on Hebrew lexicography was entitled 'Hebräisch-Deutsches Handwörterbuch über die Schriften des Alten Testaments,' 2 vols. 8vo., 1810-12, which was translated into English by Leo, 2 vols. 4to., Lond., 1825. In 1815 Gesenius published a smaller Hebrew and German lexicon, which has gone through several editions, and formed the basis of 'A Manual Hebrew and English Lexicon,' by Gibbs, Andover, U.S., 1824; reprinted in London, 1827 and 1833. The most recent Lexicon by Gesenius, entitled 'Lexicon Manuale Hebraicum et Chaldaicum,' was published at Leip., 1833, and has been translated into English by Robinson, Boston, U.S., 1836. Parkhurst's 'Hebrew and English Lexicon,' which was published originally in 1762 in 4to., and has since been frequently reprinted, is intended for the use of those who are unacquainted with the vowel-points. A review of the most important Hebrew grammars and lexicons is given in Nos 9, 11, and 13, of the 'Journal of Education.'

Those who are commencing their Hebrew studies without the assistance of a master will find the following works useful:—Leusden's 'Clavis Hebraica Veteris Testamenti,' 4to., Utrecht, 1683; Robertson's 'Clavis Pentateuchi,' 8vo., Edinb., 1770; reprinted at Norwich, 1824; Bythner's 'Lyra Prophetica, sive Analysis critico-practica Psalmorum,' reprinted at Glasgow in 1823; Meisner's 'Nova Veteris Testamenti Clavis,' 8vo., Leip., 1809; Reay's 'Narratio de Josepho,' Oxf., 1822; Olivant's 'Analysis of the Text of the History of Joseph, upon the principle of Professor Lee's Hebrew Grammar,' 8vo., 2nd ed., Lond., 1833; Greenfield's 'Book of Genesis in English-Hebrew; accompanied by an Interlinear Translation, Philological Notes, and a Grammatical Introduction,' 8vo., Lond.

HEBREWS. [Jews.]

HEBREWS, EPISTLE TO THE, a book of the New Testament. The absence of the initiatory formula usual in the apostolic epistles has led some to doubt whether this book is an epistle or a dissertation. But it contains allusions to particular circumstances, which prove it to be an epistle (v. 11, 12; vi. 9, 10; x. 32-34; xiii. 19, 22, 23). The general opinion respecting the persons to whom this Epistle was addressed is that they were the Jewish converts in Jerusalem or Palestine generally. This opinion, as Michaelis has shown, is supported by the contents of the book itself. (Marsh's *Michaelis*, vol. iv., pp. 193-7.) Others suppose it to have been addressed to the Jews of Asia Minor, and Dr. Noesselt contends for its having been written to the Thessalonians. Concerning the language in which this epistle was written critics have been much divided; some supposing that it was written in Greek, and others that it was written in Hebrew and translated into Greek. The latter opinion was held by Clement of Alexandria, (who states 'that it was written by Paul in the Hebrew language for the use of the Hebrews, and that Luke translated it for the benefit of the Greeks'); by Eusebius, and by other fathers; and is strongly advocated by Michaelis. The other opinion is supported by Lardner, Macknight, Rosenmüller, Professor Stuart, and most modern commentators. But the arguments on either side are far from being conclusive.

The author of this Epistle is equally uncertain. The general voice of tradition assigns it to the apostle Paul, but it has also been ascribed to Barnabas, to Luke, to Silas, and to Apollos.

In the first ages of the church it appears to have been generally considered as a production of the apostle Paul, though great doubts were very early entertained on the subject. In the Alexandrian church we have the testimony of Pantænus (A.D. 180) to its Pauline origin, as well as that of Clement, in the passage quoted above, and in other parts of his writings. These testimonies are preserved by Eusebius (*Hist. Eccles.*, book vi., c. 14). Eusebius also quotes a passage from Origen (*Ibid.*, c. 25), which has been variously understood, but which seems to imply that an objection had been raised against the Pauline origin of the epistle from the superiority of its style to that of the acknowledged Epistles of Paul, and that to meet this objection Origen supposed the sentiments to be Paul's, but the diction that of some other person, a disciple of Paul. But he adds—'If any church therefore hold this epistle to be Paul's, let it receive commendation for this. For it is not without reason that the antients have handed it down as Paul's.' In Origen's own writings it is frequently quoted as being written by Paul; and after his time the Alexandrian fathers unanimously ascribe it to the same apostle. Turning to the Eastern church we find passages in the writings of the fathers, which are thought by some to be indirect quotations from this epistle. The earliest direct testimony is that of Eusebius, who mentions fourteen epistles as being clearly and certainly Paul's, but adds that 'some have rejected that which is written to the Hebrews, alleging, with the church at Rome, that it is spoken against as not being Paul's.' He frequently cites it as written by Paul. The Western church seems to have been greatly divided on this subject from about the close of the second to the middle of the fourth century, when Jerome states that the Epistle was received as Paul's by all the Greek and some of the Latin churches, though rejected by most of the Latins, who ascribed it to Barnabas or Clement of Rome, but held it in high esteem, and read it in their churches. Jerome himself, and Augustin, constantly refer to it, sometimes as an apostolic production, and sometimes as St. Paul's. Their authority appears finally to have established the belief in its Pauline origin among the Western churches. The modern advocates of the same opinion have attributed the doubts which prevailed in the Western church at the end of the second century to the disputes with the Montanists, who relied on this Epistle in support of some of their opinions. On the other hand, those who believe that Paul did not write the Epistle ascribe the strong testimony of the Alexandrian fathers in its favour to their great fondness for the allegorical interpretation of Scripture, which the style of this Epistle is thought to sanction. The passage in 2 *Peter*, iii. 15, is thought by some to refer to the Epistle to the Hebrews.

The internal evidence in favour of Paul being the author is drawn from the reference (c. xiii., v. 23) to Timothy, who is known to have been Paul's intimate friend and frequent companion; and from other incidental allusions (see x. 34; xiii. 18, 19, 24). In the arrangement of the Epistle, the former part being doctrinal and the latter part hortatory, in the mode of using quotations from the Old Testament and the style of argument adopted, in the doctrines most prominently stated and the phraseology employed, there are great resemblances between this book and St. Paul's acknowledged epistles. (For examples see Prof. M. Stuart's *Commentary on the Hebrews*, Introd., sects. 20—24, and Horne's *Introduction*, vol. iv., p. 415, &c., ed. 1834.) The chief objections against the Pauline origin of the epistle are drawn from the absence of the usual address at the beginning, the superiority of the style to that of Paul's acknowledged epistles, and the resemblance between its style and that of the Alexandrian school. The points above stated are discussed with great ability and candour by Prof. Moses Stuart in favour of the Pauline origin of the epistle, and Prof. Bleck on the other side.

The opinions which assign the authorship to Barnabas, Apollos, Luke, and Silas, rest on very slight grounds. The second of them was first started by Luther, a conjecture founded on the resemblance which the epistle bears to what we might expect to have been written on such a subject by a man of the character given to Apollos in *Acts*, xviii. 24—28.

The date depends partly on the settlement of the former question. The internal evidence of the Epistle shows that it was written while the temple at Jerusalem was standing (see viii. 4-5; ix. 9), and probably not long before its destruction in A.D. 70. If Paul was the author, it was probably written during his first imprisonment at Rome, and immediately before he was released (see xiii. 18, 19, 23).

Accordingly most critics refer it to A.D. 61 or 62; some say A.D. 58.

The canonical authority of this Epistle depends partly on its authorship; but may be argued on other grounds. It is repeatedly quoted by Clement of Alexandria, and apparently by Barnabas, Hermas, Polycarp, Ignatius, and Justin Martyr. It is contained in the Peshito Syriac version, the date of which is not later than the second century, and in the old Latin versions made about the same period. From that time the questions of the canonical authority and the authorship are very much mixed up together.

The design of the writer of this Epistle appears to have been to sustain the faith of those to whom he wrote, while they were suffering under persecution and inclined to apostacy. With this object he argues the dignity of Christ as superior to angels (c. i., ii.), to Moses (c. iii.), and to the race of Jewish priests (iv. 14—16; v.—viii.); the superiority of the Christian to the Jewish religion, inasmuch as the latter was only typical of the blessings conferred by the former, and was intended only to last for a time, while Christianity is to be permanent (c. ix.; x. 1—18). He proceeds to apply these arguments to encourage the Hebrews to constancy in their faith, and to enforce his exhortations by the example of eminent men (x. 19—xii.). After urging them to the practice of various Christian duties, he concludes with the usual salutations. In warmth of feeling, elegance of language, and force of argument, this epistle yields to no book of the New Testament.

(Lardner's *Credibility;* Marsh's *Michaelis*, vol. iv.; Prof. Moses Stuart's *Commentary on the Hebrews;* of Prof. Bleek's *Brief an die Hebräer*, perhaps the best commentary on this epistle, two vols. only have appeared, the first (8vo., Berlin, 1828) containing Dissertations, &c., and the 2nd the Commentary as far as c. iv., v. 13, Berlin, 1836; Hug and Horne's *Introductions;* for a list of commentators see Watt's *Bibliotheca Britannica*, and Seiler's *Biblical Hermeneutics.*)

HEBRIDES, THE (or Western Islands of Scotland), are scattered in the Atlantic Sea, along the western coast of North Britain, between 55° 35′ and 59° N. lat., and 5° and 8° W. long. They amount to the number of nearly 200, but more than one-half of them are so small or so sterile as not to be inhabited. In 1808 only 79 were regularly peopled all the year round, but in eight more houses were found, which were tenanted during the summer, and abandoned at the approach of winter.

These islands are commonly divided into the Northern and Southern Hebrides, the most western point of the main land, the promontory of Airdnamurchan (56° 40′ N. lat.), being considered as the point from which the line of division between them runs westward into the Atlantic. But geographically they should be divided into the Eastern and Western Hebrides, as the greater number of them are at no great distance from the coast of Britain, and one extensive group is much farther to the west in the ocean. The wide and open strait which divides the last-mentioned group, which is comprehended under the general name of Long Island, from the former islands and the mainland of Scotland, is called the Minch; and in its narrowest part (about 20 miles), between Skye and North Uist, it is called the Little Minch.

The surface of the Hebrides is stated to exceed 3184 square miles, which is nearly one-twelfth part of Scotland and one-thirtieth of Great Britain. They are larger than Corsica, or the two provinces of Holland, and than any county of Great Britain, excepting Yorkshire and Inverness.

The surface of these islands varies considerably. Some of the larger islands, especially those which approach the mainland, are mountainous, such as those of Arran, Jura, Mull, and Skye, in which the elevated masses rise to the height of 2000 or 3000 feet and more above the sea. The rest are in general only hilly, the most elevated parts not exceeding 1500 feet; and in a few of them the hills do not rise to more then 300 or 500 feet, as in Tyree and in the southern islands which belong to the group of Long Island. The coasts are everywhere rocky, and in many parts high, and particularly so along the western shores towards the Atlantic, with the exception of the innermost angles of the bays and inlets, where they are frequently low. The southern islands of Long Island have a series of sand-hills on their western coast, and the shores are generally indented by large bays and inlets, which form a vast number of harbours of every description, some of which, in security and capaciousness, are equal to any in the world. It is stated that there is no place, even in the larger islands, which is more than seven miles from the sea-shore. The rivers are small, but numerous, and all of them abound in salmon, trout, and eels; many of them contain also several other kinds of fish. Some of the islands abound in lakes. Those of Long Island alone cover 25,000 acres, and in the small island of Tyree they are stated to occupy about 700 acres. The soil is in general as good as in other parts of Scotland, except a few tracts particularly favoured by nature. The islands of Bute and Islay are considered fertile, and also several districts in the island of Skye. But a comparatively small portion of the surface of the whole is under cultivation. The whole area of the islands comprehends 1,592,000 Scotch acres, of which only 210,000 are arable or meadow land; 600,000 acres mountains, morasses, and lakes; 70,000 acres pasture ground, commonly on hills, and of little value; 25,000 acres are barren sands tossed about by the winds; 22,000 are occupied by peat-mosses; and 30,000 acres are dry at ebb-tide, and serve as kelp-shores. There are no natural woods on the islands, but about 5000 acres have been planted.

The backward state of these islands is chiefly to be attributed to the want of timber, their great distance from towns and markets, and the difficulty of intercourse on account of the boisterous seas which surround them, and the storms which frequently prevail nine months of the year, especially from the south-west. This wind brings torrents of rain almost annually from August to the beginning of March. Early in March, and often also in October and November, a north-east or north-north-east wind prevails; and although the coldest that blows here, it is generally dry and pleasant. The climate is upon the whole mild. Frost and snow are almost unknown in the smaller isles, and they seldom prevail in the larger to any considerable degree. On the sea-shores the thermometer rarely falls more than 5° below the freezing-point. The annual quantity of rain which falls in the higher islands may be between 30 and 36 inches; but in the lower it probably does not exceed 25 inches. Grasses and corn ripen very quickly: in Uist, Lewis, and Tyree, big, or bear, is frequently cut down within ten weeks after being sown.

The great mass of the population resides within a mile of the sea-shore. The traveller meets with scarcely an inhabited house 1000 yards from the sea-mark, or 300 feet above the level of the ocean, except in the islands of Bute and Islay. From their language and customs it is evident that they are of the same stock with the inhabitants of Ireland and of the Highlands of Scotland. In most of the islands they gain as much by catching herrings, cod, and ling, with which the surrounding sea abounds, or by burning kelp, as by their agricultural industry.

The Hebrides belong politically to four Scotch counties. Those of them which lie in the Frith of Clyde, between the peninsula of Cantyre and the coast of Ayrshire, constitute a county by themselves. [BUTE; ARRAN.] All the other Southern Hebrides, together with the islands of Muck, Rum, and Canna, which are included in the Northern Hebrides, are annexed to the county of Argyle. [ARGYLE.] The Long Island, except Lewis, constitutes a part of Inverness-shire. Lewis is a part of Ross-shire; and Skye belongs to Inverness.

The Hebrides are mentioned by Ptolemy under the name of Ebudæ, and by Pliny (iv. 16) under that of Hebudes. Pliny makes the Hebudes thirty in number.

(M'Culloch's *Highlands and Western Islands;* Macdonald's *General View of the Agriculture of the Hebrides.*)

HEBRUS. [MARITZA.]

HECATÆUS of Miletus, son of Hegesander, was one of the earliest Greek prose writers. He was present at the deliberation of the Ionians (B.C. 501), and attempted to dissuade them from revolting against the Persian king. (Herod., v. 36.) He is also mentioned by Herodotus (v. 125) as being alive at the time of the flight of Aristagoras, B.C. 497.

His works, which consisted of histories, genealogies, and geographical pieces, were held in considerable esteem by the antients. Herodotus (vi. 137) quotes one of his historical works. Strabo (i. p. 12, *Casaubon*) complains that his geographical works only contained the descriptions of the poets written in prose; but he is mentioned by Ammianus Marcellinus (xxii. 8) in conjunction with Eratosthenes and Ptolemy. Hecatæus appears, like Herodotus, to have visited distant countries for the purpose of acquiring information respecting the history, customs, and physical peculiarities of foreign lands. Herodotus (ii. 143) gives an account of a conversation of Hecatæus with the priests at Thebes in Egypt, which was apparently derived from his works.

The fragments which remain of the writings of Hecatæus have been published by Creuzer in his 'Historicorum Græcorum Antiquissimorum Fragmenta,' 8vo., Heidel., 1806, by Klausen, 'Hecatæi Milesii Fragmenta,' 8vo., Berl. 1831; and in the 'Museum Criticum,' vol. i., p. 88-101, Camb., 1814.

HE'CATE, one of the antient Greek divinities, the daughter of the Titan Perses and Asteria, according to Hesiod (*Theog.*, 411). Her attributes correspond in most respects with those of Artemis; and it has therefore been conjectured that she may originally have been the same as Artemis. Her name, the feminine of Hecatus (' the far-shooting'), one of the names of Apollo, the brother of Artemis, is thought to favour this supposition. Hecate presided over hunting and fishing, the deliberations of the popular assembly and the courts of justice. She seems also to have appropriated to herself part of the duties of Persephine (Proserpine); since she was regarded as the mistress of the lower world, and the patroness of magic. She was considered a beneficent deity, who answered the prayers of her worshippers. Her statues were placed at cross-roads and before houses. She was held in much respect in Athens, where she was regarded as the patroness of families and children. She was greatly venerated by the inhabitants of Ægina, who held a festival once a year in honour of her; which was said to have been instituted by Orpheus. (Pausan., ii. 30.)

HECLA. [ICELAND.]

HE'DERA, a genus of Araliaceous plants consisting of nearly fifty species, inhabiting chiefly the warmer parts of the world, is interesting to Europeans for containing among others the common ivy with its numerous varieties. This plant, the Hedera Helix of botanists, does not exactly represent the habit of the genus, for many of the exotic species, instead of being creepers, adhering to other plants, or to rocks and walls by their sucker-like roots, are trees of considerable size

Common ivy is dispersed through many distant parts of the Old World, lying between the Canaries and Europe on the west, and the northern parts of China on the east. In the Canaries it acquires its largest size, being what is called in English gardens the Irish or giant ivy, which grows so much faster than the European form. In the north of India, and indeed occasionally in Italy, the berries, instead of being black as with us, are bright yellow, and it is supposed that this is more particularly the Hedera of the Roman poets. The leaves vary much in form, and there is a kind which never runs or creeps upon other plants, but merely forms a compact bush.

HEDGE, one of the most lasting and effectual of our fences. When hedges have been well made, and are kept in good order, nothing can surpass them, except well-built stone or brick walls, and even these are far less effectual in keeping out trespassers of every description.

Hedges are made of various kinds of shrubs and trees, trained so as to throw out numerous branches along the stem from the surface of the earth upwards; this is done by judicious pruning when they are young. The head being cut off and the side branches shortened, numerous smaller branches spring out, which are shortened in their turn, and form a very compact mass, consisting of the ends of stumps and branches pointing in every direction. Those shrubs which are of a thorny nature are best adapted for hedges. Holly, which bears prickles on the edges of the leaves, is on this account by far the best shrub to form a hedge. But it has a great inconvenience in its very slow growth, and, except in very old gardens, which have been surrounded by a high holly hedge before the present generation was born, it is very seldom that such a hedge is met with. The high price which the nurserymen charge for this plant is another reason why it is more seldom planted.

In forming a holly-hedge the ground should be prepared by trenching and abundant manuring: the plants should be most carefully planted after midsummer, or immediately before the usual rains which come at that season. There should also be a portion of virgin soil for the roots to spread in; and in planting they should be well divided, to give them the greatest possible extent from which to draw their nourishment. The earth should be well pressed to them by treading it down; and, in case of a continued want of rain, they may be occasionally watered, late in the evening, or early in the morning. By a little attention to them in the first year, they will form a good fence several years sooner than those which are comparatively neglected. The plants which are usually put in are three years old; but if they could be transplanted at once from the seed-bed, they would sooner come to perfection; and by being cut down and pruned earlier, would lay the foundation of a closer and better hedge. Next to holly, as forming a close and durable hedge, is the yew: it bears very close clipping, and forms a thick hedge and good shelter all through the year. For gardens and nursery-grounds, where shelter and occasional shading are required, the yew-hedge is preferred; but in all places where cattle are put to pasture, they should never be permitted to grow. Many valuable horses and cattle have been destroyed by grazing in places where yew-trees grew; and notwithstanding the instinct which leads animals to reject food which is hurtful, they greedily eat the yew leaves in spring. The same may be said of box.

The various kinds of thorns are peculiarly adapted to form hedges, and they are consequently by far the most common plants of which a live hedge is formed.

For high hedges and strong fences the hornbeam and a variety of the beech which throws many branches from the stem are extensively used in old gardens, where geometrical figures and numerous angles are admired.

Where it is desirable that the hedge should arrive very rapidly to such a size as to be a good defence against cattle, elder may be planted. Elder grows very rapidly, and throws out many long hollow branches, which soon become hard, and are admirably calculated for a fence, and cattle will not eat the leaves; but it is never very close or ornamental; and as it requires to be cut down frequently, it displays very unsightly knots and stumps when it has acquired a certain age.

Sweetbriar is ornamental, and forms a good fence against sheep. It is chiefly confined to flower-gardens and enclosures in pleasure-grounds.

Many other shrubs might be named, such as the *pyrus Japonica*, which is prickly, grows close, and bears a beautiful flower. It is as hardy as any native British plant, and will bear cutting and training as well as any of them. Hitherto no edges have been made of this shrub, except a few in the gardens of nurserymen; but there is no doubt that if many young plants were wanted for hedges, they would soon be produced at a reasonable price. The privet is a very common and quick-growing shrub, which is frequently planted as a hedge where cattle are not admitted; but of all shrubs, the most common and most useful for the purpose of hedges are the black and white thorn, and they almost universally form the quick hedges by which our fields are separated and enclosed.

In order to have a good hedge, the shrubs should be planted in a soil which is naturally strong, but well pulverised, and in which no shrub or tree has lately grown. The best soil is that which is produced by the decomposition of sods taken from commons or old pastures; and it is observed that in new enclosures, where the quick has been inserted between two sods, it always grows luxuriantly, and only requires to be protected, when young, against the cropping of cattle and sheep, which are fond of the young tender shoots. The usual mode is to insert, in the early part of the spring, two or three rows of quick in the side of the bank, on a level with the surface of the ground, where a sod has been turned over, and forms the base of the bank raised by the earth taken out of the ditch. This quick requires to be protected from cattle or sheep by some fence. [FENCE.] Sometimes the quick is planted in two or three parallel rows on the top of the bank, which in this case is made much wider, with a ditch on each side. A double fence in such case is necessary for its complete protection. When the quick is planted on the top of the bank, the surface sods are reserved to lay at the top; and after being broken and chopped to pieces, are dug into the bank. Stable-dung is frequently dug in at the same time, and is well bestowed: the quicks are then inserted, and well watered. They never fail to come up luxuriantly; and when properly pruned they form a close and impenetrable hedge.

Many think that it is advantageous to prune and cut down the young shoots every year, in order to excite them to throw out fresh ones in greater number. But this is an error by which the growth of the hedge is much retarded. The shoot should be allowed to grow to its full extent the first and second year; the root will then have struck deep into the ground; and in the third or fourth year the quicks may be cut down to a few inches. They will then send out several fresh and strong shoots, which may be cut and pruned to the height and width of the intended hedge.

In Holland and Flanders the hedges are often trained along stakes and rods placed for the purpose, and tied together with oziers. In this case every slender branch is tied to the rods, and they are laid so as to cross each other frequently, and the redundant shoots which cannot be conveniently tied in are cut off. These hedges, when in leaf, look very close and light, and take up very little room; and birds can scarcely harbour in them. It appears at first sight that much labour is required to train hedges in this way; but this is by no means the case. When they have once grown to the proper height they only require to be regularly clipped.

In forming a hedge it is necessary to take into consideration the quality of the soil, the aspect of the bank, and whether the land is porous, or very retentive of moisture. In the first case it will be advantageous to plant the quick in the side of the bank, raising the earth above it to keep in the moisture. A ledge may be made by setting the first sod at a couple of inches from the edge of the ditch. The water which may fall on the bank and run down the smooth side is arrested by the ledge and soaks into the roots. In the other case the top of the bank is the proper place, and a small concavity may be given to it to retain the water and keep the roots moist.

In a dry soil which does not require draining, ditches are unnecessary, and it is much better to plant a hedge on a little bank formed by a few sods about eighteen inches wide, with a small water-furrow on each side. The whole width need not be above two feet six inches, whereas a bank and ditch take up at least six feet, and the plough cannot go nearer than a foot from the edge of the ditch or the bank. Thus eight feet are taken up by the fence.

When a hedge has been left uncut for several years, it grows wide and high. It requires to be cut down once in seven or eight years; in this case much care is required in the cutting that the shoots may grow out again regularly. The common labourers often do this very carelessly by cutting the stems downwards with one or more cuts of their bill-hook. The consequence is that the stem is split and shivered, and the rain lodging in the ragged cut injures the wood and causes it to die down farther than it otherwise would. Hence the general maxim of 'cutting up,' so strongly recommended by all those who give directions about cutting hedges. Portions of the stems are often left of a greater length than the rest for the purpose of holding the bushes, which are generally laid over the cut stumps to protect them against cattle. But it is better to cut the hedge regularly, one row close to the ground, and one a few inches longer; this will strengthen the foot of the hedge, and prevent its being thin and hollow at bottom.

When a hedge has become old, and many of the plants are decayed, it is very difficult to renew it. If young quicks are planted on the same spot, they will scarcely ever succeed, unless very great precautions are taken. The soil is exhausted or deteriorated, and must be renewed: but manuring is not sufficient; fresh earth is required for the new quick. The simplest process is to level the old bank, spread the earth of which it was formed, which will be of great use to the ground where it is spread, and form a new bank in the same place from earth taken elsewhere; or, where it can be done without inconvenience, it is better to make an entirely new ditch and bank, and to fill up the old. This is perhaps the surest as well as the soonest way of having a new hedge which will be permanent.

What has been said of renewing a hedge is equally applicable to repairing gaps in an old one. It is of no use to put in young plants in the old bank. The earth must be removed, and fresh earth put in its place. The old hedge must be cut and trimmed, so that the young quick may not be shaded, and in that case the gap will shortly be filled up, and the hedge be restored as a continuous fence. Where the gaps are very small, and the hedge is not cut down altogether, it may sometimes be advisable to plant hollies or other plants, which will grow well and fill up the deficiency.

Well managed hedges are the most effective fences, the cheapest, and the most pleasing to the eye. It is to the hedge-rows that England owes much of its garden-like appearance; but the trees, which are their chief ornament, are very destructive of the hedge as a fence; and where trees are planted it would be much better if they stood within the bank, without interfering with the hedge. Whether trees can be allowed in hedge-rows, in a perfect system of agriculture, is a question which we will not attempt to answer.

There is a method of repairing hedges which is called *plashing*. It consists in cutting half through some of the stems near the ground, and then bending the upper parts down in a horizontal or oblique position, keeping them so by means of hooked sticks driven into the bank. Thus a live hedge is made, which fills up the gaps in the same manner as a dead hedge would have done, and the bent stems soon throw out shoots. If the stems are young, and not above the thickness of a finger, an excellent hedge may be thus formed, which, when clipped, will be close and perfectly impervious. But the work is generally done in a very injudicious manner. When a hedge is plashed which has been long neglected, the thick stems, which are hacked through, leaving only a small portion of the under bark uncut, have an unsightly appearance, and seldom throw out shoots near the bottom, where they are most wanted. To plash a young hedge by merely bending the twigs is an excellent practice: but when the stems are thick and old, the only remedy is to cut them down, or make an entirely new bank well planted with quick.

HEDGEHOG, *Hérisson* of the French. The Hedgehogs are placed by Cuvier at the head of the *Insectivorous Mammifers*; and M. F. Cuvier observes that in *Chrysochloris* the normal system of dentition of the *Insectivora* may be seen reduced to the narrowest dimensions; whilst in the Hedgehogs it appears to be brought to the greatest development.

Dental Formula.—Incisors $\frac{6}{2}$; Canines 0; Molars $\frac{7-7}{7-7}$ = 36.

Generic Character.—*Body* covered with spines, with the power of rolling itself up in a ball by means of appropriate muscles; *muzzle* pointed; *ears* more or less apparent; *tail* short; each *foot* five-toed and armed with robust claws.

Geographical Distribution of the Genus.—Species of Hedgehog have been recorded as inhabitants of Europe, Africa, and India.

We select as an example the *Common Hedgehog, Erinaceus Europæus.*

This is the *Riccio* of the Italians, *Erizo* of the Spanish, *Ourizo* of the Portuguese, *L'Hérisson* of the French, *Igel* of the Germans, *Eegel-varken* of the Dutch, *Pin-suin* of the Danes, *Draenog* and *Draen y coed* of the antient British, *Urchin* of the modern British, *Echinus terrestris* of Gesner, *Echinus (Erinaceus) terrestris* of Ray, and *Acanthion vulgaris* of Klein. There can be little doubt that it is the Echinus (Ἐχῖνος) of Aristotle.

This indigenous animal is too well known to need a lengthened description. The length is generally rather more than nine inches.

Food, Habits, Reproduction.—The food of the Hedgehog, which is a nocturnal animal, consists principally of insects, worms, slugs, and snails. That it will eat vegetables is shown by White of Selborne, who relates how it eats the root of the plantain, by boring beneath it, leaving the tuft of leaves untouched. In the *Zoological Journal* (vol. ii.) is an account by Mr. Broderip of an experiment made by Professor Buckland, proving that, in captivity at least, the Hedgehog will devour snakes: but there is no good reason for supposing that it will not do the same in a state of nature, for frogs, toads, and other reptiles, and mice, have been recorded as its prey. From its fondness for insects it is often placed in the London kitchens to keep down the swarms of cockroaches with which they are infested; and there are generally hedgehogs on sale in Covent Garden market for this purpose. It is hardly worth while to refute the idle story that this persecuted animal sucks the cows; but, according to Sir William Jardine, it is very fond of eggs, and is consequently mischievous in the game-preserve and hen-house. The Hedgehog hybernates regularly, and early in the summer brings forth from two to four young ones at a birth, which, at the time of their production, are blind, and have the spines white, soft, and flexible. The nest wherein they are cradled is said to be very artificially constructed, the roof being rain-proof.

Utility to Man.—The flesh of the Hedgehog, when it has been well fed, is sweet and well-flavoured, and is eaten on the Continent in many places. In Britain few besides the gipsies partake of it. The prickly skin appears to have been used by the Romans for hackling hemp.

We refer those who would pursue the history of the common Hedgehog still further to the interesting account in the 'History of British Quadrupeds,' by Thomas Bell, Esq., F.R.S., &c., 8vo. London.

Among the foreign *Erinaceadæ*, *Erinaceus spatangus* and *Erinaceus Grayi* will be found recorded in the *Proceedings of the Zoological Society* for 1832. Both came from the Himalayan Mountains, and the latter was considered by Mr. Gray to be identical with *Erinaceus collaris*, figured in the *Illustrations of Indian Zoology*. Mr. Bennett however regarded it as a new species, inasmuch as *Erinaceus Grayi* was destitute of a white collar, and differed in other particulars from the figure referred to. A species from the interior of South Africa, forming part of the collection brought from that country by Mr. A. Steedman, *Erinaceus frontalis*, is recorded in the same vol. of the *Proceedings*.

Mr. Gray places the subfamily *Erinacina* under the family *Talpidæ*. (*Annals of Philosophy*, 1825.)

HEDGEHOG, a name given in gardens to the round prickly pods of various species of Medicago.

HEDINGHAM. [ESSEX.]

HEDJAZ, or HEJAZ. [ARABIA.]

HEJIRA. [ÆRA.]

HEGEL, GEORGE WILLIAM FREDERICK, was born at Stuttgart on the 27th of August, 1770, and was educated at the gymnasium of his native city. At the age of eighteen he proceeded to Tübingen to join the classes of theology and philosophy, where he had for his class-fellow the illustrious Schelling. Dissatisfied with the prevailing system of metaphysics, Hegel sought to supply its deficiencies by the works of Plato, Spinosa, and Kant; and in the conviction that a truly philosophical comprehension can only be educed by an enlarged and diversified inquiry, he combined with a knowledge of philosophy a profound acquaintance with the natural and political sciences. Upon being admitted to the degree of doctor in philosophy, he accepted an engagement as private tutor, in which capacity he lived for some years first in Switzerland, and afterwards at Frankfort-on-the-Main, until, on the death of his father in 1800, he was enabled by the inheritance of a small patrimony to devote himself without restraint to the study of philosophy. He accordingly proceeded to Jena, where Schelling was teaching his system of *Absolute Identity*, and of which Hegel was at this period one of the warmest partisans. Here he composed as an academical exercise the essay 'De Orbitis Planetarum,' (Jenæ, 1801), and shortly afterwards his first philosophical work, entitled 'On the Difference of the Systems of Fichte and Schelling;' which treatise, notwithstanding the sincerity with which Hegel then advocated the views of the latter, contained the germ of that dissent which was afterwards expanded into a peculiar theory. He was also associated with Schelling in conducting the 'Critical Journal of Science;' and among the most important of the articles contributed by him is that 'On Faith and Science,' which contains a luminous review of the doctrines of Kant, Jacobi, and Fichte, whose several systems are represented as nothing more than so many forms of a purely subjective philosophy. In 1806, when Schelling went to Würzburg, Hegel was appointed to supply his place as lecturer. The duty of communicating his views to others necessarily imparted to them distinctness and precision; and now for the first time Hegel openly avowed his dissatisfaction with the system of Schelling. The difference between the ideas of the master and disciple was marked still more strongly in the 'Phenomenology of Mind,' which was published at Bamberg, whither Hegel had retired after the battle of Jena. This work he used to call his 'Voyage of Discovery,' as indicating the researches he had passed through in order to arrive at a clear knowledge of the truth. It contains an account of the several grades of development through which the 'self,' or 'ego,' proceeds: first of all from consciousness into self-consciousness; next into reflecting and active reason, from which it becomes philosophical reason, self-cognisant and self-analyzing, until at last, rising to the notion of God, it manifests itself in a religious form. The title 'Phenomenology' points out the limits of the work, which is confined to the phenomena of mind as displayed in the element of its immediate existence, *i.e.* in experience. It traces the course of mind up to the point where it recognises the identity of thought and substance, of reason and reality, and where the opposition of science and reality ceases. Henceforward mind develops itself as pure thought or simple science, and the several forms it successively assumes, which differ only in their subject-matter or contents, are the objects of logic, or *dialectic*.

During his retirement at Bamberg, Hegel conducted the political journal of that town with great ability, and with an honesty and candour rare in the journals of that period, until he was called, in 1808, to preside over the gymnasium of Nürnberg. The duties of this situation he discharged with as much energy as skill, and the benefit of the reforms he effected, both in the discipline and the studies of the school, are still gratefully noticed at the annual commemoration. In 1812 he published his 'Logic,' which was designed, with the 'Phenomenology,' to complete the whole body of science. Hegel employs the term logic in a very extended sense. He does not confine it, as is usually the case, to the account of the abstract forms of thought and the laws of the enchainment and development of ideas, but understands thereby the science of the self-sufficient and self-determining idea—the science of truth and of reality. From his fundamental principle, that thought and substance are one and identical, it followed that whatever is true of the former is true also of the latter, and consequently the laws of logic become ontological. From this point of view Hegel describes in this work the progress of reason; how, by virtue of a peculiar and inherent impulse, it passes constantly onwards, until at last it returns into itself. The general merits of this work were at once admitted, and the high powers of philosophical reflection which it evinced were acknowledged by the offer of a professorship at Heidelberg. His first course of lectures was attended by a numerous and distinguished class, attracted by the profoundness and originality of his views, notwithstanding the great obscurity of his style. By the publication of the 'Encyclopædia of Philosophical Sciences,' in 1817, his reputation as a philosopher was established, and Hegel was invited by the Prussian government to fill the chair at Berlin, which had remained vacant since the death of Fichte, in 1814. This work, being designed as a manual for his class, takes a general view of his whole system, and exhibits in the clearest manner the ultimate tendency of his views. Considering logic as the base of all ontology, and starting from the idea in itself or potentially, he considers it as the essence and primary substance. He then examines thought as at first existing in itself, then *in other* or in nature; next in the mind of the individual, in a purely subjective point of view; and then objectively, in its outward realisation; and lastly, as he terms it, absolutely, *i.e.* as manifesting itself in art, religion, and philosophy. From 1817 until death terminated his career there is nothing to relate in the life of Hegel beyond the constantly increasing celebrity of his lectures and the publication of several works. He successively published the 'Philosophy of Jurisprudence;' two new editions of the 'Encyclopædia;' the 1st vol. of the 2nd edition of his 'Logic;' and several articles in the 'Annals of Scientific Criticism,' which he had established as an organ of his system, and of its application to every branch of art and science. He fell a victim, on the 14th November, to the cholera which ravaged Berlin in 1831, and was, in compliance with his express desire, buried by the side of Fichte.

The history of philosophy from its earliest origin to its latest development forms so perfect and compact a whole, that no single part can be separately considered without losing something of its value and significancy. This difficulty is greatly increased in the case of a philosophy which gives itself out not only as the completion of its immediate forerunner, but as the sum and result of all anterior systems. Accordingly our general view of the Hegelian system will be unintelligible unless preceded by a rapid sketch of the states of philosophy out of which it grew. The transcendental idealism of Kant formed the transition from the *empiricism* of the eighteenth century, and effected, as it were, a compromise between the antient realism and the scepticism of Hume. To the system of Kant succeeded the pure and absolute idealism of Fichte, destined to be displaced in its turn by Schelling's system of absolute identity and intellectual intuition, which was itself to be further modified and developed by the *dialectical momentum* of Hegel. Essentially the systems of Hegel and Schelling are both founded on the same principle, viz. the absolute ideality of thought and being; for there is evidently but little difference between the doctrine of Schelling, which supposed that the human mind contains within it the fullness of reality and truth, the consciousness of which it may attain to simply by contemplating its own nature, and that of Hegel, according to whom the *concrete notion*, or the reason, comprises within itself all verity, and that in order to arrive at the science thereof it is only necessary to employ ogical thought, or dialectic. The difference is purely a difference of method. For the cold and narrow abstractions, the rigorous formalism, of Fichte, Schelling had substituted a sort of poetical enthusiasm, and banishing from philosophy the scientific form it had received from Wolff, had introduced into it the rapturous mysticism of the intellectual intuition. Hegel however, insisting that the scientific system is the only form under which truth can exist, re-established the rights and utility of method by his doctrine of the dialectical momentum, or development of the idea. Indeed with Hegel the method of philosophy is philosophy itself. This he defines to be the knowledge of *the evolution of the concrete*. The concrete is the idea, which, as a unity, is diversely determined, and has in itself the principle of its activity. The origin of the activity, the action itself, and the result, are one, and constitute the concrete. Its movement is the development by which that which exists merely potentially is realized. The concrete in itself, or virtually, must become actual; it is simple, yet different. This inherent contradiction of the concrete is the spring of its development. Hence arise differences, which however ultimately vanish into unity. There is both movement, and repose in the movement. The difference scarcely becomes apparent before it disappears, whereupon there issues from it a full and concrete unity. Of this he gives the following illustration:—the flower, notwithstanding its many qualities, is one; no single quality that belongs to it is wanting in the smallest of its leaves, and every portion of the leaf possesses the same properties as the entire leaf. He then observes, that although this union of qualities in sensible objects is readily admitted, it is denied in immaterial objects, and held to be irreconcilable. Thus it is said that man possesses liberty; but that freedom and necessity are mutually opposed; that the one excluding the other, they can never be united so as to become concrete. But according to Hegel, the mind is in reality concrete, and its qualities are liberty and necessity. It is by necessity that man is free, and it is only in necessity that he experiences liberty. The objects of nature are, it is true, subject exclusively to necessity; but liberty without necessity is an arbitrary abstraction, a purely formal liberty.

This concrete idea develops itself in obedience to certain laws which it determines of itself. Among these Hegel distinguishes three species of thought, or three productions of thought in general. 1. The *thought*, which he calls formal, as considered independent of its subject matter, or, in the Hegelian terminology, of all its *contents*. 2. The *notion*, which is thought more closely determined; and 3. The *idea*, or thought in its totality and fully determined. The truth, determined in itself, experiences a want of development. The idea, concrete and self-developing, is an organical system, a totality comprising in itself vast treasures of degrees and *momenta*, or germs of further development. Now philosophy is nothing else than the knowledge of this development, and, in so far as it is methodical and self-conscious thought, it is the development itself. With the progress of this evolution philosophy advances towards perfection. The more the idea develops itself the more precise and limited does it become, the wider its expansion and the deeper its intensity. All the partial results it gives rise to, as well as their systematization, proceed from the one identical *idea*. Particular systems are but so many diversified forms of the same *life*; they have no reality but in this unity, and their differences and their specific determinations taken collectively are but the expression of the forms contained in the idea. The idea is at once the centre and the circumference—the source of light, which in all its expansions does not pass out of itself; it is both the system of necessity and its own necessity, and yet nevertheless liberty.

In the history of philosophy we have, under the form of accidental succession, the actual development of philosophy itself. In the different systems which the history records there is one and the same philosophy at different degrees of its development, and the different principles which have been employed to support these systems are but branches of a single unity and of one whole. The philosophy therefore which is the last in time is the result of all preceding systems, and consequently must comprise the principles of all, and therefore it is the most perfectly developed, the richest, and the most *concrete*. The more concrete the idea becomes, the more widely extended is the domain of science. It reconciles the apparent inconsistencies of appearance and reason, and a true philosophy removes the contradiction in which the antient philosophy was involved with the natural and historical development of the human mind. Starting from and nourished by experience, the thought rises to the idea of the general and the absolute, and, being allowed its free course, passes beyond the moment of doubt and difficulty, to reproduce all that it has conceived in a rational order, and to impress upon it the stamp of a logical necessity. For all verity is virtually contained in thought, from which, being made fruitful by experience, it is the duty of philosophy to draw it, and to deduce the actual consciousness. Accordingly it is the high pretension of the Hegelian philosophy to reconcile philosophy with reflection, and positive religion with the state and with every political and religious establishment. It is, he observes, an evil prejudice to suppose that true philosophy is opposed to the sober results of experience, and with the rational enactments of actual laws.

Hegel divides philosophy into three parts:—1. Logic, or the science of the idea in and by itself, or in the abstract element of pure thought; 2. Philosophy of nature, or the science of the idea out of itself—or in nature, or as nature; 3. Philosophy of mind, or the science of the idea in its return into itself. Into the details of this division it would be idle to enter, as it would only lead to a dry and barren nomenclature. Each part is again divided into three parts; for this holy number determines throughout the divisions and subdivisions of the system. In this respect, as well as for his obscurity and neologism, Hegel well deserves the reproach of Wolfianism, which his master Schelling has urged against him. Schelling indeed disavowed him as his disciple, which honour however Hegel still loved to claim with a satisfaction mingled with regret.

A complete edition of the works of Hegel, in 17 vols., collected by Michelet and others of his disciples, is in course of publication.

HEIDELBERG, an antient city in the circle of the Lower Main, in the grand-duchy of Baden, is situated in one of the most beautiful parts of Germany, on the left bank of the Neckar, over which there is a covered stone bridge of nine arches, 702 feet long and 30 wide; in 49° 24′ N. lat. and 8° 41′ E. long. The town is between the river and the mountains. On the south is the Königstuhl, 2000 feet high (called the Kaiserstuhl since the emperor Francis ascended it in 1815), on the summit of which a lofty tower has been erected. The population, which is now about 12,000, and gradually increasing, is much inferior to what it formerly was. Various causes have contributed to this decay: and among them chiefly the desolation of the Palatinate by the French in 1689 and 1693, and then the removal of the court of the elector Palatine to Manheim in 1709. In 1689 the elector's splendid palace was most wantonly devastated, and in 1764 it was struck with lightning and rendered wholly uninhabitable. In the cellar of the palace is the celebrated Heidelberg tun, which contains 600 hogsheads. Heidelberg has three Lutheran, one Calvinist, and one Roman Catholic church, and a synagogue. It owes its chief renown to its university, which is the oldest in Germany except that at Prague. It was founded in 1386 by the elector Ruprecht II., and soon acquired a high reputation to which its valuable library greatly contributed; for it gradually became possessed of 1956 Latin, 431 Greek, 289 Hebrew, and 846 German manuscripts, in all 3522. The university continued to flourish till 1622, when the town was taken by Tilly, and the library sent by duke Maximilian of Bavaria to Rome, as a present to Gregory XV., who placed it in the Vatican by the name of Bibliotheca Palatina. In 1795 the French having compelled the pope to let them take 500 manuscripts from the Vatican, carried off 38 of the Heidelberg collection. In 1815, when France was obliged to restore all its plunder, the pope not only gave up those 38 manuscripts to Heidelberg, but, at the intervention of Austria and Prussia, ordered all the German manuscripts to be restored. Accordingly 847 antient German manuscripts, and also the celebrated Codex Palatinus of the monk Ottfried's poetical paraphrase of the Four Gospels, and four Latin manuscripts containing the history of the university, were delivered up to Heidelberg. A new æra for the university commenced in 1802, when it was assigned, together with the bailiwick, which has 80,000 inhabitants, besides the population of the town, to the grand-duke of Baden, who is of the Lutheran religion, and is himself the rector. The reputation of the university is increasing, but the number of the students has been much reduced, because Prussian subjects must have a special permission from their government to visit it. Its annual revenue is now 108,000 florins, of which 84,000 are contributed by the government; and its library, much increased by the purchase of the library of the Cistercian convent of Salmansweiler (or Salem), is said now to consist of 120,000 volumes. All the institutions and collections attached to the university have been much improved; and among the twenty professors are some of the most eminent men in Germany. The streets of the town are narrow and gloomy, and there are no manufactures except on a small scale. Its trade is however improving, and the great beauty of the country and its many other advantages have caused a great number of foreigners to settle here. There are numerous descriptions of Heidelberg; one of the latest is Engelmann, 'Heidelbergs alte und neue Zeit, Stadt, Universität, Schloss, und Umgebungen.'

HEIGHTS, MEASUREMENT OF. There are three very distinct ways by which heights may be measured. The first is by observation of the angles of elevation of objects, supposing their distances to be known, which is explained roughly in works of trigonometry and mensuration, and with more precision in those on geodesy. [MENSURATION.] The second serves for the measurement of heights in cases where not only the height of a summit is required, but also that of the slope which leads to it, at different distances from the summit; and this is done by means of the level. [LEVELLING.] The third, which we propose here to describe more particularly, is accomplished by means of the barometer. [BAROMETER.]

If we ascend with a barometer through any height, the weight of the column of air which presses on the instrument is diminished, and the counterpoise, namely, the column of mercury under the vacuum, must diminish likewise; that is, the mercury must fall. The amount of this fall depends upon the height in question: and when the relation between the two is perfectly well ascertained, may be made the means of determining it. If the temperature at the higher and lower station were the same in all places and at all times, and if the force of gravity were precisely the same at all heights, one formula would serve for all times and for different places, if the height of the barometer remained always the same at the same height above the sea. In such a case, one observation made in London a hundred years ago, combined with one made at Quito in the present time, would serve to determine the difference of level between those two places. And even as it is, the mean height of the barometer at the two places, when known, could be made to determine the point. But when only one or two observations can be made at each place, the differences of temperature, &c., must be noted and allowed for: and this necessity renders the numerical operations connected with the solution of the problem more intricate than they would otherwise be.

If the temperature were unaltered during the ascent, and the force of gravity also remained uniform, the *logarithms* of the atmospheric pressures corresponding to different altitudes would *decrease* in arithmetical proportion as the altitudes themselves *increase* in arithmetical proportion. Thus if at altitudes 0 and h the logarithms of the pressures were k and $k-l$, at an altitude $2h$ the logarithm of the pressure would be $k-2l$, and so on. And since the height of the barometer is proportional to the pressure for the time being, this would lead to an equation of the form

$$z = c\,(\log. h - \log. h');$$

where z is the difference of altitudes at two stations, and h and h' the heights of the mercury at the lower and upper stations. This is proved in every elementary work on pneumatics which professes to apply the differential calculus.

The constant c might be determined either from theory or actual measurement; for if h and h' were known in any one case, and also z by trigonometrical or other measurement, c might be determined, and being independent of z, h, and h', would then be known in all cases. But in truth c is not to be thus determined, for though independent of h and h', it varies with temperature, the force of gravity, &c.

1. If the temperature either of the higher or lower stations be not the same in different observations, the multiplier c will be of one value or another, depending on the temperatures.

2. If the mercury be not of the same temperature at all times, its specific gravity will vary, so that a given column of it will not represent the same atmospheric pressure at all times.

3. If the force of gravity be taken into account, the pressure taken off by the ascent will be a larger proportion of the whole pressure than was supposed in the investigation of the preceding formula, since it is taken from the part of the atmosphere where the force of gravity is greatest. This is independent of its greater weight as being taken from the densest part of the atmosphere. The latter circumstance has been already taken into account in the formula, and from it comes the law that the logarithms of the pressures diminish in arithmetical progression, since the pressures themselves would diminish in arithmetical progression if the density of the air were the same at all heights.

We now proceed to describe two formulæ made on slight differences of hypothesis as to the element of the problem about which we know least, namely, the law of variation of the temperature of the atmosphere. The first formula, which is nearly in the form given by Laplace, is taken from the second edition of Poisson's Mechanics, and supposes that the air intermediate between the higher and lower stations may be treated as if it had throughout the mean between the temperature of the two stations. The second, taken from Lindenau's Barometric Tables (Gotha, 1809), is on the supposition (which was also made by Euler and Oriani) that the temperature of the air diminishes in harmonic progression through a series of heights increasing in arithmetical progression.

Let h and h' be the heights of the barometer at the lower and upper stations; t and t' the temperatures of the air; T and T′ those of the mercury (ascertained by a thermometer whose bulb is in the cistern); r the radius of the earth, supposed to be 6366198 metres or 6962283 yards; and λ the latitude of the place. All the temperatures are in degrees of Fahrenheit. Let

$$k = h\left(1 + \frac{T - T'}{9990}\right)$$

$$c = \frac{20053\cdot95}{1 - \cdot002588\cos. 2\lambda}\left(1 + \frac{t + t' - 64}{900}\right)$$

$$z = c\,(\log. h - \log. k).$$

Then z itself is a near approximation to the number of yards in the difference of level between the two stations (for metres use 18337·46 instead of 20053·95); but if a more exact one be required, it may be found by calculating (using z itself as just found)

$$c\left(\log. h - \log. k + 2\log.\left(1 + \frac{z}{r}\right)\right)\left(1 + \frac{z}{r}\right).$$

When the lower station is at a great distance from the higher on the earth's surface, then five-eighths of $\frac{z}{r}$ should be used instead of $\frac{z}{r}$ in the last formula.

The preceding is the most accurate formula which the present state of science will allow to be given, and there is reason to suppose that the constant 20053·95 could not be altered by a single unit with any increase of correctness. The following formula however is sufficient for ordinary purposes:—

$$20115\left(1 + \frac{t + t' - 64}{900}\right)(\log. h - \log. h');$$

in which the constant 20115 is that determined by a considerable number of comparisons of theory with trigonometrical observation made by M. Ramond in the Pyrenees.

The second formula, by M. Lindenau, is as follows, the letters meaning the same things as before; but the degrees are those of Réaumur's thermometer, and the distances are expressed in toises. The toise is 2·1315308 English yards, and a reading of Réaumur is reduced to one of Fahrenheit by the following formula:—

$$\text{Fahr.} = 32 + \frac{9}{4}\ \text{Réaum.}$$

$$\text{Let } c = \left(1 + \frac{t + t'}{400} - \frac{(t - t')^2}{160000}\right) \times 9442;$$

$$H = h\left(1 - \frac{T - 10}{4329 \cdot 6}\right)$$

$$H' = h'\left(1 - \frac{T' - 10}{4329 \cdot 6}\right)$$

Then the number of toises in the difference of elevation of the stations is

$$c\ (\log. H - \log. H').$$

The formula which has been generally used is of the form

$$a\left(1 + \frac{t + t'}{b}\right)(\log. h - \log. h');$$

and the following are the constants a and b used by the observers whose names are mentioned, all reduced by M. Lindenau to those values which they should have when the thermometer is Réaumur's and the result in toises:—

Ramond	$a = 9437$	$b = 400$
Trembley	$a = 9401$	$b = 361$
Roy	$a = 9388$	$b = 362 \cdot 2$
Schuckburgh	$a = 9400$	$b = 366 \cdot 6$
Deluc	$a = 9220$	$b = 396 \cdot 4$

HEILBRONN, the capital of the circle of the Neckar in the kingdom of Würtemberg; in 49° 7′ N. lat. and 9° 8′ 45″ E. long. It has 8400 inhabitants, considerable manufactures, and an extensive trade, which, with the culture of the vine, give employment to the inhabitants. According to tradition, it was founded about the year 800, by Charlemagne, and named by him Heilbronn, or the 'spring of health,' from a medicinal spring in the vicinity. It was a free imperial city, till it was adjudged to Würtemberg in 1803. It had formerly a commandery of the Teutonic order. The house of that order has been converted into barracks, and the old orphan house into a handsome palace. The town-hall contains an antient collection of archives; and the gymnasium has a library of 12,000 volumes. There are three Lutheran and two Roman Catholic churches, and many respectable public institutions. A tower called Thieves' Tower, in which Götz von Berlichingen was confined in 1525, is shown as a curiosity.

HEINECCIUS, JOHN GOTTLIEB, born at Eisenberg, in Saxony, in 1681, was one of the most learned jurists that Germany has produced. He was appointed professor of philosophy at Halle in 1713, and was afterwards professor of law at Franeker in West Friesland, which place he left in 1727, on account of ill health. He was then appointed professor of law at Frankfort-on-the-Oder, and lastly ho filled the same chair at Halle, where he died in 1741. His principal works are:—1. 'Antiquitatum Romanarum Jurisprudentiam illustrantium Syntagma, secundum Ordinem Institutionum Justiniani digestum, in quo multa Juris Romani, atque Auctorum Veterum loca explicantur atque illustrantur,' 8vo., 1741; a very useful work, which has since been edited by Haubold, 1822. 2. 'Elementa Juris Civilis, secundum Ordinem Institutionum.' 3. 'Elementa Juris Civilis, secundum Ordinem Pandectarum, commoda Auditoribus Methodo adornata.' This work, which comprises a course of civil law, explains the origin, object, and application of the various laws. 4. 'Historia Juris Civilis Romani ac Germanici,' published with Ritter's notes, Leyden, 1748. 5. 'Elementa Juris Germanici, tum Veteris tum Hodierni,' 2 vols. 8vo., Halle, 1736. 6. 'Corpus Juris Germanici Antiqui,' 4to., 1738. 7. 'Prœlectiones Academicæ in H. Grotii de Jure Belli et Pacis libros.' 8. 'Elementa Juris Naturæ et Gentium,' translated into English under the title of 'A Methodical Sytem of Universal Law, or the Law of Nature and Nations, deduced from certain principles and applied to proper cases,' by G. Turnbull, 2 vols. 8vo., London, 1763. 9. 'Fundamenta Styli Cultioris.' 10. 'Elementa Philosophiæ Rationalis et Moralis;' besides academical dissertations, &c. The works of Heineccius were collected and published at Geneva, 'Opera omnia,' 9 vols. 4to., 1771, with additions and notes by his son John Christopher (Gottl.) Heineccius, who prefixed to tho first volume a Life of his father.

HEINECKEN, or **HEINECKE, CHRISTIAN HEINRICH**, born at Lübeck, the 6th February, 1721, was the son of the painter Paul Heinecken, and younger brother of Karl Heinrich Heinecken, also an artist, and a writer on the fine arts. Christian Heinrich was an extraordinarily precocious child. At the age of ten months he could speak and repeat every word which was said to him: when twelve months old he knew by heart the principal events narrated in the Pentateuch: in his second year he learned the greater part of the history of the Bible, both of the Old and New Testaments: in his third year he could reply to most questions on universal history and geography, and in the same year he learned to speak Latin and French: in his fourth year he employed himself with the study of religion and the history of the Church, and he was able not only to repeat what he had read, but also to reason upon it, and express his own judgment. The fame of this wonderful child spread widely, and many persons resorted to Lübeck on purpose to see and hear him. The king of Denmark wishing to see him, he was taken to Copenhagen, and there examined before the court, and pronounced to be a wonder. On his return home he learned to write, but his constitution being weak, he shortly after fell ill. Though he rallied for a time, he soon relapsed, and died on the 27th June, 1725, without, it is said, showing much uneasiness at the approach of death. His teacher, Christian Von Schöneich, published a narrative of his life, 8vo., Lübeck, 1726, and his account is confirmed by many respectable contemporary authorities; among others Hirsching, in his 'Historisch-literärisches Handbuch,' 3rd part, pp. 62-64; the 'Deutsche Bibliothek,' vol. 17; and by most of tho journals of the time. See also Jöcher, 'Gelehrtenlexicon,' vol. ii., p. 1454, and the 'Allgemeine Encyklopädie der Wissenschaften und Kunst,' Leipzig, 1829, art. 'Heinecken.' Martini published a dissertation at Lübeck, 1730, in which he endeavoured to account for the circumstances of the child's early development of intellect.

HEINSE, WILLIAM, the author of 'Ardinghello,' was born at Langewiesen, near Ilmenau in Thuringia, in 1749. After passing through a course of legal studies at the university of Jena, he took up his residence at Erfurt, where, being encouraged to apply himself to literature by Wieland, he commenced his career as an author by a translation of Petronius (1773), which was quickly followed by 'Laidion, or the Eleusinian Mysteries.' The choice ho had shown in selecting the first-mentioned work, together with the fidelity with which he adhered to the original, and also many parts of the other, scandalized not only the public, but Wieland himself. His next productions were less objectionable for their tendency, being a prose translation of Tasso's 'Jerusalem,' and another of Ariosto's 'Orlando,' both which he is said to have executed during his residence in Italy (1780-83); but these tasks did not prevent him from giving full scope to his unrestrained passion for enjoyment; and with what license he abandoned himself to the gratifications which Italy, long the object of his wishes, presented to him, may easily be inferred from his 'Ardinghello,which may ho considered in some degree as the record of his own feelings and opinions, and, while it gives us much eloquent and impassioned criticism on art, abounds not only with the most dissolute scenes, but with maxims immoral in the extreme. Fortunately the narrative and incidents are so interrupted by the dialogues and disquisitions on art, that the work can hardly be classed as a romance; for most of the scenes and characters which belong to it as such, are calculated only to corrupt. It is true, considered merely in regard to its ability as a production of the pen, that its dissolutoness is redeemed by the refinement with which the grossness of vice is veiled; yet this does not at all abate its moral turpitude. However, if we estimate the critic apart from the novelist, Heinse must be allowed to have here manifested an extraordinary sympathy for art; and although some of his views of it may be erroneous, he is always original, forcible, and enthusiastic. His 'Dialogues on Music' were not published till after his death, which happened June 22, 1803. Besides another romance, entitled 'Hildegard,' he contributed a variety of articles to the 'Deutsche Mercur,' and other periodicals; including a critical account of the principal pictures of the Düsseldorf Gallery, in a series of letters to Gleim. A complete edition of his works in 10 vols. 8vo., with a critical and biographical introduction by Laube, is now in course of publication.

HEINSIUS, DANIEL, was born at Ghent in the year 1580 or 1581. He was taken to England at an early age by his father, who was obliged to leave Holland in consequence of the part he took in the wars which then prevailed in his native country. His father returned to Holland after a short time, and sent his son, at the age of fourteen, to study law at Franeker. But Heinsius, contrary to the wish of his father, resolved to study antient literature; and accordingly, after remaining at Franeker only six months, he went to Leyden, where he prosecuted the study of the classics under Joseph Scaliger. At the age of eighteen he explained the Latin classics in the university, and seven years afterwards was appointed professor of history and politics. In 1607 he was made librarian and secretary to the university. Heinsius was considered one of the most learned men of his time, and was repeatedly solicited by many of the monarchs of Europe to settle in their dominions; but he refused to leave his native country, in which he died on the 23rd February, 1655, at the age of 75. He held the office of historian to the states of Holland, from which he received a handsome salary. He also took an active part in the theological warfare of the times, and was appointed secretary to the celebrated synod of Dort in 1618.

The name of Heinsius is principally known by his editions of the Greek and Roman classics. But his Latin poems, which are seldom read in the present day, were highly esteemed by his contemporaries: they were published at Leyden in 1602. He also wrote some poems in his native language, which were published by Petrus Scriverius in 1616.

The following is a list of the principal classical authors edited by Heinsius:—'Crepundia Siliana, sive notæ in Silium Italicum,' 1600; 'Theocritus,' 1603; 'Hesiod,' 1603; 'Paraphrasis Andronici Rhodii in Aristotelis Ethica,' 1607, 1617; 'Maximi Tyrii Dissertationes,' 1607, 1614; 'Dissertatio de Nonni Dionysiacis,' 1610; 'Senecæ Tragœdiæ,' 1611; 'Aristotelis Poetica,' 1611, 1643; 'Theophrastus Eresius,' 1611, 1613; 'Horatius et de Satira Horatiana,' 1612; 'Animadversiones et Notæ in Horatii Opera,' 1629; 'Notæ et Emendationes in Clementem Alexandrinum,' 1616; 'Terence,' 1618; 'Paraphrasis Perpetua in Politica Aristotelis,' 1621; Aristarchus sacer, sive Exercitationes ad Nonni Paraphrasin in Johannem,' 1627; 'Ovid,' 1630, 1653, 1661; 'Livy,' 1620, 1631, 1634; 'Aurelius Prudentius,' 1637; 'Exercitationes Sacræ ad Novum Testamentum,' 1639. Heinsius was also the author of 'Rerum ad Sylvam Ducis atque alibi in Belgia aut a Belgis anno 1629 Gestarum Historia,' Leyd., 1631, fol.; 'Orationes varii Argumenti,' Leyd., 1615, 1620, 12mo.

HEINSIUS, NICHOLAS, only son of Daniel Heinsius, was born at Leyden, 29th July, 1620. His education was carefully attended to by his father, and he enjoyed the advice and instruction of Gronovius, Grotius, and other learned men of the time. In 1642 he visited England, and afterwards went to France, Germany, and Italy, principally with the view of consulting MSS. of Ovid and Claudian. In 1649 he was invited by Christina, queen of Sweden, to settle at Stockholm, where he remained till the death of his father in 1655. He resided principally in Holland during the remainder of his life. He was sent on a public mission to Russia in 1667. He died on the 7th October, 1681.

Heinsius edited 'Claudian,' 1650, 1665; 'Ovid,' 1652, 1661; 'Virgil,' 1676; 'Valerius Flaccus,' 1680. His Latin poems were published at Amsterdam in 1666. He also left behind him many MSS. notes on the Latin poets, which have been published by Burmann, in his editions of Virgil, Valerius Flaccus, Silius Italicus, Phædrus, &c. (*Life of Heinsius* prefixed to Burmann's 'Adversaria,' 4to., 1742.)

HEIR, by the law of England, is he who succeeds by right of blood to the real property or lands, tenements, and hereditaments of the deceased owner, designated by the correlative term of ancestor, not given away from him by will. The English law which determines the succession to personal property, when uncontrolled by local custom, is contained in the statutes of distributions (22 and 23 Chas. II., c. 10; 29 Chas. II., c. 3; and 1 Jac. II., c. 17), which are founded upon the provisions of the civil law. The persons so entitled are not called heirs, but next of kin.

The several rules of descent which regulate the right to succeed to real property spring from the system of feudal tenures, but have been somewhat modified by the recent statute of 3 and 4 Wm. IV., c. 106. [DESCENT; ENTAIL; ESTATE; FEUDAL SYSTEM.]

Heir-at-law, or heir-general, is he who succeeds according to the rules explained in the article DESCENT, where there is no will of his ancestor and no instrument which determines a special course of descent. Heir-special is he who succeeds in the order pointed out by some instrument which determines such special course of descent. [ENTAIL.] Heir-apparent is he whose right of inheritance is indefeasible, provided he outlives his ancestor; as the eldest son. Heir-presumptive is he who, if his ancestor should die immediately, would in the present circumstances be his heir, but whose right of inheritance may be defeated by the birth of some nearer heir; the brother or nephew of a man who has no children is heir-presumptive. Heir by custom is he whose right as heir is determined by certain customary modes of descent, which are attached to the land. [DESCENT; COPYHOLD; GAVELKIND.]

The expression 'heirs by devise' has also been sometimes used, though such are not strictly heirs according to the English law; but have been so called inaccurately after the *heres factus* of the Roman law.

The rules of the civil law upon the subject long prevailed in Scotland, both in principle and practice. But various alterations have been made in the Scotch law of inheritance, and now the different descriptions of heirs are far more numerous than in either the English or the Roman law. Heirs-at-law are called heirs whatsomever. Heirs-in-tail, heirs of tailsie, and heirs of provision differ little in their nature. There are also heirs active, heirs by conquest, heirs of line, heirs passive, heirs male, and heirs portioners, the particular distinctions between each of whom it is not necessary here to describe. [See Bell's *Commentaries and Principles*, and Lord Kames's *Law Tracts*.)

The French law of descent has followed the Roman law, and the obligations and privileges of the heir are essentially the same as there prescribed.

In America the English law of descents has been in most instances rejected, and each state seems to have established rules for itself. There is no entire information upon this subject; indeed chief-justice Reeve in the preface to his 'Treatise on the Law of Descent in America,' has this strong passage, that the nation 'may be said to have no general law of descents, which probably has not fallen to the lot of any other civilized country.' (Kent's *Commentaries*, lect. 65.)

The term *heres* in the Roman law has a very different signification from the term *heir* in the English law. The Roman term *hereditas* denoted all the rights and obligations of a testator or intestate; and the *heres*, when his title as such was completed, represented the person of the testator or intestate, and as a consequence succeeded to all his rights and obligations. A man might by his will appoint one *heres* or more; and the property of an intestate might devolve on one *heres* or more, but this made no difference with respect to their character. Each person was *heres* in proportion to his share of the inheritance. The *heres* appointed by will was called *scriptus*, or *factus*, or *testamentarius;* the *heres* who succeeded in case of intestacy, *ex lege*, or *legitimus*, that is, appointed by the law, or *ab intestato*.

An important distinction between *heredes* as established by the old Roman law was this, and the distinction was the same (so far as it could be applicable) both in the case of testacy and intestacy. All persons who were in the power (*potestas*) of the testator, or intestate, during his lifetime, such as children not emancipated, and slaves, were obliged to accept the inheritance with all its burdens; the inheritance in fact devolved upon them by the will of the testator, and no act of assent on their part was necessary. Other persons, not in the power of the testator, were only bound to undertake the burden of the testator's debts in case they accepted the inheritance, for which purpose their express assent was necessary. But by the legislation of Justinian the *heres* in all cases was only answerable for the debts of the testator, or intestate, to the amount of the property which such testator or intestate left behind him, of which however the *heres* was required to make an inventory within a certain time. (*Cod.* vi., *Tit.* 30, l. 22; *Instit.*, ii. 19.)

The discussion of the various rights and duties of the Roman *heres scriptus* belongs to the subject of wills.

In the case of intestacy the distribution of the property was analogous to the distribution of an intestate's personal estate by the English law. The Roman law gave no preference to an eldest son over a younger, or to a brother over a sister. Emancipated sons, who, by the strict rule of the civil law, were excluded from the inheritance [EMANCIPATION], were placed by Justinian's legislation on the same footing as children not emancipated. It is unnecessary here to state more minutely the rules which regulated the distribution of an intestate's property. (*Instit.*, iii. 1; *Nov.* 118, c. 1, 2, 4.)

It is important to conceive clearly the fundamental notion of the difference between the Roman *heres* and the English *heir*. The Roman *heres*, when his title to the inheritance was completed, represented the person of the testator or intestate, and so far corresponded to our executor or administrator. His title to the property, as *heres*, was absolute and derived entirely from him to whose rights and obligations he succeeded. The English *heir*, according to the strict principles of tenure, derives his title to the land not from his immediate ancestor, as such, but by virtue of his relationship by blood to the person who acquired the land, deduced through his immediate ancestor. The consequences which flow from these two different notions of the Roman *heres* and English *heir* are numerous and important. They are well stated, in a general way, by Mr. Butler in his note on *Coke-Litt.*, 191 *a*. The stat. 4 Wm. IV., c. 104, which makes all a deceased person's estate in land liable to the payment of his debts, has materially affected the antient right of the English heir.

HEIR-LOOMS are such goods and personal chattels as, contrary to the nature of chattels, go to the heir by special custom along with the inheritance, and not to the executor of the last proprietor. [CHATTELS.] They are principally such things as cannot be removed without damage to the inheritance, as chimney-pieces, fixed tables, &c. Deer in an authorized park, fishes in a pond, deeds, charters, and court-rolls, together with the chests in which they are contained, are heir-looms. And so it seems are Journals of the House of Lords in the possession of a peer. By special custom in some places carriages also and household implements may be heir-looms.

The termination 'loom' is of Saxon origin, in which language it signifies a limb or member; so that an heir-loom is nothing else but a limb or member of the inheritance. (2 Bl. *Com.*) Chattels are sometimes directed by testators to go to the heir, together with the inheritance, as heir-looms, and though it is the duty of the executors to carry the intention into effect so far as they can, yet the direction does not affect the rights of creditors, neither can it effectually prevent the devolution of the chattels according to their real nature.

HE'LAMYS, a genus of Rodents nearly allied to the Jerboas. [PEDETES.]

HELARCTOS. [BEAR, vol. iv., p. 91.]

HELDER and HELDER CANAL. [HOLLAND.]

HE'LENA, daughter of Constantine the Great and of Fausta, was given in marriage by her brother Constantius to her cousin Julian, when he made him Cæsar, at Milan, A.D. 355. She followed her husband to his government of Gaul, and died in 359 at Vienne. The historian Ammianus Marcellinus (b. xvi., c. 10) reports that the Empress Eusebia bribed Helena's midwife, who occasioned the death of a son, the only child that Helena bore; and yet Eusebia had been the constant protectress of her husband Julian. The truth of the story is doubted by Gibbon, in his 'Decline and Fall' (ch. xix.).

HE'LENA, ST., the first wife of Constantius Chlorus, was born of obscure parents, in a village called Drepanum, in Bithynia, which was afterwards raised by her son Constantine to the rank of a city, under the name of Helenopolis. Her husband Constantius, on being made Cæsar by Diocletian and Maximianus (A.D. 292), repudiated Helena, and married Theodora, daughter of Maximianus. Helena withdrew into retirement, until her son Constantine, having become emperor and triumphed over his enemies, called his mother to his court, and gave her the title of Augusta. He also gave her large sums of money, which she employed in building and endowing churches, and in relieving the poor. About the year 325 she set out on a pilgrimage to Palestine, and having explored the site of Jerusalem, she thought that she had discovered the sepulchre of Jesus Christ, and also the cross on which he died. The identity of the cross which she found has been much doubted: she however built a church on the spot supposed to be that of the Sepulchre, which has continued to be venerated by that name to the present day. She also built a church at Bethlehem in honour of the nativity of our Saviour. From Palestine she rejoined her son at Nicomedia, in Bithynia, where she expired in the year 327, at a very advanced age. She is numbered by the Roman Church among the saints. (Eusobius, *Life of Constantine*; Hübner, *De Crucis Dominicæ per Helenam inventione*, Helmstädt, 1724.)

HELE'NA, ST., an island in the Atlantic Ocean, 1200 miles west of the coast of Benguela, in South Africa, and nearly in the latitude of Cape Negro, and about 1800 miles east of the coast of Brazil, in South America. Seen at a distance it appears like a lofty mass of barren rocks rising in a pyramidal form; on a nearer approach, rugged and almost perpendicular cliffs, from 600 to 1200 feet high, are seen encompassing the island all round, broken through in several places by deep chasms which open to the sea-shore, and which form so many narrow valleys winding up to the table-land in the centre of the island. One of the principal of these openings is called James' Valley, on the north-west coast of the island, and at the opening of it to the sea is James' Town, the only town and port of the island, which is defended by strong batteries, and is the residence of the authorities. James' Town is in 15° 55′ S. lat. and 5° 49′ W. long. Ascending James' Valley we arrive at the plain or table-land of Longwood, situated in the eastern part of the island, and consisting of 1500 acres of fine land, nearly 2000 feet above the sea, sloping gently towards the south-east. Longwood House was the place of Napoleon's confinement and death, and his tomb is at a short distance from it, situated under a willow-tree, and covered by a plain tombstone without inscription, and enclosed by an iron railing. In the centre of the island rises Diana's Peak, 2693 feet above the sea. A calcareous ridge, which runs across from east to west, sloping abruptly on the south, divides the island into two unequal parts, the larger and finer of which is on the north side of it, containing James' Valley, Rupert's Valley, Longwood Plain, the deep crater-like dell called the Devil's Punchbowl, the Briars, near which is a fine cascade, Plantation House, which is a country residence of the governor, &c. The whole circumference of the island is about 28 miles. The population, exclusive of the garrison, is about 5000, about one-third of which are Europeans, and the rest are blacks, men of colour, and Chinese. The climate of St. Helena is one of the healthiest under the tropics, and is found beneficial to invalids from India, and even from Europe. The range of the thermometer at Plantation House is from 61° to 73° within doors; it sometimes falls to 52° in the open air between June and September. In James' Town it is generally from 5 to 7 degrees higher than at Plantation House, and at Longwood it is somewhat lower. The summer rains fall in January or February, and the winter rains in July or August. Cloudy days are frequent and refreshing throughout the year. Viewed from the sea the island appears barren; but the interior is covered with a rich verdure, and is watered by abundant springs; the soil of the valleys is very rich, and produces all the fruits and flowers of Europe and Asia. Horned cattle, sheep, and goats feed on the rich pastures. Pretty cottages in picturesque situations are scattered about the island. (Major Beatson's *Tracts relative to the Island of St. Helena, written during a residence of five years*, 4to., London, 1816, with plates.) The base of the island appears to be basalt, and lava and scoriæ are found scattered about the surface.

The island of St. Helena was discovered by the Portuguese in 1502. It was afterwards taken possession of by the Dutch, who abandoned it in 1651 for the Cape of Good Hope. The English East India Company then took possession of it, and it became a resting-place for their ships between India and Europe. In our days it has become celebrated as the place of banishment of Napoleon, who resided there five years and a half. It is now still visited by ships returning from India, who take in fresh provisions and water, and on those occasions the place assumes the appearance of a bustling market-town.

HELGOLAND, or HELIGOLAND, a group of islands in the German Ocean, on the west coast of Schleswig, 25 miles from the mouths of the Elbe, Weser, and Eider. It consists of the principal island, so called, of the Sand Island, or Downs, and of several cliffs and reefs, the chief of which is that called the Monk. The main island is divided into the cliff and the low land. The cliff is a rock rising almost perpendicularly, and varying in elevation from 90 to 170 feet above the level of the sea. The ascent to it is by a flight of 191 steps. The summit is a tolerably level plain about 4200 paces in circumference. It is joined by a bottom of rock, 500 paces long, to the low land, which is an uninhabited down, with two good harbours, and to the east of the down is a road where vessels may anchor in 48 fathoms. The circumference of the whole island does not exceed three miles. In former ages it was of much greater extent; and is said to have been the residence of a chief of the Sicambri or North Frieslanders, and the seat of worship of a Saxon deity.

Of the rapid waste of this island, Mr. Lyell presents the following notice. Helgoland began in the year 800 to be much consumed by the waves. In the years 1300, 1500, and 1649, other parts were swept away, till at last a small portion only of the original island remained, consisting of a rock of red marl (of the *Keuper* formation of the Germans), about 200 feet high. Since 1770 a current has cut a passage no less than ten fathoms deep through this remaining portion, and has formed two islands, Helgoland and Sandy Island. (*Principles of Geology*, book ii., ch. 7.)

The inhabitants of the island, 2400 in number, live on the cliff. They are descended from the Frieslanders, and speak, besides the old Friesland language, the low German, retain their antient dress and customs, and subsist chiefly by fishing, and acting as pilots. They obtain turf, wood, vegetables, &c. from Cuxhaven and Hamburg in exchange for fish. The low land has now only some fishermen's huts; but when the English took possession of it in 1807, during the war with Denmark, and it became the depôt for goods which were smuggled into the Continental ports, the low land was covered with warehouses, and the population of the island increased to 4000. On the conclusion of peace in 1814 England retained possession of the island, probably for the sake of its double harbour, and for the advantages which it offers for defence, in having two wells of good water. The English have erected four batteries and a lighthouse on the cliff. They have a garrison and a governor, but levy no taxes and do not interfere with the internal government. The lighthouse is in 54° 11′ 84″ N. lat. and 7° 53′ 13″ E. long.

HELIACAL (ἥλιος, the sun), a term applied to the rising of a star, when it takes place just before that of the sun. If we suppose a star not very far from the sun's orbit, then as the sun approaches that star it will become for a season permanently invisible, for it will rise after the sun, and set after it also, the heavens remaining too light in the quarter of sunset to permit the star to be seen. But as soon as the orbital motion of the sun has carried it past the star, the latter will begin to rise first, and in process of time will rise so much before the sun as to become visible just before daylight. In this case it is said to rise heliacally: thus a star sets heliacally before its season of disappearance, and rises heliacally after its reappearance. The successive heliacal risings of stars thus form a continued warning of the seasons, and were used for this purpose among some antient nations. But since the precession of the equinoxes slowly changes the offices of different stars with respect to the seasons, an antient record of the time of the year when a given star rose heliacally would enable us to make a rough guess at the number of centuries elapsed since the time of the observation. Upon such a basis Newton rested a great part of his system of chronology, taking the descriptions of the heliacal risings of stars from Hesiod.

HELICA'RION. [Helicidæ.]

HELI'CIDÆ, HELIX FAMILY, the general name by which the land shell-snails are distinguished.

Mr. Gray, in his paper on *Streptaxis* (Loudon's *Magazine of Natural History*, vol. i., new series), observes that zoologists have divided land-shells into several genera; but that the late Baron Férussac united most of them into a single genus, as he wished to establish as a rule, that all the genera of Molluscans should be alone characterized by some peculiarity in the animal. 'The increased knowledge,' continues Mr. Gray, 'of the animal has shown that some of the species which he (Férussac) referred to the genus *Helix* have very different animals from the typical kinds; and it is probable that eventually several of the genera established before his time (which he attempted to set aside) will be found to be true genera, according to his own theory. The knowledge of the animal, and the history of several species which were unknown at the time he wrote his system, have shown that several of the characters which he considered as of generic importance are common to other species belonging to quite different groups. Thus we now know that some *Helices* (*Carocolla inversicolor*, *Balea Chemnitzii*, and some others) are viviparous, as well as the *Partulæ*; that the degree of development in the lower pair of tentacles is variable in the different species of *Pupa* and *Vertigo*; and that to separate the latter genus from the former, on account of the partial obliteration of these organs, has the effect of dividing very nearly allied species. I am inclined to think that these and numerous similar facts, which must be well known to every practical conchologist, show us that we are warranted in establishing genera from any peculiarity in the structure or form of a series of shells, as well as on a peculiarity in the animal alone; especially when we consider how very few of the animals of the different species which we are called upon to arrange are or ever can be known; and also as we constantly find by experience that every peculiarity in the form or structure of the shell is the indication of some peculiarity in the habit or organic structure of the animal which formed it, and warrants its separation from the rest of the species of the family.'

Having thus laid before the reader the difficulties with which the history of this very extensive family is surrounded, we shall first endeavour to give some account of the *general* organization of the *Helicidæ*, properly so called, as manifested in one of the most common forms.

Organization.*

Nutrient Organs.—In the museum of the Royal College of Surgeons, in London (*Physiological Series, Gallery*, No. 301), is a preparation of the large Shell-snail (*Helix Pomatia*, Linn.), showing the form of the mouth and the part which performs the office of teeth. This is a dentated horny substance, of a dark colour and arched form, situated transversely above the aperture of the mouth, and forming, as it were, the margin of the upper lip; the lower lip is divided by a vertical fissure. No. 302 of the same series shows in the head of another Shell-snail the same structure of mouth. No. 767 shows the soft parts of *Helix Pomatia*, and the alimentary canal has been injected with size and vermilion; so that the salivary glands, from their white colour, may be distinctly perceived upon the parietes of the stomach. These glands are of a flattened, elongated, and irregular form, and of a conglomerate structure: they may be seen diminishing in breadth as they extend upwards towards the pharynx, where their ducts terminate. Here also the semicircular, dentated, horny jaw, the course and termination of the alimentary canal, and the position and form of the liver, are well displayed. The next preparation (No. 768), which exhibits the mouth, œsophagus, and stomach of the same species, shows the junction of the two salivary glands at their lower extremities, and the termination of their ducts. The œsophagus and stomach being laid open, their internal structure is seen. (*Catal. Gal.*, vol. i.)

Circulating System.—In the Shell-snail, *Helix*, the heart is situated on the right side of the posterior third of the pulmonary sac; and in the Slug, *Limax*, it is situated at nearly the middle of the posterior surface of the pulmonary sac, and protected above by the rudimentary shell, so that this part of the structure in these animals is, as in other points, nearly allied. The preparation in the College Museum, No. 882 (*Gallery*), is a specimen of *Helix Pomatia* with the shell removed in order to show the heart, which is situated on the left side of the dorsal aspect of the body, near the posterior part of the branchial sac. The pericardium is laid open, and the heart being injected, the auricle, from its thinner parietes, is seen of a red colour; a bristle is passed behind the ventricle, and the aorta may be seen ramifying over the liver. No. 883 is a specimen of *Limax ater*, Linn. (Slug), to show the heart situated in the middle of the back. (*Catalogue, Gallery*, vol. ii.).

Respiratory System.—In the same series the soft parts of *Helix Pomatia* are prepared (No. 1081), to show the pulmonary sac, which receives the air by an anterior orifice on the right side of the neck. The sac is laid open from that orifice to the opposite extremity; and the roof of the cavity, upon which the pulmonary artery, or continuation of the veins of the body, ramifies, is turned back to exhibit the reticulation of the vascular and respiratory surface. The parts are injected with size and vermilion. No. 1082 is a similar specimen, with the left parietes of the pulmonary sac

* The reader should especially consult Swammerdam, in whose works he will find some excellent remarks on the anatomy of the Helicidæ.

removed, and the orifice by which the air is admitted and expelled left entire. No. 1083 is the portion of the vascular parietes of the pulmonary sac removed from the preceding preparation, and inverted to show the ramifications of the pulmonary vessels. These are continued from the veins of the body without the interposition of the propelling ventricle. No. 1084 is a similar preparation. No. 1085 shows the roof of the pulmonary sac of another *Helix Pomatia*, with the vessel injected; and in No. 1086 there is, in a similar specimen, a bristle inserted into the rectum, which terminates close to the orifice of the pulmonary sac. (*Catalogue, Gallery*, vol. ii.)

Brain, Nervous System, and Senses.—Not being able to refer to any preparation of the nervous system of a Shell-snail, we must call the reader's attention to this part of the organization in a slug, which so nearly corresponds with that of the Shell-snail as to afford a very sufficient illustration. In the same series of the same noble collection is a preparation of a slug (*Limax rufus*, Linn.)—No. 1304—laid open longitudinally along the back to show the nervous system. The viscera are removed. 'In this,' says Professor Owen, 'as in other Encephalous Mollusks, a well-developed ganglion is situated above the œsophagus; it is of a transverse shape, slightly enlarged at its extremities, and supplies the antennæ, or horns, and the eyes. The œsophageal nervous ring is completed by a larger ganglion below the tube, from which numerous nerves radiate to supply the body. The principal nerves are the two inferior ones, which extend on either side the mesial line of the ventral surface straight to the opposite end of the body, giving off nerves to the muscular disk or foot from their outer sides. A small unsymmetrical ganglion is formed on the nerve, which supplies the heart and respiratory apparatus.' No. 1305 is the same species of slug laid open along the ventral aspect, and the viscera removed, to show more especially the subœsophageal ganglion and its nerves. A bristle occupies the place of the œsophagus. No. 1306 exhibits the nervous system of a Black Slug removed from the body. (*Catalogue, Gallery*, vol. ii.)

Touch.—In the Shell-snails the sense of touch will be readily supposed, by any one who has observed the motions of a common garden-snail, to reside especially in the ventral disk, or foot, and the lower tentacles. In the Museum of the College we find, No. 1391, a specimen of *Helix Pomatia* prepared to show the different character of the surface of the skin in the exposed and protected parts of the body: in the latter it is thin and smooth; in the former, thick, vascular, and rugose. No. 1392 is a snail injected, slit down the back and eviscerated, to show the vascularity of the foot. No. 1393 is a snail injected, with one pair of tentacles, which serve as special instruments of touch, extended. Here too the pulmonary cavity is laid open. (*Catalogue, Gallery*, vol. ii.)

Sight.—In the gallery (*Physiological Series*) of the same rich museum is a preparation of a *Helix Pomatia* (No. 1756) with the posterior tentacles or horns extended, showing the eye-specks, or ocelli, situated at the side of the extremity of each horn. 'In this position, although destitute of appropriate muscles, the eyes have the advantage of all the mobility with which the tentacle itself is endowed; and by the admirable construction of the same part, they are defended from external injury by being retracted and inverted, together with the extremity on which they are supported within the cavity of the tentacle, as in a sheath*.' (Professor Owen, *Catalogue, Gallery*, vol. iii.)

Generative Functions.—In the common shell-snails (*Helix*), the male and female sexual organs are complete in one individual, but it requires a reciprocal junction of two individuals to produce a fruitful impregnation. The situation of these organs is at the anterior orifice of the neck; and at the time of congress a sharp horny or glass-like excitatory appendage is protruded, apparently for the purpose of stimulus. Some assert that these appendages are absolutely shot out from the body of one snail into the body of another, and engravings even exist where two snails are represented at a distance from each other reciprocally darting these *spicula amoris*, some of which are seen actually in the intervening space, and others on the ground. With all due submission, we do not believe that the *spiculum amoris* is ever thrown: we have had opportunities of examining the common garden shell-snails frequently when engaged in the reproduction of the species, and have never seen the hard excitatory appendage thrown from the body of the snail. Col. Montagu, it appears, is of the same opinion. He admits the existence of the *spicula* in the animal of *Helix aspersa*, as well as *Helix nemoralis* (or at least some of them); but 'that they are missile darts,' he continues, 'we have much reason to doubt, though it is natural to suppose the animals are furnished with them for the purpose of stimulating each other to love, because it is only at that season they are found to possess them. If such are ever discharged at each other, we have been extremely unfortunate in our observations, for in no one instance could we ever find the dart penetrated, though at the time the animals are close the point may irritate; but it is neither sufficiently strong nor sharp pointed to penetrate the tough skin with which these animals are furnished; and indeed the extremely viscid secretion with which they are so copiously provided adheres so strongly to these *spiculi* (spicula), when wholly projected from the body, that they are for a time held by it. Perhaps we may be told hereafter, that this tough excretory fluid is used as a cord to regain these darts after they have been discharged; but such we should hold equally fabulous with much of the accounts related by various authors. These celebrated love-darts are subpellucid, white, and very brittle, about one-fourth or three-eighths of an inch in length, and somewhat triangular like the blade of a small sword.' (*Testacea Britannica.*) Dr. Maton often observed these *spicula*, but never saw them actually projected from one to the other.

Where the reproduction is by means of eggs, as it is in the great majority of *Helicidæ*, these are either enveloped in a skin and round, as in the common garden snail, or provided with a hard calcareous shell, generally of a white or of a dirty white colour, as in *Achatina* and *Bulinus*. [BULINUS, vol. vi., p. 8.] These hard-shelled eggs are generally oval: in other instances they are round. Specimens of these eggs, some whole, some showing the young shell included, and others showing it breaking out of the egg-shell, are now in the British Museum (from Mr. Broderip's collection). In the museum of the College of Surgeons are several preparations, showing the organs of generation in the shell-snail, now numbered from 3000 to 3008, but these numbers will be changed when the catalogue of that part of the collection comes to be printed, and we have reason to believe that it will be printed in the course of a year.

Power of repairing Injuries.—The power which snails, in common with other testaceous mollusks, possess of repairing their shells, is known to most observers, and requires no comment; but the extent to which these animals will repair lesions of the soft parts, and even reproduce some of the principal ones after they have been deprived of them, is deserving of notice. The works of Schoeffer, Spallanzani, Bonnet, and others bear testimony to the wonderful *vis vitæ* in these animals, and its energy in replacing parts, the deprivation of some of which must, it might have been previously thought, have been followed by immediate death. Spallanzani cut off one of a snail's horns: it began to bud again in about 25 days, and continued to grow till it was equal in length to the other. He removed part of the head: in course of time the part was renewed. Not that this was always the case in those instances where the entire head had been taken off; but even in these instances the snail often recovered, and at the end of a few months appeared with a new head in all respects equal to the old one. The snails so treated retired into their shells the moment the operation was over, and there they concealed themselves for weeks and even months, covering the aperture with the parchment-like secretion so well known to those who have seen this temporary sort of operculum. When forced out for examination at the end of thirty or forty days, some appeared without any marks of renewal; but in others, especially in those cases which had the advantage of warm weather, there was a fleshy globule towards the middle of the trunk, soft, and whitish-ash in colour. At this period no organization was detected in the globule. But in eight or ten days the globule became larger, rudiments of lips were seen, and of the smaller horns, mouth, and tongue. A membrana-

* Swammerdam describes the eyes in detail; but some are of opinion that the organs above alluded to are not eyes. Sir Everard Home denied that they were visual organs; and so does M. Gaspard, who allows the snail no senses, save those of taste and touch, the latter of which he admits it to possess in an extreme degree of delicacy. See M. Gaspard's 'Memoir on the Physiology of *Helix Pomatia*.' (Majendie's *Journal de Physiol.*, tom. ii., p. 295, et seq.; and an abstract of the paper, with notes, by T. Bell, Esq., *Zool. Journ.*, vol. i.) See also Mr. Brayley's paper 'On Certain Organs of the *Helicidæ*, usually regarded as their Eyes, &c.' (*Zool. Journ.*, vol. ii.)

ceous substance was observed fixed in the upper jaw: this proved to be the new tooth. The parts then became further developed and more conspicuous, occupying a greater space, and in two or three months the injury was so completely repaired that the lighter colour only of the new head served to distinguish it from the old one. These experiments were confirmed by others, by Gerardi among the rest.

Hybernation.—M. Gaspard remarks that in our temperate climate, as soon as the first autumnal chills are felt, about the commencement of October, generally, *Helix Pomatia* becomes indolent, loses its appetite, and associates in considerable numbers on hillocks, the banks of ditches, in thickets, hedges, and such places. In a day or two the animals cease feeding, expel the last contents of the intestines, and then hide themselves under moss, grass, dead leaves, or the like rubbish. Here each forms for itself, with the anterior part of its muscular foot, a cavity sufficiently large to contain at least its shell: this cavity it enlarges and excavates by turning itself round on every side, then raising itself against the sides of the cavity, and at last against the roof formed of moss or leaves, or a small quantity of earth brought there by its motions. When it has succeeded in bringing the aperture of the sholl to nearly a horizontal position, it stops. The foot is soon contracted within the shell, the snail then expands, so as completely to cover it, the collar of the mantle, which is at this period very white; and then inspires a quantity of air, after which it closes the respiratory hole. When this is done, a fine transparent membrane is formed with its mucus, and interposed between the mantle and any extraneous substances lying above. The mantle then secretes a quantity of very white fluid over its whole surface, which sets uniformly, like plaster of Paris, and instantly forming a continuous covering about half a line thick. When this is hardened, the animal separates its mantle from it by another and stronger mucous secretion; and after a few hours, expelling a portion of the air it had previously inspired, it is enabled to shrink a little farther into the shell. It now forms another lamina of mucus, expires more air, and thus retires farther into the shell. In this way sometimes a fourth, fifth, and even sixth partition are formed, with intermediate cells filled with air. Such is M. Gaspard's account; but Mr. Bell remarks that it does not completely explain the manner in which the excavation is formed. 'It is not by the pressure of the foot,' says the last-named zoologist, 'and the turning round of the shell, that this is principally effected. A largo quantity of very viscid mucus is secreted on tho under surface of the foot, to which a layer of earth or dead leaves adheres; this is turned on one side, and a fresh secretion being thrown out, the layer of earth mixed with mucus is left. The animal then takes another layer of earth on the bottom of the foot, turns it also to the part where he intends to form the wall of his habitation, and leaves it in the same manner, repeating the process until the cavity is sufficiently large, and thus making the sides smooth, even, and compact. In forming tho dome or arch of the form, a similar method is used, the foot collecting on its under surface a quantity of earth; and the animal turning it upwards, leaves it by throwing out fresh mucus, and this is repeated until a perfect roof is formed. As I have very often watched this curious process, I am certain of the facts. On removing very carefully a portion of the roof soon after its completion, I was enabled to see the formation of the operculum. In about an hour, or even less, after the hybernaculum is covered in, the whole surface of the collar of the mantle instantaneously pours out the calcareous secretion in considerable quantity. This is at first as fluid as thick cream, but very soon acquires exactly the consistence of bird-lime, being excessively adhesivo and tenacious; and in about an hour after it is poured out it is perfectly solid.'

M. Gaspard states that the labour of each individual continues for about two or three days; but that the whole of the month of October is occupied by the general closing of the shells of the species. He adds that about the beginning of April the hybernation ceases. 'The mode by which their escape from confinement is effected is simple and easily comprehended. The air which is contained in the different cells, and which had been expired on the animal withdrawing itself farther and farther into the shell after the formation of the operculum, is again inspired, and each separate membranous partition broken by the pressure of the hinder parts of the foot projected through the mantle. When it arrives at the calcareous operculum, the animal, making a last effort, bursts and detaches its most obtuse angle. Then insinuating by little and little the edge of the foot between the shell and the operculum, it forces the latter off or breaks it away.' (See the Abstract of M. Gaspard's Memoir, with notes, by T. Bell, F.L.S., 'Zoological Journal,' vol. i., the whole of which is well worthy the perusal of the student in natural history and physiology.)

SYSTEMATICAL ARRANGEMENT AND NATURAL HISTORY.

We now proceed to give a sketch of the views of systematists with regard to this numerous tribe of animals.

The genus *Limax* (Slugs) is placed by Linnæus at the head of the *Mollusca* in his last edition of the 'Systema Naturæ,' and is numbered 282. The genus *Helix* is numbered 328, and consequently is widely separated by him from *Limax*. Both land and fresh-water testaceous gastropods were assembled under this genus, which stands between *Turbo* and *Nerita*.

Cuvier's *Pulmonés Terrestres*, or *Terrestrial Pulmoniferous Mollusks*, consisted of tho Slugs, *Limaces* (*Limax* of Linnæus, including *Vaginulus*, *Testacella*, and *Parmacella*), the *Escargots* (*Helix*), the *Nompareilles* (*Clausilia*, Drap.), and the *Agatines* (*Achatina*, Lam.).

Under *Helix*, Cuvier arranges *Helix*, *Vitrina* (Helicolimax), *Bulimus*, *Pupa*, *Chondrus*, and *Succinea*.

Then come the *Clausiliæ* (*Turbo perversus*, *Turbo bidens*, Linn., &c., &c.).

The *Achatinæ*, including *Liguus* and *Polyphemus* of De Montfort, follow.

Lamarck defines his *Colimacés* to be air-breathing Trachelipods (*Trachélipodes aëricoles*), provided with or deprived of an *operculum*, and baving cylindraceous tentacles. Their shell he characterizes as spirivalve, having no projecting parts on its exterior oxcopt the striæ and riblets (*costules*) of growth, and whose aporture is often recurved or reflected outwards. He divides this, the first family of his *Phytiphagous* (plant-eating) *Trachelipods*, into the following sections and genera:—

(*a*) Four Tentacles.

Helix, *Carocolla*, *Anostoma*, *Helicina*, *Pupa*, *Clausilia*, *Bulimus*, *Achatina*, *Succinea*.

(*b*) Two Tentacles.

Auricula and *Cyclostoma*.

M. de Férussac makes the fourth and fifth orders of Gastropods, consist of the Pulmoniferous Gastropods without an operculum (*Pulmonés sans opercule*), and the Pulmoniferous Gastropods with an operculum (*Pulmonés Operculés*).

The fourth order consists of the following suborders and genera:—

1st Suborder. Geophila.

The 1st family of this order consists of the different genera of *Slugs*, and of *Parmacella*, *Testacella*, &c.

The 2nd family embraces the following genera of *Snails*—*Helicarion*, *Helicolimax*, *Helix*, *Vertigo*, *Partula*.

2nd Suborder. Gehydrophila.

3rd Family (*Les Auricules*), *Carychium*, *Scarabus*, *Auricula*, *Pyramidella*, *Tornatella*, *Pedipes*.

3rd Suborder. Hygrophila.

This suborder consists of the *Limneans* or *Water-Snails*, such as *Limnæa*, *Planorbis*, &c.

The fifth order contains two families:—

1st. The Helicinians (*Helicina*).
2nd. The Turbicinians (*Cyclostoma*).

The *Pulmobranchiata* form the first order of M. de Blainville's *Paracephalophora Monoica*, the second subclass of the second class (*Parcephalophora*) of his *Malacozoa*.

M. de Blainville gives the following description of the *Pulmobranchiata*:—

Organs of respiration retiform or aërian, lining the roof and floor (plafond) of the cavity situated obliquely from left to right on the origin of the back of the animal, and communicating with the ambient fluid by a small rounded orifice, pierced on the right sido of the swollen (renflé) border of the mantle. All these animals are more or less framed for breathing air; tho greater part are terrestrial; some live on the banks of fresh waters, and others on the sea-banks (rivage des mers.) None bury themselves in the mud, with the exception of the Limnaceans, during the rigorous season; all are phytiphagous. Some of them are known in all lands.

M. de Blainville divides the *Pulmobranchiata* into the following families and genera:—

1st Family, the *Limnaceans*. (*Limnæa, Physa, Planorbis.*)

2nd Fam., the Auriculaceans. (*Pedipes, Auricula, Pyramidella.*)

3rd Fam., the Limacinians. (*Succinea, Bulimus, Achatina, Clausilia, Pupa, Tomogeres, Helix, Helicolimax:—Testacella, Parmacella, Limacella, Limax, Onchidium.*)

M. Latreille divides the *Pulmonés*, his fourth order of his *first* section of Gastropods (the Hermaphrodites), into tho following families and genera:—

1st Fam., Nudilimaces. (The Slugs, and *Parmacella, Testacella*, &c.)

2nd Fam., Géocochlides. (*Helicarion, Vitrine* (Helicolimax), *Succinea, Helix, Carocolla, Anostoma, Pupa, Chondrus* (Grenaille), *Clausilia, Bulimus, Achatina, Vertigo, Partula.*)

3rd Fam., Limnocochlides. (*Carychium, Scarabus, Auricula, Conovula, Cassidula, Limnæa, Physa, Planorbis, Ancylus.*)

The *second* section, the *Diœcious Gastropods*, consists of his fifth order (*Pneupomes*), and contains two families:—1st. The Helicinides (*Helicina*). 2nd. The Turbicines (*Cyclostoma*).

M. Rang in his 'Tableau Méthodique' makes the *Limaçons* of Férussac (*Trachélipodes colimacés* of Lamarck; *Limacinés* of De Blainville; *Géocochlides* of Latreille) the second family of the *Pulmonés inoperculés* of Férussac (*Pulmobranches* of De Blainville).

M. Rang, following De Férussac, thus, with some slight alterations, defines and arranges the family:—*Animal* elongated, having the body distinct from the foot, and forming a twisted spiral, rarely furnished with a cuirass, but always showing a fleshy collar which closes the shell. *Tentacula* to the number of four, rarely two, the upper ocellated. *Pulmonary cavity* placed forward, and opening in the thickness of the collar. *Organs of generation* united in front; vent near the respiratory orifice. *Shell* always spiral, very variable in form, receiving the animal more or less completely. Terrestrial.

† TETRACEROUS.

A. A cuirass and a collar.

Genera. *Vitrina*, Draparnaud (*Helicolimax* and *Helicarion* of Férussac).

B. A collar without a cuirass.

Genera. *Helix*, Muller (*Helix, Succinea, Amphibulimus, Acavus, Polydontes, Tomogeres, Anostoma, Carocolla, Bulimus, Achatina, Polyphemus, Pupa, Clausilia*, &c., &c., Fér.).

(†) Redundantes.

† *Volutatæ*:—*Helicoides.*

I. Subgenus. *Helicophanta*, Férussac.

Peristome simple.

1st Group. *Vitrinoides*, F. (*Helix brevipes*, &c.)

Peristome thickened and subreflected.

2nd Group. *Vesiculæ*, F. (*H. Cafra*, &c.)

†† *Evolutatæ*:—*Cochloides.*

II. Subgenus. *Cochlohydra*, F. (*Succinea*, Drap.; *Amphibulima*, Lam.; *Amphibulimus*, Montf.)

(††) *Inclusæ.*

† *Volutatæ*:—*Helicoides.*

III. Subgenus. *Helicogena*, Fér. (*Helix*, Linn.)

Columella solid and twisted.

1st Group. *Columellatæ.*

α. Peristome simple. (*Helix naticoides*, &c.)

β. Peristome reflected or thickened. (*Helix Jamaicensis*, &c.)

Shell perforated.

2nd Group. *Perforatæ*, F. (*Helix ligata*, &c.)

Shell umbilicated: umbilicus entirely covered.

a. Shell globulose or subtrochoid.

3rd Group. *Acavi* (*Helix aspersa*, &c.).

Shell imperforate.

β. Shell somewhat depressed (surbaissée).

4th Group, *Imperforatæ*, F.

. Mouth rounded; peristome open. (*Helix guttata*, &c.)

2. Mouth sinuous; peristome strongly reflected. (*Helix squamosa*, &c.)

3. Mouth turning over (versante); columellar border sinuous, flattened, and subdentated. (*Helix cognata*, &c.)

IV. Subgenus. *Helicodonta*, F. (*Tomogeres*, Montf.; *Anostoma*, Lam.)

1st Group. The *Grimaces, Personatæ*, F. (*Helix dentiens*, &c.)

Aperture defended by one or more elongated and internal laminæ.

2nd Group. *Lamellatæ*, F.

* Many laminæ. (*Helix carabinata*, &c.)

** A single lamina. (*Helix labyrinthica.*)

Peristome furnished with large teeth, one of which at the base of the columella forms a gutter.

3rd Group. *Maxillatæ, Polydontes*, Montf. (*Helix imperator*, &c.)

Mouth reversed, furnished with elevated folds, the impressions of which are visible outwards.

4th Group. *Anostomes*, F.; *Anostoma** (*Helix ringens*, &c.)

Interior border of the aperture furnished near the peristome, with elevated, longitudinal folds, the impressions of which are visible outwards.

5th Group. *Impressæ.* (*Helix cepa*, &c.)

V. Subgenus. *Helicigona*, F.

Umbilicus covered.

1st Group. *Carocolla*, Montf. (*Helix angistoma*, &c.)

Umbilicus masked or visible.

2nd Group. *Vortices*, Ok. (*Helix marginata*, &c.)

VI. Subgenus. *Helicella*, F.

Peristome reflected.

1st Group. *Lomastomes, Lomastoma*, F. (*Helix carascalensis*, &c.)

Peristome simple.

2nd Group. *Aplostomes, Aplostoma*, F.

* *Verticilli.* (*Helix lineata*, &c.)

** *Hyalinæ.* (*Helix olivetorum*, &c.)

*** *Fasciatæ.* (*Helix candida*, &c.)

Peristome bordered.

a. Shell horn-colour or brown, nearly unicoloured, rarely fasciated, often hairy; peristome rather spread; epidermis caducous.

3rd Group. *Hygromanes*, F. (*Helix cinctella*, &c.)

β. Shell white or reddish, very much ornamented with bands or small vivid-coloured lines; epidermis insensible, never hairy; sometimes carinated; peristome bordered but not spread.

4th Group. *Heliomanes*, F.

* Shell somewhat depressed or globulose. (*Helix groyana*, &c.)

* Here it is that the new genus *Streptaxis* should be inserted. Mr. Gray, who established it, states (Loudon's *Magazine of Natural History*, vol. i., *New Series*), that the Antique lamp (*Helix ringens*, Linn.), on which Lamarck established his genus *Anostoma*, had been long known and valued, on account of its rarity and strange form; the animal turning up the last whorl before it completes its growth, so that the mouth of the shell is even with the outer surface of the spire. A similar form, Mr. Gray remarks, has been lately observed among tho fossil shells, which on account of its resemblance to the *Cyclostomata* by the roundness and simplicity of its mouth, M. Deshayes has separated into a genus under the name of *Strophostoma*. (See Post, *Ferussina*, p. 109.) Mr. Gray in his paper on the structure of shells (*Phil. Trans.*, 1833) pointed out that some land shells, as *Helix contusa*, when they arrive at a certain period of their growth, throw their whorls out of tho regular series, as if the shell had been crushed, producing what may be considered as a natural distortion. Having since that time had the opportunity of observing several other species of a similar structure, and finding that they all agreed in the general form and position of their mouth, Mr. Gray was induced to consider them as forming a peculiar group, for which he has proposed the name of *Streptaxis*. One of the species, he states, forms, during the dry season, a hard, thin, calcareous epiphragma, differing considerably in structure from any that has hitherto been observed among the *Helicidæ*; but this, he observes, may be only a peculiarity of the species, though the *epiphragma* in this family often forms a good subsidiary character. The following is Mr. Gray's definition of *Streptaxis*:—

Animal like *Helix*?

Shell ovate or oblong; when young, sub-hemispherical, deeply umbilicated, with rapidly enlarging whorls. At length the penultimate whorl is bent towards the right and dorsal side of the axis, and the umbilicus becomes compressed and often nearly closed. The mouth lunate; the edge slightly thickened and reflexed, and often with a single tooth on the outer side of the inner or hinder lip.

Mr. Gray gives six species, which he subdivides into five sections, and says that these shells inhabit the tropical parts of Africa and South America; and that two of the species of these two distant countries appear to be very nearly allied. He further observes, that the animals of these shells, like the *Anostoma*, &c., must remain satisfied with the size of the shell after they have once formed its mouth, as they cannot alter it by reabsorption, as many of the *Helices* do, without removing the whole of the last whorl; for, if a new whorl were added to it, it would entirely alter the form of the shell.

** Shell trochoid and a little carinated. (*Helix pyramidata*, &c.)

VII. Subgenus. *Helicostyla*, F.

Columella strait; peristome simple; shell subdepressed.

1st Group. *Aplostomes, Aplostoma*, F. (*Helix misella*, &c.)
Columella twisted, truncated as it were at its base, or furnished with an internal spiral rib, forming a gutter and appearing under the form of a tooth or callosity.
2nd Group. *Canaliculatæ*, F. (*Helix delicatula*, &c.)
Columella flattened, without either tooth or lamina, forming a sort of gutter at its intersection with the penultimate whorl; peristome reflected.
3rd Group. *Marginatæ*, F. (*Helix studeriana*, &c.)
†† Evolutatæ. *Cochloides*.
* Mouth generally toothless.
1. Columella solid.
a. *En filet*, not truncated at its base.

VIII. Subgenus. *Cochlostyla*, F.

Peristome reflected.
1st Group. *Lomastomes*, F. (*Helix metaformis*, &c.)
Peristome simple.
2nd Group. *Aplostomes*, F. (*Helix Dufresnii*, &c.)
β. Columella solid, flattened, and truncated at its base.
† Shell conic or very ventricose; aperture enlarged.

IX. Subgenus. *Cochlitoma*, F.

Shell conical; mouth short; anterior border advanced.
1st Group. The *Rubans*, F. (*Helix exarata*, &c.)
Shell ventricose; mouth very large; external border in a vertical direction.
2nd Group. *Achatinæ*.
†† Shell ovoïd or turriculated; mouth elongated and narrow.

X. Subgenus. *Cochlicopa*, F.

Shell ovoïd; mouth long; exterior border in a vertical direction.
1st Group. The *Polyphemes*, Montf. (*Helix Priamus*, &c.)
Shell turriculated, mouth short, external border a little advanced.
2nd Group. *Styloides* F. (*Helix fulminea*, &c.)
2. Shell perforated or umbilicated; umbilicus masked or uncovered; peristome simple.
a. Whorls of the spire equalized; the last whorl shorter than the others united.

XI. Subgenus. *Cochlicella*, F.

Only group. *Turritæ*, F. (*Helix conoïdea*, &c.)
β. Last whorl of the spire generally larger and longer than the others united.

XII. Subgenus. *Cochlogena*, F.

† Peristome simple or thickened, but with sharp edges.
a. Shell umbilicated, columella straight.
1st Group. *Umbilicatæ*, F. (*Helix flammata*, &c.)
β. Shell perforated, columella twisted.

2nd Group. *Perforatæ*, F.
* Shell oblong. (*Helix fasciolata*, &c.)
** Shell ovoïd. (*Helix costulata*, &c.)
†† Peristome reflected or dentated.

Mouth crescent-shaped, without either teeth or folds; peristome reflected and regular; columella twisted, perforated; last whorl of the spire sometimes shorter than the others united.

3rd Group. *Lomastomes*, F.
* Last whorl of the spire larger and longer than the others united; shell ornamented with vivid colours. (*Helix Favannii*, &c.)
** Last whorl shorter and less than the others united; shell unicoloured. (*Helix Beticata*, &c.)

Mouth short, crescent-shaped; peristome simple or thickened and regular; columella twisted, more or less projecting and bent, or furnished with a plait which turns upon it and makes it appear subtruncated; umbilicus masked or exactly closed; last whorl of the spire sometimes shorter than the others united.

4th Group. *Helicteres*, F.; *Achatinella*, Sw.
* Shell coniform. (*Helix vulpina*, &c.)
** Shell turriculated. (*Helix turritella*, &c.)
*** Shell ovoïd. (*Helix tristis*, &c.)

Mouth angular at its extremities, or overlaid superiorly, often narrowed by the sinuosities of the external border; columella large, more or less spiral, and forming a plat more or less projecting in the aperture. Peristome thick and reflected; last whorl of the spire longer and more convex than the others united.

5th Group. *Stomotoides*, F. (*Helix Auris Leporis*, &c.)

Mouth crescent-shaped, rather angular at its extremities, most frequently furnished with short teeth at the peristome, which is bordered or a little opened out or reflected; never any laminæ; columella twisted, hollow, flattened at its base, or forming a protuberance; generally perforated.

6th Group. *Dontostomes*, F.
(*) Last whorl of the spire larger and longer than the others united. (*Helix Auris Bovis*, &c.)
(**) Whorls of the spire equalized, often pressed and narrow. (*Helix turgens*, &c.)
(**) Mouth generally furnished with teeth or laminæ.
1. Without gutters; peristome generally not continuous.

XIII. Subgenus. *Cochlodonta*, F.

Shell cylindrical.
1st Group. *Pupa*, F. (*Helix Uva*, &c.)
Shell fusiform.
2nd Group. *Cereales*, F. (*Helix Moricandi*, &c.)
2. One or two gutters; peristome generally continuous.

XIV. Subgenus. *Cochlodina*, F.

(*) Shell right-handed.
† Mouth without teeth or laminæ.
Peristome not continuous.
1st Group. *Pupoïdes*, F. (*Helix Carinula*, &c.)
Peristome continuous.
2nd Group. *Tracheloïdes*, F. (*Helix Sloanii*, &c.)
†† Mouth armed with great plaits or elongated teeth (*Helix Gargantua*.)
(**) Shell left-handed.
Mouth without any lamina. *Balea*, Gray.
3rd Group. *Anomales*, F. (*Helix perversa*, &c.
Mouth armed (with laminæ, one of which performs the part of an elastic operculum).
4th Group. *Clausilia*, Draparnaud. (*Helix torticollis*, &c.)

DICEROUS.

Genera. Vertigo. (Muller.)

Animal elongated, demi-cylindrical, with a rather large spiral body and a collar closing the shell; only two tentacles, long, obconical, retractile, rounded at their extremity; orifice of the pulmonary cavity upon the collar and to the right, approximated by that of the vent; organs of generation united and showing their orifice near the right tentacle, oviparous.

Shell cylindrical, very spiral; aperture straight, in the direction of the axis, short, often dentated; peristome often sinuous and reflected; right or left handed (dextral or sinistral).

Partula. (Férussac.)

Animal elongated, demi-cylindrical, with a rather large spiral body; a collar closing the shell and carrying the orifice of the pulmonary cavity on the right and at the external angle of the aperture; two tentacles only, cylindrical and retractile, ocellated on their summit; organs of generation united? showing their orifice near the right tentacle. Ovo-viviparous.

Shell oval, pointed; spire conical, last whorl convex and longer than the others united, whorls of the spire four to six; aperture straight in the direction of the axis, short, sometimes dentated or furnished with elevated laminæ; peristome commonly very much reflected, with the edge in the same vertical plane; columellar side or lip, callous at its base; dextral or sinistral.

M. Rang's 3rd family of inoperculate pulmoniferous mollusks consists of the *Auricules* of Férussac (*Auriculacea* of De Blainville; *Auriculidæ* of Gray; *Limnocochlides* (*à collier*) of Latreille). These are either terrestrial or marine; and one has been announced as fluviatile. They comprehend the genera *Carychium*, *Auricula* (*Auricula* and *Conovula*, Lam.; *Melampus*, Montf.), *Pedipes*, and *Scarabus*. To these may be added *Chilina*, Gray; *Acmea*, Hartmann; and *Marinula*, King. None of these can be considered to belong to the *Helicidæ*, properly so called.

The 4th family, the Limneans of Lamarck (*Limnæcea* of De Blainville; *Limnocochlides* (without a collar) of Latreille), is entirely fluviatile, consisting of the genera *Planorbis*, *Limnæa*, or, as Lamarck writes it, *Lymnæa*, and *Physa*, *Aplexus*, Flem., and *Amphipeplea*, Nils. This family cannot be considered as belonging to the *Helicidæ*, properly so called.

The order *Pulmonés Operculés* of Férussac (Trachélipodes *colimacés* of Lamarck; *Pectinibranches* of Cuvier; *Chismobranches cricostomes* of De Blainville; *Pneupomes* of Latreille) is thus defined by M. Rang:—

Animal furnished with a foot fitted for creeping, no branchiæ, but a pulmonary cavity receiving the ambient fluid by a large opening placed above the head; tentacles two in number; organs of generation on different individuals.

Shell external, complete, spiral, globulose or conical. *Operculum* calcareous or horny. All terrestrial.

M. Rang observes that this order was established by M. de Férussac at the expense of the *Pectinibranchiata* of M. Cuvier, and for the genus *Cyclostoma* only; but afterwards M. de Férussac added to it the genus *Helicina*, which was, at one time, confounded with the *Colimacés* of Lamarck. At present, continues M. Rang, the *Operculated Pulmonians* establish very well the passage from the *Pulmonians* to the *Pectinibranchians*, because they are related to the first with reference to the organs of respiration, and to the second with reference to the separation of the sexes.

1st Family.

Helicines of Férussac (*Helicinides* of Latreille).

Animal furnished with a collar, and two filiform tentacles carrying the eyes at their external base upon tubercles.

Shell more or less globulose, with a demi-oval aperture, and the columella transversal and delicate. *Operculum* horny, sometimes calcareous externally.

M. Rang observes that M. de Férussac established the two families of *Helicinians* and *Turbicinians* for two genera nearly approximated, and that it would be perhaps more convenient to unite them, the difference between them being really not very remarkable, except in their testaceous envelop; but Mr. Gray has pointed out that one has an annular, and the other a spiral operculum. See also the Rev. M. G. Berkeley's memoir hereinafter alluded to.

Genera. Helicina, Lam. (Oligyra, Say; Ampullina, De Blainville.)

Animal very spiral, furnished with a proboscidiform head and a bilabiated muzzle; tentacles filiform, carrying the eyes at their external base on tubercles; foot short, rounded, with a transverse anterior furrow; pulmonary cavity opening in front of the mantle by means of a large transversal slit.

Shell sub-globulose or conoïd, a little depressed, not umbilicated, with a low spire, an aperture demi-oval, or nearly oval, the peristome reflected into a border (bourrelet), the left lip enlarged upon the umbilicus, which it entirely covers; columella transversal and planulate. *Operculum* horny, sometimes slightly calcareous externally, lines of growth concentric.

Helicina was established by Lamarck, and placed by him among his *Colimacés*. M. Rang is of opinion that the genera *Ampullina* of De Blainville and *Oligyra* of Say ought to be referred to *Helicina*, an opinion which seems to be in unison with that of M. de Blainville himself, who has arranged both those genera under *Helicina* in his Manual. Mr. Gray has published a valuable monograph of the genus in the 1st vol. of the 'Zoological Journal;' and the late Rev. Lansdown Guilding has recorded some other species, with plates of the animal, in the same work, vol. iii.

The definition of M. de Férussac's second family, the *Turbicinians*, is—*Animal* without a collar, provided with two tentacles ocellated at their external base.

Shell conoïd, more or less elevated, with a roundish aperture and continuous borders. *Operculum* calcareous.

Cyclostoma. (Lamarck.)

Animal very spiral, furnished with a proboscidiform head, which bears two cylindraceous tentacles, convex, or swollen at their summit, contractile, and ocellated at their external base; foot elongated and oblong; pulmonary cavity communicating with the exterior by means of a large slit at the superior and anterior part of the mantle: position of the male organ indicated by a tentaculiform appendage situated at the right side.

Shell conoïd, discoïd, or turriculated, more or less elevated, with a sharp or mammillated summit, having all the whorls rounded; aperture round, with continuous and reflected borders. *Operculum* calcareous, with concentric lines, summit subcentral. (Rang.)

The species of *Cyclostoma* are very numerous, and many of them are very beautiful. Mr. G. B. Sowerby has added considerably to the catalogue. They are principally the inhabitants of temperate or warm climates; there is one English species, *Cyclostoma elegans*. The reader will find an excellent paper on the anatomy of this species, by the Rev. M. G. Berkeley, in the 4th vol. of the 'Zoological Journal.'

M. Rang adds to these pulmoniferous operculated mollusks, the fossil genus

Ferussina, Grateloup. (*Strophostoma*, Deshayes.)

Animal unknown.

Shell oval, subglobulose; aperture round, bordered, oblique, simple, toothless, turned over from the side of the spire; umbilicus more or less large. *Operculum?* (Rang.)

M. Rang remarks that M. Grateloup established this genus for a fossil shell from Dax, which seems at the first view very near to *Anostoma*, but which M. Grateloup, from the examination of its aperture, considers as more approximate to *Cyclostoma*. M. Rang states that he participates in this opinion, which the knowledge of the operculum can alone confirm; and he goes on to observe that M. Deshayes, doubtless not having seen the publication of this genus in the first number of the 'Bulletin of the Linnæan Society of Bordeaux,' had subsequently published it under the name of *Strophostoma*. Three or four species are known. (See above, *Streptaxis*, p. 107, note.)

Some may have doubts as to the propriety of placing these operculated pulmoniferous terrestrial mollusks under the family *Helicidæ*. But we believe, notwithstanding the difference of the operculum, that their general organization will warrant their being so placed; and that the terrestrial shell-snails may without violence be placed in one great family, which may be subdivided into the *Helicidæ* without opercula, and the *Helicidæ* with opercula.

Before we conclude this part of the subject, we must draw the reader's attention to the following arrangement proposed by Mr. Gray in the 'Annals of Philosophy' (August, 1824):—

Terrestrial.

Tentacles retractile. Eyes pedicillate.
Gasteropodous. *Limacidæ*.
Trachelipodous. *Helicidæ*.

Aquatic.

Tentacles contractile. Eyes sessile.
Trachelipodous (mantle thick-edged). *Auriculidæ*.
———— (mantle thin-edged). *Limnæadæ*.
Gasteropodous (mantle shield-like). *Onchidiadæ*.

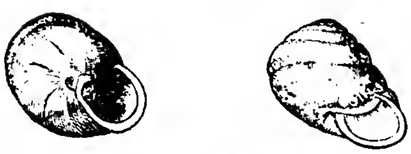
In the paper above alluded to, some interesting observations are made on the affinities of the family; and, with regard to the arrangement, Mr. Gray informs us that he has in his MS. corrected that of the first division, because the distinction between the two first families, though it is that used by Lamarck, Cuvier, and others, is, in his opinion, artificial and of little importance; and the knowledge which he has since acquired of the animals of several genera which were before unknown, have shown him that the character which De Férussac pointed out as the distinction between *Arion* and *Limax* (but which many succeeding naturalists have considered of little importance) is even of more importance than was accorded to it by De Férussac, affording a good character for dividing the Land Pulmonobranchous Mollusca into two families. Thus, he observes, the *Arionidæ* are characterized by having a gland on the end of the tail (which, in the gasteropodous genera, is produced beyond the mantle), and they have the orifices of the organs of generation on the right side immediately under the respiratory hole; whilst in *Helicidæ* there is no gland on the end of the tail, and the orifice above referred to is just behind the base of the upper right tentacle. There is also, he states, an important difference in the nervous system between the two families: in the first the under part of the infra-gular ganglion is 6-lobed, whilst it is only 4-lobed in the *Limacidæ*. Mr. Gray is further of opinion that, at present, only a few genera, as *Arion* and *Helicarion*, Fér., *Nanina*, Gray, and *Stenopus*, Guilding, can be referred with certainty to the *Arionidæ;* but he thinks it very probable that, when the animals of other shells are known, many of them may be found to belong to that family.

Geographical Distribution and Habits.—The *Helicidæ* are most widely diffused over the surface of the earth; scarcely any countries but those where the climate is surpassingly rigorous are without some species of the family. Many of the shells are strikingly beautiful in form and colour, and these are mostly the inhabitants of intertropical countries. Some of the genera (*Achatina*, for instance) attain a very large size, and lay eggs in proportion. *Helix aspersa*, the common garden-snail, is distributed over a large portion of the globe. It is found, for instance, at the foot of Chimboraço, in the forests of Guiana and Brazil, and on all the coasts of the Mediterranean in Europe, Asia, and Africa. *Helix Pomatia* has been naturalized with us, and is still found in some countries. The first importation is attributed by some to Sir Kenelm Digby. Merrett mentions it as a British inhabitant before his time. A moist and rather warm state of the atmosphere seems most congenial to this family. To avoid great dry heat they get under stones, under old trunks of trees, leaves, &c. &c., and some of the species will burrow into the earth for protection against it. A shower will bring them forth in such numbers sometimes, the smaller species especially, as to induce the belief in some cases that it has been raining snails. Most of the species hybernate.

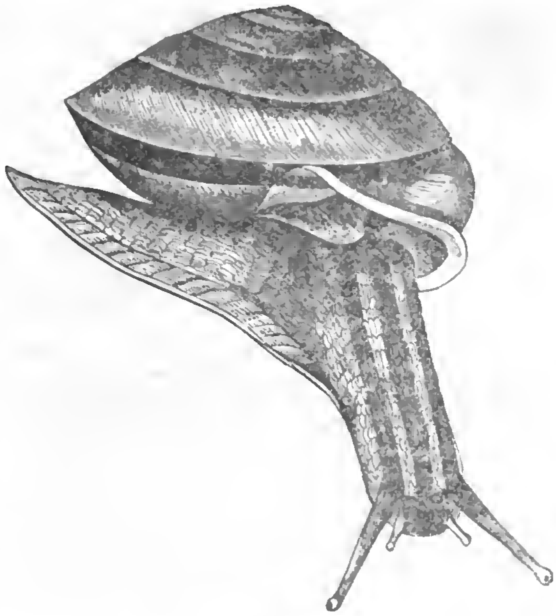
Utility to Man.—The *Helicidæ*, from their voracity, are very injurious to the agriculturist and horticulturist; but there can be no doubt that the larger species are good food. We know that they were a favourite dish with the Romans, who had their *cochlearia*, where they were regularly fattened with new wine boiled down and meal (*sapa et farre*, &c.). (Pliny, *Hist.*, lib. ix., c. 56.) *Helix Pomatia* is used as food in many parts of Europe during Lent, and the snails are kept in an *escargotoire* (snaillery), which is generally a large place boarded in, having the floor covered half a foot deep with herbs, where the animals fatten. Many are familiar with the passage in Pliny (*loc. cit.*), who, on the authority of Varro, relates the incredible size to which the art of fattening had brought the snails. There must, one should think, be some mistake in the text, which says, 'Cujus artis gloria in eam magnitudinem perducta sit, ut octoginta quadrantes caperent singularum calices.' Pennant, referring to this and to Varro (*De Re Rusticâ*), says, 'If we should credit Varro, they grew so large that the shells of some would hold ten quarts! People need not admire the temperance of the supper of the younger Pliny (*Epist.*, lib. i.; *Epist.* xv.), which consisted of only a lettuce a-piece, three snails, two eggs, a barley cake, sweet wine and snow, in case his snails bore any proportion to those of Hirpinus.'

The following cuts, and those given under Bulimulus and Bulinus, will afford the reader an idea of some of the forms of the *Helicidæ* :—Anostoma, Streptaxis, Carocolla, Balea, Partula, Vertigo, Clausilia, Cyclostoma.

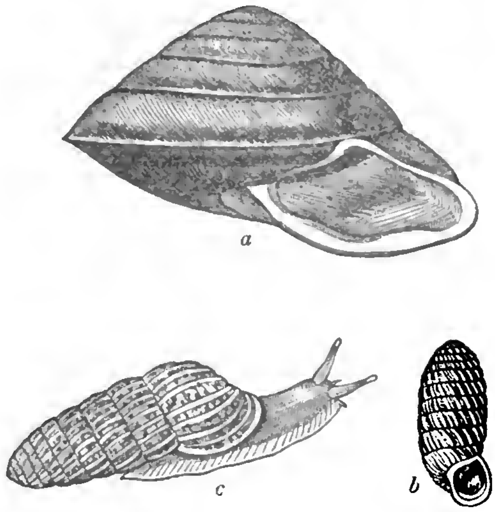
Anostoma depressum.



Streptaxis costatus.

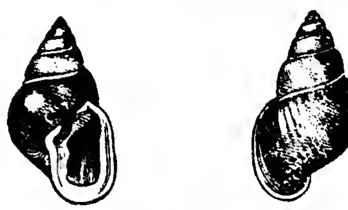


Carocolla Lamarckii.

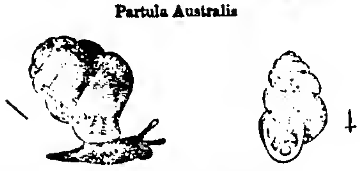


a, Carocolla albilabris.
b, Pupa Uva; c, Pupa Chrysalis, with the animal.

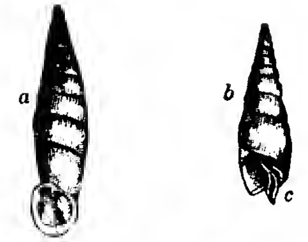
Balea fragilis, magnified.



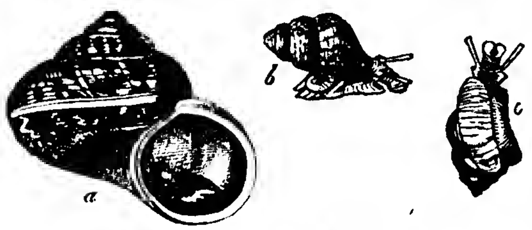
Partula Australis



a, Vertigo pusilla; b, another species of Vertigo, with the animal; both magnified.



a, Clausilia Macascarensis; b, the same, broken, to show the clausium, c.



a, Cyclostoma involvulus; b, Cyclostoma elegans, with the animal; c, Cyclostoma elegans; showing the alternate contraction of the two sides of the animal's foot.

Fossil Helicidæ.

Fossil species of *Helicidæ* are by no means rare. Thus M. Deshayes enumerates thirty-five species of *Helix*, two of *Anostoma*, one of *Helicina*, three of *Pupa*, two of *Clausilia*, three of *Bulimus*, three of *Achatina*, seven of *Pedipes*, and six of *Cyclostoma*, &c., as fossil (tertiary), mostly in the Pliocene period of Lyell, and many of them as both living and fossil.

The student should consult especially the great work of Férussac, and the writings of Cuvier, De Blainville, Deshayes, Draparnaud, Gray, Lamarck, Linnæus, De Montfort, Montagu, Rang, Sowerby, Swainson, &c. &c., and the works of Bonnet, Gaspard, Réaumur, Redi, Schœffer, Spallanzani, and Swammerdam. He will find many new species recorded in the 'Proceedings of the Zoological Society of London,' and in Müller's 'Synopsis Testaceorum' (Berlin, 1836). He should also consult M. Bouillet's 'Catalogue of the Terrestrial and Fluviatile Testacea of Auvergne, both recent and fossil;' among the latter are two species of *Vertigo*.

HELICI'NA. [Helicidæ.]

HELICOLI'MAX. [Helicidæ.]

HELICOSTE'GUES. [Foraminifera, vol. x., p. 348.]

HELICTIS, Mr. Gray's name for a genus of quadrupeds, which inhabits eastern Asia and has the general appearance and colouring of *Mydaüs*, combined with a dentition resembling that of *Gulo* or *Mustela*, but differing from both the latter genera in the large internal central lobe of the upper carnivorous tooth. The genus is thus characterized by Mr. Gray:—

Dental Formula:—Incisors (primores) $\frac{6}{6}$; Canines (laniarii) $\frac{1-1}{1-1}$; molars $\frac{5-6}{5-6}$.

Head elongated. *Feet* short; soles of the feet nearly naked to the heel; toes 5—5; claws strong, the anterior ones long and compressed. Tail cylindrical and moderate.

Mr. Gray exhibited to the Zoological Society one species, *Helictis moschata*, the entire length of which was 23½ inches, of which the tail measured 8. Inhabits China and smells strongly of musk. For further particulars see *Zool. Proc.*, 1831. [Gulo, vol. xi., p. 483.]

HELIER, ST. [Jersey.]

HELIOCENTRIC (having the sun as centre), a term applied to the place of a planet, as seen from the centre of the sun, in opposition to its *geocentric* place, as seen from the centre of the earth. [Parallax.]

HELIODO'RUS, was born at Emesa in Syria, in the fourth century of the Christian æra. He was bishop of Tricca in Thessaly, and is said to have introduced into his diocese the custom of deposing from their office all priests who lived with their wives after their ordination.

He wrote in his youth a romance in the Greek language entitled 'Æthiopica,' which contains an account of the wonderful adventures of two lovers, Chariclea, the daughter of Hydaspes, king of Ethiopia, and Theagenes, a noble Thessalian. It has been remarked that the work of Heliodorus served as a kind of model to the subsequent Greek writers of romance. Though not without merit in point of style and animated description, it belongs to that kind of works of fiction which deal in improbabilities and strange adventures, and in no respect approaches to that class which fix our attention and hold fast our sympathies by exhibiting a portrait of human life and its accidents. This work was published for the first time by Obsopoeus, 4to., Basel, 1534; afterwards by Commelinus, 8vo., 1596; Bourdelotius, 8vo., Paris, 1619; Pareus, 8vo., Frankf., 1631; Schmidius, 8vo., Leip., 1772; Mitscherlich, 2 vols. 8vo., Bipont edition; but the best edition is by Coray, 2 vols. 8vo., Paris, 1804. The 'Æthiopica' has been translated into most of the modern European languages:—into French by Amyot, Paris, 1549, 1559; anonymous, 8vo., Paris, 1623; anonymous, 8vo., Lond. (Paris), 1743, Paris, 1757; by Quenneville, 3 vols. 12mo., Paris, 1803:—into Spanish by Ferdinand de Mena, 12mo., 1616:—into Italian by Ghini, 1556, frequently reprinted:—into German by Meinhard, 2 vols. 8vo., Leip., 1767; and by Göttling, 8vo., 1822, said to be a good translation:—into English by Underdowne, 4to., 1587; Lisle, 4to., 1622; Tate, 8vo., 1686 and 1753; anonymous, 2 vols. 12mo., 1791:—into Dutch, 12mo., 1669; and into Polish, 8vo., 1606. At least half a dozen other Greek writers of the name of Heliodorus are mentioned.

HELIOGABA'LUS. [Elagabalus.]

HELIO'METER (ἥλιος, the 'sun,' and μέτρον, 'measure') is the name given by M. Bouguer to a micrometer invented by himself about 1745, by means of which the diameters of the heavenly bodies may be measured with considerable accuracy. In Bouguer's construction the tube was of a conical form, and provided with two object-glasses of equal focal length, which were so adjusted as to admit of being moved in a direction transverse to the axis of the tube. By this contrivance the two images which are formed in the focus of the eye-glass may be made to diverge, coincide or lap over each other, by merely varying the distance between the centres of the object-glasses, and this distance is indicated by a graduated scale attached to the tube. When the two images coincide, the angle subtended by the observed objects will be equal to that subtended by the centres of the object-glasses, which being known, the magnitude of the observed object may readily be computed when its distance is given, or the distance determined when its magnitude is given. As this instrument does not differ in principle from the divided object-glass micrometer, the reader is referred to the article Micrometer; and for further information relative to the invention, see the 'Mémoires de l'Académie Royale des Sciences,' 1748, p. 11. [Bouguer.]

HELIO'POLIS. [Baalbek; Egypt.]

HELIO'PORA, a genus of stony Polyparia, established by Blainville, from observations of MM. Quoy and Gaimard on a recent species called by Lamarck Pocillopora cærulea.

Generic Character.—Animals short and cylindrical, provided with a simple circle of thick tentacula, fifteen or sixteen in number, contained in vertical or diverging cylindrical cells; cells immersed, internally crenulated by imperfect radiating lamellæ, united into a calcareous mass, which is regularly porous in the intervals of the cells. The Coral is found attached to various bodies.

Three recent species are mentioned by Blainville, all from warm seas. One of the fossil species (Heliopora porosa, Bl.; H. interstincta, Bronn) abounds in strata of the Silurian system; others occur in the chalk and in tertiary deposits. (*Manuel d'Actinologie.*)

HELIORNIS, Bonaterre's name for a genus of water-birds (*Grèbifoulques* of Buffon) which have lobated feet like the Coots and Grebes, but with a greater development of tail and sharper claws. [Podoa.]

HELIOSCOPE (a Greek term signifying literally 'sun-observer') is a kind of telescope adapted for making observations upon the sun without the eye being injured by the intense brightness of the solar rays. Dr. Hooke wrote a treatise in 1742 expressly on the subject of helioscopes, wherein he recommends four reflecting-glasses to be so placed within the tube of the telescope that the solar rays may suffer four reflexions before they strike the eye; and thus, he observes, their intensity will be reduced to the 256th part of their original intensity. Hevelius and other philosophers preferred the use of coloured glasses, which is the common practice of the present day; while Huygens merely blackened the inner side of the eye-glass by holding it over the smoke of a lamp or candle. (Dr. Hooke's treatise, above mentioned.)

HELIOSTAT (ἥλιος, the 'sun,' and the root στα, *sta*, to 'put or place') is the name given to an instrument employed in optical experiments to fix the position of the solar ray. 'Experiments upon the physical properties of light are usually made in a room so darkened as only to admit the solar rays through a single aperture. The solar ray thus admitted is in two respects unfavourably circumstanced for being operated upon. In the first place, from the ordinary elevation of the sun, the ray enters the room obliquely, is immediately thrown upon the floor, and thereby that portion of its length which can be experimented upon is inconveniently limited; secondly, from the rotation of the earth the ray can only be admitted during a few hours in the day, and even during that time the position of the ray will be constantly changing, and will thus require a corresponding change in the position of the lens or other object employed in the experiment. To remedy these inconveniences is the object of the heliostat, invented by s'Gravesande, by means of which the solar ray may be fixed at pleasure in any desired position. It consists of a plane metallic mirror provided with a vertical and horizontal movement, and of a clock, the index of which moves in a plane parallel to that of the equinoctial. The extremity of the index is connected with the hinder part of the mirror by means of a long cylindrical rod adjusted perpendicularly to the plane of the mirror. The subordinate parts, which are numerous and complicated, are explained in Desaguliers's translation of s'Gravesande's 'Natural Philosophy,' vol. ii., p. 107, ed. 1747; and in Biot's 'Physique Experimentale,' tom. ii., cap. 4.

HELIX. [HELICIDÆ.]

HELIX. [SCREW.]

HELLA'NICUS, one of the early Greek prose writers, was born at Mitylene in the island of Lesbos, B.C. 496 (*Gell.*, xv. 23). According to Lucian (*Macrob.*, c. 22) he lived to the age of 85. Suidas says that he lived at the court of Amyntas, king of Macedon, together with Herodotus; but this statement is inaccurate, since there was no king of Macedon of the name of Amyntas during the lives of Hellanicus or Herodotus.

He wrote several works, which are frequently quoted by antient writers; of which the most important appear to have been, a 'History of Argos,' arranged in chronological order, according to the successive priestesses of the temple of Hera in that city; a 'History of Attica, Cyprus, Æolia, and Lesbos;' an account of Phœnicia, Persia, Scythia, and other Eastern nations; and some geographical pieces. Hellanicus is mentioned by Thucydides (i. 97).

The fragments which remain of the writings of Hellanicus were published by Sturz, 8vo., Leip. 1787; 2nd edition, 1826; and in the 'Museum Criticum,' vol. ii., p. 90-107, Camb. 1826.

HELLEBORE, WHITE. [VERATRUM ALBUM.]

HELLE'BORUS, a genus of exogenous plants belonging to the natural order Ranunculaceæ, among which it is known by its having eight to ten very short tubular petals, permanent sepals, and from three to ten leathery follicles. The most remarkable species is that which produced the 'Black Hellebore,' a dangerous acrid poison, much used by the antient Greek physicians in mania, epilepsy, and dropsy. This plant, the *Helleborus orientalis* of botanists, was found by Sibthorp abundantly in mountainous broken ground in Greece and the Levant, where it is still used medicinally under the name of *scarphe* (Σκαρφη). It has a thick black rhizoma, pedate leaves downy on the under side, and corymbose purple flowers. Except in the colour of the flowers and downy leaves, it resembles the *Helleborus niger*, or Christmas rose, an alpine plant now common in gardens, where it flowers about Christmas time, whence its common name. Other species are *H. viridis* and *fœtidus*, two herbaceous plants with green flowers; of these the properties are nearly the same as those of *H. orientalis*, but less energetic. Their leaves are emetic and purgative, and are recommended as an active vermifuge.

HELLE'BORUS OFFICINA'LIS (Salisbury), H. Orientalis (Dec.), has been substituted in the Pharmacopœia for the H. Niger, from a belief that it is more powerful. It is a perennial species, growing in mountainous places in the East, and used to be collected by the antients in Eubœa, Bœotia, on Helicon, Œta, and in the island of Anticyra; by the moderns it is gathered in Greece and the Levant, as mentioned in the previous article. The root, which is the part employed, is black, the caudex thick, the fibres cylindrical: it is extremely acrid.

The root of H. Niger will long continue to be employed as the officinal one, and it is to be regretted that many other roots, especially those of Actæa spicata and Adonis vernalis are often intentionally or accidentally sold in its stead. These may be discriminated by physical characters (particularly the internal structure) and by chemical tests. The activity of Hellebore seems to reside in its resinous matter, for which rectified (not proof) spirit is the proper menstruum.

Like most ranunculaceous plants hellebore can occasion rubefaction and inflammation of any surface with which it is brought in contact; when taken into the stomach in a moderate dose it gently stimulates it and the other viscera of the abdomen; but in large doses it is a fatal poison. It was celebrated in antient times as a cure for various forms of insanity, which it sometimes accomplished by its drastic action on the bowels; and it has been employed occasionally in this and some other diseases in modern times. It is however a dangerous medicine, and one which it is rarely necessary to have recourse to.

HELLE'NES. [GREECE.]

HELLESPONT. [DARDANELLES.]

HELMET, an antient armour of defence for the head, still worn by the officers and soldiers of some of our cavalry regiments. Its original name was Helm, possibly borrowed from the Latin (of the lower age) *helmus*. Skinner however derives it from the Anglo-Saxon verb *helar*, to hide. 'Helm' certainly occurs both in Cædmon's 'Paraphrase' and in the Saxon Gospels, as well as in Ælfric's 'Glossary.' *Helmet* was probably adopted, in the middle age, from the Italian *elmetto*.

As a part of defensive armour the helmet is of high antiquity: some sort of covering of this description for the head appears to have been worn by the warriors of every country. Helmets were found even among the inhabitants of the South Sea Islands when discovered by Captain Cook. Among the oldest specimens now remaining are probably the two helmets found on the field of Cannæ in 1752, preserved in Sir William Hamilton's collection in the British Museum. Another antient helmet, bearing an inscription, found at Olympia, was presented to the British Museum by King George IV.

The form of the Greek helmet and its general description may be collected from various passages of the Greek writers from Homer downwards, and more especially from the medals and marbles on which it is represented. [ATHENS, p. 13, and the *Library of Entertaining Knowledge* (*Elgin* and *Townley Marbles*), published by the Society for the Diffusion of Useful Knowledge.] It does not appear that the Greek or Roman helmet usually protected the face. Both the helmets found at Cannæ however protect the face, and have projecting nasals. Lipsius's treatise *De Militia Romana* (iii., c. 5) contains a full account of the Roman helmet, with which the reader may compare the plates and descriptions in the third volume of Count de Caylus's *Recueil d'Antiq.* For the helmets in more modern use Grose's *Treatise*, and Meyrick's *Critical Account, of Antient Armour* must be referred to. Among the varieties which had separate names we find the Chapelle de Fer, the Bacinet, the Burgonet, the Castle, the Hufken, the Morion, the Salade, and the Skull. These were almost invariably of steel. There was also the Justing Helmet, used in tournaments, which was sometimes of leather.

The *nasal*, the *ventaile* or moveable front, the *visor*, lifted up by pivots, and the *bevor*, to allow of drinking, were the names of parts of certain helmets introduced at different periods, and not always used.

As ornaments over the shield or coat of arms, helmets are still used in heraldry. The full-faced helmet with six bars, all of gold, damasked, is for the sovereign and princes of the blood; the full-faced helmet of steel for marquises and dukes; earls, viscounts, and barons have a profile or side-standing helmet of steel ornamented with bars; the full-faced helmet of steel, with the visor or bevor open, is for baronets and knights; the profile helmet, steel, with the visor closed, for an esquire.

HELMONT, VAN. [CHEMISTRY.]

HELMSTEDT, a town in the district of Schöningen in the duchy of Brunswick, 52° 13′ N. lat. and 11° E. long., has about 6300 inhabitants, who carry on a pretty considerable trade. Helmstedt was formerly the seat of a university, which was founded in 1575 by Duke Julius of Brunswick, and was supported at the joint expense of the principalities of Wolfenbüttel and Calenberg. It was one of the most flourishing universities in Germany, till the foundation of that of Göttingen in 1734. In 1735 the elector of Hanover, as sovereign of Calenberg, ceased to contribute his share towards its support, and in 1809 Jerome Bonaparte, king of Westphalia, suppressed it entirely. Besides the fine building formerly occupied by the university, and now appropriated to the district tribunal, there are the gymnasium, the church of the Holy Sepulchre, and the town-hall. The old town had a rampart, with four gates, now converted into a promenade with an avenue of lime-trees. In the neighbouring romantic forest of Marienberg are much frequented medicinal springs; and on the Corneliusberg are the Lübbensteine, or four enormous altars of Thor and Odin, surrounded with a circle of single stones. (Kunhard's *Beiträge zur Geschichte der Universität H.*; and Ludwig's *Geschichte und Beschreibung der Stadt H.* 1821.)

HELOISE. [ABELARD.]

HELO'NIAS. [CEVADILLA.]

HELO'PIDÆ (Leach), a family of Coleopterous insects of the section Heteromera and subsection Stenelytra. Distinguishing characters:—head short, obtusely terminated anteriorly; mandibles notched at the apex; antennæ placed near the eyes, generally filiform, or nearly so, or slightly thickened at the apex, where the joints are short; the basal joint of the antennæ hidden above by a projected margin of the head; the third joint long; terminal joint of the maxillary palpi large and securiform; eyes emarginated anteriorly; legs moderate; the penultimate joint of the tarsi generally simple or but slightly emarginated; claws simple; body usually convex, and of an oval form.

The larvæ of these insects live in rotten wood, upon which they feed; they are of a cylindrical form, hard to the touch, and have six small legs, attached, two to each of the thoracic segments. The perfect insects are, like the larva, also found in rotten wood, or under the bark of trees; they are rather slow in their movements, and generally adorned with metallic colours.

In the genus Helops, as it is now restricted, the joints of the antennæ are somewhat compressed; the two basal joints are short, the third is long; the two or three terminal joints are short and obconic, the last joint is the shortest; the intermediate joints are moderately long and nearly cylindrical. The thorax approaches to a square form, or is slightly attenuated behind, and is closely applied to the elytra: the body is of an oblong oval form.

Helops Caraboïdes, an insect very abundant in various parts of England, will afford an example of this genus. It is rather less than half an inch in length, of an oval form and deep brown colour, having a bronze gloss in certain lights; the upper surface of the body is finely punctured, and so are the striæ of the elytra. This insect is usually found under the bark of trees, near the root.

Helops Cæruleus is another species of this genus, which is common in many parts of England. This insect is nearly three-quarters of an inch in length, and of a violet-blue colour. It is generally found in old pollard willow-trees. The larva is cylindrical in form, of a yellowish-white colour, and has two recurved hooks on the terminal segment of the body.

Upwards of sixty species of the genus Helops are enumerated in catalogues, and these are chiefly confined to Europe and North America.

HELOTS. [SPARTA.]

HELSINGFORS, the capital of the Russian government of Finland, at the mouth of the Wanna, in 60° 10′ N. lat., and 25° 0′ 15″ E. long. It has now about 10,000 inhabitants, and a considerable export trade in corn, fish, iron, and deals; and important manufactures of sailcloth, sacking, and linen. The town was built by Gustavus I. of Sweden, and burnt in the Russian war in 1728. The fine harbour is defended by several forts, especially the strong fortress Sweaborg. Finland having been taken by the Russians in 1808, and ceded to them at the peace in 1809, no pains have been spared by them to render it an important naval station. Since 1815 a plan for enlarging the town has been carrying into effect. Masses of rock have been blown up and inequalities levelled in order to obtain a site for the new buildings. Among the public edifices the most remarkable are the palace of the governor and the barracks; and likewise the magnificent building for assemblies, on the Esplanade, which was finished in 1833. After the destructive fire at Abo, the university, called Alexander's University, was transferred by an ukase of 21st December, 1827, to Helsingfors. It is divided into four faculties, with 22 professors; and has a library and botanic garden. There are now above 400 students.

HELSTON. [CORNWALL.]

HELVELLYN. [CUMBERLAND.]

HELVETIUS, CLAUDE-ADRIEN, was born at Paris in January, 1715, and was educated at the Jesuits College of Louis-le-Grand, where his earlier years were far from betokening those talents of shrewdness and observation which his writings subsequently exhibited. Having passed through a course of legal study, Helvetius was sent to his maternal uncle d'Armancourt, *directeur des fermes* at Caen, in order to acquire a practical knowledge of finance, and he shortly afterwards obtained the lucrative appointment of *fermier-général*, through the influence of the queen Marie Leczinsky, to whom his father was physician. But disgusted with the oppressive nature of its duties, which however he discharged with singular lenity, he resigned this situation, and purchased that of chamberlain to the queen's household. At this period Helvetius led a disorderly life, without having any elevated or moral end in view, though his general conduct was relieved by occasional acts of the noblest generosity. Into these excesses he appears to have been led by an inordinate vanity athirst for universal admiration. Thus, in order to gain the applause of the theatre, he danced on the public stage in the mask of Javiller (for masks had not yet been exploded by Voverre), and his temporary study of mathematics was stimulated by the honours and attention which were lavished by the highest circles at Paris upon Maupertuis after his return from a scientific visit to Lapland. Aspiring to rival the dramatic fame of Voltaire he composed the tragedy 'La Conjuration de Fiesque,' and upon the appearance of Montesquieu's work, 'L'Esprit des Lois,' Helvetius declared that he too would raise a monument worthy to stand by the side of that of the philosophical legist. But Helvetius was as kind-hearted as he was vain, and an act of beneficence was as dear to him for its own sake as the applause which he courted so eagerly. When Saurin the academician married, Helvetius not only made him a free gift of 200*l.* but also settled upon him an annuity of 80*l.*, and when Marivaux, to whom he allowed a yearly pension of 120*l.*, forgot the decencies of gratitude, Helvetius mildly observed, 'How would I have answered him if he had not, by accepting my favours, laid me under an obligation to him!'

In 1751 Helvetius married the beautiful and accomplished daughter of the Comte de Ligneville and niece of Mad. de Graffigny, by whom she had been brought up. From this time he lived chiefly in retirement at a small estate at Voré, enjoying with his wife and children the pure pleasures of domestic life and ameliorating the condition of his tenants and vassals. He is said to have been very jealous of the game on his estates, and very severe against violators of the game-laws. In 1758 he published the treatise 'De l'Esprit,' which, while it was favourably received by the self-styled philosophical party, was denounced by the court and the Jesuits as dangerous to society and to religion, and as being nothing less than a summary of all the evil doctrines of the 'Encyclopédie.' A strong passion for praise is usually accompanied by a keen sensibility to censure: to regain the favour of the court Helvetius thought no concession too great, and he successively published three letters of apology which gradually advanced in humility and submission. Notwithstanding the confession which they contained of a Christian faith and his disclaimer of all opinions inconsistent with its spirit, the doctors of the Sorbonne drew up a formal condemnation of the work, which they declared to be a compendium of all the evil contained in all the bad books that had yet appeared. It was publicly burned, according to a decree of the parliament of Paris. As to the literary merits of this work, the style is vicious and declamatory, but the argument is well sustained throughout, and enforced by great felicity and copiousness of illustration. In 1764 Helvetius visited England, and in the following year Germany, where he was received by Frederick the Great with marks of the highest consideration and esteem. Helvetius died at Paris, 26th December, 1771, leaving behind him a work entitled 'De l'Homme, de ses Facultés et de son Education,' which was published the same year at London by Prince Gallitsin. This treatise, which may be considered as a continuation of and commentary upon his earlier philosophical work, is vastly superior to it in style and diction. Among the earliest works of Helvetius is his poem 'Sur le Bonheur,' which, however secondary as a poetical composition, evinces all that nice observation of men and manners which forms at once the truth and the charm of his philosophical essays. These may be considered to constitute the practical portion of the sensuous system which in this part was left incomplete by Condillac, who confined himself to the exposition and derivation of the cognitive faculties. By 'esprit' Helvetius understood as well the mental faculties as the ideas acquired by them. Both faculties and ideas he reduced to simple sensation, and he accounts for man's superiority over the brutes by the finer organism of his senses and the structure of his hands. Man, he considers, is the work of nature, but his intelligence and virtue are the fruits of education. The end of virtue is happiness, and utility determines the value of all actions, of which those are virtuous which are generally useful. Utility and inutility are however merely relative, and there is consequently nothing which is either absolutely good or absolutely evil. The happiness and enlightenment of the people he makes to be the true end of all human government; and, denying a Divine Providence in the government of the world, he declares all religion to be a cheat and a prejudice. (*Œuvres d'Helvetius*, 3 vols., Paris, 1818.)

HELVIN, a crystallized mineral of which the primary form is a cube. Cleavage parallel to the planes of the regular octohedron, indistinct; fracture uneven; hardness 6·0, 6·5; scratches glass; colour pale-wax and greenish-yellow; streak white; lustre resinous, vitreo-resinous; translucent; transparent on the edges; specific gravity 3·166.

It is found at Schwarzenberg in Saxony.

Before the blowpipe or charcoal it melts with effervescence into a globule of the same colour as the mineral; in the oxidizing flame the colour becomes deeper and the fusion is more difficult; with borax it yields a transparent glass often coloured by manganese.

Analysis by Gmelin—

Silica	35·272
Glucina	8·026
Alumina and Glucina	1·445
Protoxide of manganese	29·344
,, iron	7·990
Sulphuret of manganese	14·000
Loss by calcination	1·155
	97·232

HELVOETSLUYS. [HOLLAND.]

HEMATIN, the colouring matter of the *Hæmatoxylon campechianum*, or logwood, discovered by Chevreul. It is prepared by evaporating a watery infusion of logwood to dryness, treating the residue with alcohol, filtering the spirituous solution, and evaporating it to the consistence of a syrup. If a certain quantity of water be added to this, and evaporation be performed with a gentle heat, the hematin crystallizes, and requires only to be washed with a little alcohol and dried. Hematin crystallizes in small crystalline laminæ of a reddish colour. The taste of hematin is at first sweet and astringent, and afterwards bitter. It is decomposed by heat, and ammonia being one of the products, proves that it contains azote. Water dissolves hematin, and the solution is of an orange red, at 212° Fahr., but becomes yellow on cooling. Acids saturated with oxygen turn its colour first to yellow and afterwards to red; the alkalis in small quantity render hematin purple, and when in excess violet-blue, and eventually decomposing it, make it yellowish-brown.

This colouring principle is a constituent part of all the colours prepared with logwood, and the changes which it undergoes by the action of acids and alkalis render it useful as a re-agent to detect their presence.

HEMEL HEMPSTEAD. [HERTFORDSHIRE.]

HEMERALO'PIA, a word which is now used to signify 'night-blindness,' though in fact it means 'day-seeing,' being similarly formed to the genuine Greek word 'nyctalopia' (νυκταλωπία), which means 'night-seeing.' Much confusion has arisen in regard to the use of the two words, in consequence of an error committed either by Hippocrates or one of his early editors. In the 2nd book of his 'Prædicta,' he says, 'We call those nyctalopes who see by night;' but in the 4th and 6th books of his 'Epidemics,' the disease which he speaks of under a similar term appears to be that in which the patients are blind at night; and his translators, Paulus Ægineta, Ætius, and Galen, quote various authorities to show that those only are properly called nyctalopes who are affected with night-blindness. They have been followed by Bontius, Sir G. Blane, and many naval surgeons, who apply to the present disease the name of nyctalopia, or dysopia tenebrarum. Linnæus and Vogel however define nyctalopia to be night-vision, and call night-blindness, hemeralopia; and as their meanings have been since received by Scarpa, Lawrence, and all the chief writers on diseases of the eyes, they will be adopted here.

Night-blindness is a common disease amongst seamen in the East and West Indies, the Mediterranean, and in all hot countries, and affects in a slighter degree soldiers and the natives in the same parts of the globe. To persons affected by it, all objects appear at sunset as if covered with an ash-coloured veil, which becomes gradually denser, and at last involves them in complete darkness. In slight cases they can see by bright candle-light or by moon-light; but after the disease has lasted a few days, even the largest objects are invisible after sunset, and the patients have to grope their way even where the moon or candles are shining brightly. The disease will daily increase in severity if not judiciously treated, till the sight becomes weak by day-light, and so disordered that total blindness might be apprehended, though it very rarely follows. The pupils are generally dilated, and at night cannot be made to contract even by a brilliant light.

The most probable cause of this disease is the exhaustion of the retina, produced by the continued glare of a bright sun, either directly transmitted to it, or reflected from the clear waters of the tropical seas, or the bright sands of their shores; a condition of which one may form an idea from the inability to perceive objects in a dimly lighted room after leaving one where there was a glare of light. In many cases it is connected with a disordered condition of the digestive organs, and in others with scurvy.

The disease will generally get well, though it may exist for weeks or months. The most successful treatment is the repeated application of small blisters to the temples. Mr. Bampfield cured by this means upwards of 300 cases. This treatment never failed; but in some instances its effects were accelerated by the administration of purgatives and other medicines adapted for the coincident symptoms of scurvy or of disordered digestion. The best description of the disease is in Mr. Bampfield's 'Essay on Hemeralopia,' in the 5th vol. of the 'Medico-Chirurgical Transactions.'

Nyctalopia, night-vision, or day-blindness, probably never occurs as a separate disease. It is often a symptom of scrofulous ophthalmia and other diseases where the eye is so irritable that the stimulus of day-light cannot be borne, as well as of those conditions in which great dilatation of the pupil is requisite for vision, as in commencing cataract, or opacity of the centre of the lens or its capsule.

HEMICA'RDIUM. [CONCHACEA, vol. viii., p. 427.]

HEMICYCLO'STOMA, M. De Blainville's name for the fourth family of his order *Asiphonobranchiata*, the latter being the second order of the first subclass (*Paracephalophora Dioica*) of the class *Paracephalophora*, the second class of his *Malacozoa*. [NERITIDÆ.]

HEMIDA'CTYLUS. [GECKO, vol. xi., p. 103.]

HEMINGFORD, WALTER, sometimes called HEMINGBURGH, a canon regular of the Austin Priory of Giseburn, or Gisborough, in Yorkshire, where he died in 1347. His history, which begins from the Norman Conquest, continues to the reign of King Edward II. It was first published by Gale in his 'Scriptores V.,' fol., Oxford, 1687; and again by Hearne, in 2 vols. 8vo., Oxford, 1731.

HEMIO'PIA (from ἡμί, 'half,' and ὤψ, 'the eye') is a disease in which the patient sees only a part of the object he looks at; the middle of it, or its circumference, or its upper or lower part, or more commonly one lateral half, being completely obscured. In some cases it arises from a partial mechanical obstruction to vision, as when part of the transparent tissues of the eye become opaque, or when the upper eye-lid falls over half the pupil. But more frequently it is the result of a morbid and partial insensibility of the retina, produced by the excessive stimulus of a bright light, and will cease after a night's rest; sometimes it is a consequence of disordered digestion; and sometimes a symptom of commencing amaurosis, or gutta serena, and terminates in complete blindness.

A very interesting account of this disease is given in the 'Philosophical Transactions' for 1824, by Dr. Wollaston, who himself suffered from it on two occasions. He endeavoured to explain it by the semi-decussation of the optic nerves [EYE]; and it is remarkable that the appearances found in his brain after death were such as on that theory might have been anticipated. But in a large proportion of the cases the affection is too transient to admit of the supposition of any organic disease.

HEMIPLE'GIA. [APOPLEXY.]

HEMIPO'DIUS. [TETRAONIDÆ.]

HEMISPHERE, the half of a sphere. [SPHERE.]

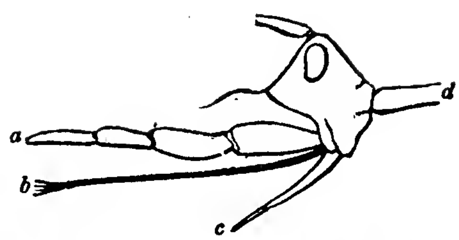
HEMI'PTERA (from ἡμί, *half*, and πτερόν, *a wing*), one of the orders of the class Insecta.

The order Hemiptera, according to the twelfth edition of the 'Systema Naturæ' of Linnæus, contains insects which agree in having incomplete metamorphoses (*i.e.* the larva and pupa both possess the power of locomotion, and bear a great resemblance to the perfect insect), and also in having the superior wings generally coriaceous, and the inferior membranous. Thus Linnæus included in this order the *Cockroaches, Locusts, Grasshoppers, Bugs, Cicadæ*, &c. The last-mentioned insects, the Bugs and Cicadæ, however differ very materially from the former, inasmuch as they possess a suctorial instead of a masticatory mouth; and as these latter characters have been considered of great importance by all the more modern entomologists, the term Hemiptera has been restricted to such insects as have *imperfect metamorphosis* and a *suctorial mouth*.

This definition will include the Linnæan genera *Fulgoria, Cicada, Notonecta, Nepa, Cimex, Aphis, Chermes, Coccus*, and *Thrips*, and these, with the addition of the genus *Pulex*, constitute the order to which Fabricius applies the name of *Ryngota*. Without the last-mentioned genus they constitute the order Hemiptera according to Latreille, Burmeister, and most of the foreign entomologists; and the orders Hemiptera and Homoptera according to Leach, Stephens, MacLeay, and several other British authors.

The Hemiptera are divided by Latreille into two sections; to the first he applies the name of *Heteroptera*, and to the second that of *Homoptera*. The *Heteroptera* are characterized by having the rostrum attached to the fore part of the head; the elytra coriaceous with the extremity membranous, folding one over the other when at rest, and the first segment of the trunk (or the prothorax) the largest, and forming the most conspicuous part of the thorax. The second section, *Homoptera* (which by many of the English entomologists is regarded as an order), is distinguished by the proboscis being attached to the lower portion of the head, near the chest; the elytra almost always of a uniform coriaceous texture, with their inner margin straight and contiguous: the three segments of the thorax are united in a mass, and the first is frequently shorter than the second. All the insects of this section feed exclusively on vegetable juices: their structure is more fully described in the article HOMOPTERA. We shall at present confine our remarks to the first section, or to the true Hemipterous insects.

In the greater number of the Heteropterous Hemiptera the head is small, situated on the same plane as the thorax, or nearly so; the fore part is somewhat produced; the eyes are of moderate size, very convex, and hence project rather suddenly from the sides of the head: between the eyes there are, in many species, two ocelli, or simple eyes; the antennæ are of moderate size, composed of long joints, few in number, and situated in front of the eyes: the part usually termed the thorax in descriptions, but which is in fact the prothorax, is of moderate size, often broader than long, and very frequently produced on each side, so as to form an angular projection; the scutellum is large, generally triangular; but in some (the Scutelleræ, for instance) it assumes the form of the body, and is so large that it completely covers that part; the body itself is often flat or concave above; convex and more or less distinctly keeled beneath: when the wings are closed, the upper part of these insects generally presents a flat or slightly convex surface, and is seldom very convex. The legs are of moderate size, or not unfrequently long. In certain groups (the *Coreidæ*) the posterior thighs of the males of many of the species are remarkably large, and many have the tibiæ also large, often broad and compressed.



The proboscis springs from the fore part of the head, and when not in use is suddenly curved downwards and backwards, and lies close to the under surface of the thorax and between the fore pair of legs. It consists of a jointed process (*a*), which is grooved upon the upper side, and in this groove there are four setæ (*b*), or bristle-like organs, which are covered above, at their base, by another appendage (*c*), which is supposed to be analogous to the upper lip or labrum of mandibulate insects; whilst the four setæ probably represent the mandibles and maxillæ, and the jointed process the labium. In the figure, the setæ (*b*) are represented as disengaged from their sheath (*a*), and the labrum is lifted up. When in the ordinary position these organs form together a tube, by means of which the juices of plants or animals are extracted and conveyed to the œsophagus.

The Heteroptera are divided by Latreille into two families; the first, or the Geocorisæ, are characterized as having the antennæ free, longer than the head, and inserted between the eyes and near their anterior margin. The tarsi are three-jointed, but the first joint is sometimes very short. The second family, to which the name of Hydrocorisæ is applied, have the antennæ enclosed and hidden in a groove beneath the eye; the tarsi have but two distinct joints,* and the eyes are generally very large.

The species of the family Geocorisæ are for the most part found on the leaves of trees or small plants; some there are which do not quit the ground, and there are others which live upon the surface of the water. The genera *Hydrometra, Gerris*, and *Velia*, afford examples of this mode of life. [HYDROMETRIDÆ.]

The insects belonging to the second family (*Hydrocorisæ*) live, as their name implies, in the water, and they prey upon other insects.

The two families which have just been characterized are by most entomologists regarded as sections or subsections rather than families; the latter is in fact an aberrant group, the former containing by far the greater portion of the species. Regarding them therefore as sections, they may be divided into the following families:

Geocorisæ.

Family 1.	Scutelleridæ.	Family 5.	Cimioidæ.
2.	Pentatomidæ.	6.	Reduviidæ.
3.	Coreidæ.	7.	Hydrometridæ.
4.	Acanthiidæ.		

Hydrocorisæ.

Family 1. Nepidæ. Family 2. Notonectidæ.

HEMITONE, an interval in antient music, the ratio of which is $\frac{243}{256}$.

HEMLOCK. [CONIUM.]

HEMP. [CANNABIS.]

HEMP. Our supplies of this article are almost wholly brought from Russia. Of 586,032 cwt. imported in 1836 into the United Kingdom, 556,458 cwt. were shipped at St. Petersburg and Riga. Some trifling shipments are made at ports in the north of Germany and the Netherlands, and a small supply is brought from India. The total quantity of hemp imported in each of the ten years from 1827 to 1836 was—

1827	573,393 cwt.	1832	593,564 cwt.
1828	504,120 „	1833	527,459 „
1829	374,932 „	1834	673,810 „
1830	506,770 „	1835	687,558 „
1831	530,820 „	1836	586,032 „

The price of hemp fluctuated exceedingly during the war. While the ports in the Baltic were closed against us it be-

* The third joint is to be found (at least in some of the species, if not all) within the apex of the tibiæ.

came exorbitantly dear. In the year 1792 the price was 25*l.* per ton, and in 1808 had risen to 118*l.*, under the restrictions imposed on the trade of this country by the Milan and Berlin decrees of Napoleon. By this advance the ingenuity of mercantile men was so stimulated, that the obstacles raised by the governments then subject to the dictation of France were overcome, and the importations, which in 1808 had been only 259,687 cwt., were increased to 858,875 cwt. in 1809, and 955,799 cwt. in 1810, when the price fell to 58*l.* per ton, which rate was below the cost, including the exorbitant freight to which it was subjected. Since the peace in 1815 the price has fluctuated between 24*l.* and 50*l.* per ton; during the last few years it has scarcely ever gone beyond 30*l.* per ton.

HEMSTERHUYS, TIBERIUS, son of a French physician, was born at Groningen, A.D. 1685. He entered the university of that town in his 14th year, and studied theology and philology under Braun, Oriental literature under Schultens, and mathematics and philosophy under Bernoulli. He afterwards went to Leyden to hear the lectures of Perizonius on antient history; where he was engaged to put in order the MSS. belonging to the university library. In his 19th year he was appointed professor of mathematics and philosophy at Amsterdam, and shortly afterwards undertook to complete an edition of Pollux which Lederlin had left unfinished. Bentley in two letters to Hemsterhuys pointed out the faults of this edition; which so much discouraged Hemsterhuys that he did not open a Greek book for two months afterwards. Conscious of his own deficiencies he resolved to acquire an accurate knowledge of the Greek language, and for that purpose read through all the Greek writers in chronological order. In 1720 he succeeded Lambert Bos at Franecker as professor of Greek; and in 1740 removed to Leyden, where he was also professor of the same language. He died 7th April, 1766.

Hemsterhuys did not write much; but he was an accurate and laborious scholar, and it was principally owing to his reputation and exertions that the study of the Greek language, which had been greatly neglected in Holland, again became general in that country. He introduced what has been called the analogical system, which prevailed in the universities of Holland for a long time, and which is fully developed in the writings of Lennep. Hemsterhuys was not only a good classical scholar, but he was acquainted with several of the Oriental languages, and had a considerable reputation for his knowledge of mathematics and philosophy.

The principal works of Hemsterhuys are: the latter part of the edition of 'Pollux' by Lederlin, 1706; 'Luciani Colloquia et Timon,' 1708; 'Plutus' of Aristophanes, 1744; 'Latin Orations,' published by Valckenaer, 1784; Latin Translation of the 'Birds' of Aristophanes, in the edition of Kuster; 'Notes and Emendations on Xenophon of Ephesus,' inserted in the 3rd volume of the 'Miscellanea Critica' of Amsterdam. He also edited the early part of the edition of Lucian, which was completed by Reitz.

The life of Hemsterhuys has been written by Ruhnken. This work has been reprinted at Leipzig, together with the life of Wyttenbach, edited by Lindemann, 8vo., 1822.

HE'NAULT, CHARLES JEAN, born at Paris in 1685, was the son of a fermier-général. He showed at an early age a taste for literature, and wrote several poems. Being made intendant-general of the queen's household, he became by his pleasing address and suavity of manners a great favourite with the high society of the capital. He was also appointed president of the Court of Enquêtes. In 1723 he was made a member of the French Academy. At the age of fifty he withdrew from the fashionable world, and gave himself up entirely to study and to practices of devotion; but his devotion was free from moroseness or superstition. He died at Paris in 1770. Not many years before his death he wrote to Voltaire, with whom he had been on intimate terms, a serious letter representing to him the impropriety and bad taste of his continual sarcasms and invectives against religion. (*Correspondance de Mad. du Deffand*, the 23rd letter of those addressed to Voltaire.). The work for which Henault is best known is his 'Abrégé Chronologique de l'Histoire de France,' which is a very good model of works of that kind. It has gone through numerous editions, and has been translated into several languages. In two small volumes the author has registered under each year every event of any importance in the annals of the French monarchy, from its first establishment to the death of Louis XIV.; with a happy conciseness of expression he has cleared up many doubtful or controverted points, and he has introduced many wise, moral, and political reflections on the character of men and times. The arrangement is clear, and the hand of a man deeply versed in the laws and the records of his country is visible throughout the work. At the beginning of every reign he exhibits in a tabular form the dates of the birth, accession to the throne, and death of the monarch, the names of his wife or wives, and children, those of the contemporary European sovereigns, and those of the ministers, generals, chancellors, and men of learning who lived during that period; and at the end of every dynasty he adds an interesting dissertation on the social, civil, and intellectual condition of France at the time. A good index completes the work. Hénault has had many imitators and continuators, one of whom is the compiler of the 'Revue Chronologique de l'Histoire de France de 1789 jusqu'au 1819,' 1 vol. 8vo., Paris, 1823, in which all the multifarious events of those thirty years are registered in due order. Hénault wrote also 'Histoire Critique de l'Etablissement des François dans les Gaules;' and several dramatic works collected under the title of 'Pièces de Théâtre,' 1 vol. 8vo. 1770.

HENBANE. [HYOSCYAMUS.]

HENDECAGON, a figure of eleven sides. For the regular hendecagon see REGULAR FIGURES.

HENLEY on Thames. [OXFORDSHIRE.]

HENLEY in Arden. [ARDEN; WARWICKSHIRE.]

HENNA. [LAWSONIA.]

HENNEBON. [MORBIHAN.]

HENRI I. of France, son of king Robert, and grandson of Hugues Capet, succeeded his father in July, 1031, being then about twenty-seven years of age. His mother, Constance of Provence, who wished to favour her younger son Robert, excited a civil war, in which Eudes, count of Champagne, and Baldwin, count of Flanders, took her part, while the duke of Normandy assisted Henri. Peace was made by Henri giving to his brother Robert the duchy of Burgundy, which was the beginning of the first ducal house of Burgundy. In the year 1035, Robert le Diable, duke of Normandy, died; and his son William the Bastard, who succeeded him, was assisted by Henri in defeating several rivals who claimed the dukedom. A new pretender however arose some time after in the person of William of Arques, cousin to the late duke; and Henri of France, who had now become jealous of the power of William the Bastard, assisted his competitor, who however was in the end defeated by the Bastard about the year 1047. Henri married, in 1044, Anna, daughter of Jaroslav, duke of Russia, by whom he had several sons, the eldest of whom, Philip, was crowned at Rheims in 1059, at seven years of age, by order of his father, who died in the following year, leaving Philip I. under the guardianship of Baldwin, earl of Flanders. [BALDWIN IV.]

HENRI II., born in 1518, succeeded his father Francis I. in 1547. In 1550 he concluded the war which was then pending with England, which gave up to him Boulogne for the sum of 400,000 crowns. About this time Mary Stuart, the queen of Scotland, then a minor, came to France, under the guardianship of her uncles of Guise, and was betrothed to Francis, son of Henri. In 1552 Henri assisted Maurice, elector of Saxony, and Albert, marquis of Brandenburg, who had united for the defence of the religious and civil liberties of Germany against Charles V. Henri invaded Lorraine and took Metz, Toul, and Verdun, which were from that time annexed to France. It is curious to see the French government, which persecuted Protestantism at home, taking up arms for the professed purpose of supporting the Protestants of Germany. After the abdication of Charles V. the war continued between his successor Philip II. and Henri, whose troops, under the command of the Constable Montmorency, were defeated by the Spaniards at the battle of St Quentin in 1557; the French arms were likewise unsuccessful on the side of Italy, where the duke of Alba commanded the Spaniards. The war ended in 1559, by the peace of Château Cambresis, by which Calais, which had been taken the year before by the duke of Guise, remained in the hands of the French. At the same time a double marriage was concluded between Elizabeth, Henri's daughter, and Philip II. of Spain; and between Margaret, Henri's sister, and the duke of Savoy. The festivals given on this occasion had a tragical end. Henri was accidentally wounded at a tournament by the count of Montgomery, with the shaft of his broken spear, which struck the king on the right eye. Henri died shortly after, July 10, 1559. By his wife Catherine de' Medici he had four sons, of whom three reigned in succession after him, beginning with the eldest, Francis II. He also left several natural children by various mistresses. He had none however by his principal female favourite Diana de Poitiers, whom he made Duchess of Valentinois, and who survived him. The great influence of the Guises began under his reign. [GUISE, DUKES OF.]

HENRI III., born at Fontainebleau in 1551, was the third son of Henri II. Under the reign of his brother Charles IX., when he was called the Duke of Anjou, he fought courageously at the battles of Jarnac and Moncontour against the Huguenots. In 1573 he was elected king of Poland and the successor of Sigismund Augustus. Henri was crowned at Cracow; but a few months after, upon hearing of the death of his brother Charles IX., he suddenly quitted Poland and returned to France, where he assumed the title of Henri III. His reign was a reign of unworthy favourites. A mixture of bigotry and debauchery, of vice and folly, characterized his court. Under his weak administration factions and civil and religious wars desolated France; and instead of checking party spirit he was himself the leader of a party, and that party not the strongest. The king's party stood between the other two parties, that of the Ligueurs under Henri of Guise, and that of the Huguenots under Henri of Navarre, and the war which ensued was appropriately called the war of the three Henris. At last Paris revolted in favour of the Guises, and Henri had recourse to assassination, by causing the Duke of Guise and his brother the cardinal to be murdered. Most of the towns of France, indignant at this base act, rebelled; the parliament of Paris instituted his trial; and the pope excommunicated him. In this emergency Henri felt for a moment his old spirit revive; he applied for assistance to his generous enemy Henri of Navarre, who joined him with his army, repulsed the Duke of Mayenne, the leader of the League, and the two kings laid siege to Paris. During this siege a fanatical Dominican monk, named Jacques Clément, excited by the declamations of the Ligueurs, assassinated Henri III. at St. Cloud. Henri died on the 2nd of August, 1589. He left no issue, and in him terminated the dynasty of Valois, which had reigned in France since the accession of Philip VI., in 1328.

HENRI IV., king of France and of Navarre, born at Pau in the Béarn, the 15th December, 1553, was descended in a direct line from Robert, count of Clermont, sixth son of Louis IX., who married, in 1272, Beatrix of Burgundy, heiress of Bourbon, and assumed the arms and the name of Bourbon. [BOURBON.] Henri's father, Antoine de Bourbon, married Jeanne d'Albret, only daughter and heiress of Henri d'Albret, king of Navarre, after whose death, in 1535, Antoine became king of Navarre in right of his wife. Henri IV., during his youthful years, was trained up to hardiness and privations in his native mountains, after which he was sent to the French court till 1566, when his mother Jeanne d'Albert recalled him to Pau and had him instructed in the Calvinist communion. In 1569 he was acknowledged at La Rochelle as the leader of the Calvinists, and fought at the battles of Jarnac and Moncontour in the same year. After the peace of 1570 he was invited to the French court, and two years after he married Margaret, sister of Charles IX. By the death of his mother, June, 1572, he became king of Navarre. At the massacre of the St. Barthélemi, which followed close upon his marriage, Henri's life was spared on condition of his becoming a Roman Catholic; but as the court did not trust a conversion which was extorted by fear, he was kept under watch as a state prisoner for about three years. Having escaped in 1576, he put himself again at the head of the Calvinists, and began a series of hazardous and hard-fought campaigns, interrupted by short cessations of arms whenever Henri III. of France made promises of peace and toleration to his Calvinist subjects,—promises which he or the Guise never failed to break. Henri won the battle of Coutras in Guyenne, October, 1587, in which his antagonist the Duke of Joyeuse was killed. In 1589 he made his peace with Henri III. and joined him against the League. Henri III. before he expired named the king of Navarre as his successor, telling him at the same time that he wished him a quieter reign than his own had been. Henri however was opposed by one half of the kingdom, which obeyed the Duke of Mayenne, whom the parliament of Paris had appointed Lieutenant-General, and he was obliged to raise the siege of the capital.

He soon after gained the battles of Arques and Ivry, received some reinforcements from Elizabeth of England, and pursued the war with renewed vigour. At last in 1593 Henri began negotiations with several of the leaders of the League, and as a preliminary condition of their submission he was induced to make a public profession of the Catholic faith at St. Denis on the 25th of July of that year. In March 1594 Paris opened its gates to him, and Rouen and other cities followed the example of the capital. Charles, duke of Guise, likewise made his submission. In the following year the Pope acknowledged Henri, and in 1596 the Duke of Mayenne submitted. It was not however till 1598 that all France acknowledged Henri, nine years after his assumption of the crown. The peace of Vervins, concluded in that year, put an end to the interference of Spain in the affairs of France. From that time till his death Henri enjoyed peace, with the exception of a short campaign against the Duke of Savoy in the year 1600, which terminated in favour of the French arms.

The king applied himself to reform the administration of justice, to restore order in the finances, and to promote industry and commerce. He established new manufactories; he introduced plantations of mulberry-trees and the rearing of silkworms, and he began the botanical garden of Montpellier. He embellished Paris, and founded the hospital of La Charité Chrétienne for invalid officers and soldiers; he added to the collection in the royal library, and encouraged and rewarded men of learning, among others Grotius, Isaac Casaubon, Joseph Scaliger, De Thou, Malherbe, &c. In his foreign politics he was the ally of England; he supported the independence of Holland, and took the part of the Protestants of Germany against the encroachments of Rudolf II. Henri was censured for his change of religion, and by none more earnestly than by his faithful friend and counsellor Duplessis Mornay. On the other hand, many of the Catholics never believed his conversion to be sincere. But the truth probably was that Henri, accustomed from his infancy to the life of camps and the hurry of dissipation, was not capable of serious religious meditation, and that he knew as little of the religion which he forsook as of that which he embraced. In his long conference at Chartres in September, 1593, with Duplessis Mornay, which took place after his abjuration, he told his friend that the step he had taken was one not only of prudence, but of absolute necessity; that his affections remained the same towards his friends and subjects of the Reformed communion, and he expressed a hope that he should one day be able to bring about a union between the two religions, which, he observed, differed less in essentials than was supposed. To which Duplessis replied, that no such union could ever be effected in France unless the Pope's power were first entirely abolished. (*Mémoires et Correspondance de Duplessis Mornay depuis l'an* 1571 *jusqu'en* 1623, Paris, 1824-34.)

By the Edit de Nantes, promulgated in 1598, Henri gave what he thought a full redress of the grievances under which his Protestant subjects had so long laboured, and such it would have proved, had the provisions of the edict been honestly and fully carried into effect, and had not the king's intentions been frustrated in great measure by the intolerance of the different parliaments and courts of justice. Henri found the finances of the kingdom in a most wretched condition; of 150 millions of livres taken from the people only 30 millions reached the king's coffers. His able minister Sully had the task of restoring order in this financial chaos. He adopted the method of letting the taxes by public auction; he entered into a rigorous examination of the accounts of former receivers-general and other agents, and introduced forms of accounts which were to be filled up and accompanied with the necessary vouchers, so that no pretence was left for obscurity or omission. During a ministry of fifteen years he reduced the taille five millions of livres, and other imposts one half: he redeemed 135 millions of debt, while he added four millions to the king's revenue, and left 35 millions in the treasury, besides a value of 12 millions in arms and ammunition, five millions expended in fortifications, and above 26 millions on public works and royal gratuities. (Bresson, *Histoire Financière de la France*, Paris, 1829.) The sympathy which Henri felt and showed for the humbler classes of his subjects, whom his predecessors had looked upon as an inferior race of beings, would alone be sufficient to account for his popularity with the French people, a popularity which has survived all the eventful changes in that country. He is the only king of the old monarchy whose memory is still popular in France. His brilliant qualities, his tastes, even his failings, such as his excessive gallantry, were national, and they flattered the self-love and the vanity of the people. 'He was,' says the President Hénault, 'his own general and his own minister. He united to a blunt frankness the most dexterous policy, to the most elevated sentiments a delightful simplicity of manners, and to an undaunted courage a most touching feeling of humanity and benevolence.' He often forgave, and when forced to punish, as in the case of Biron, he did it with extreme regret. His life was repeatedly attempted by assassins who were stimulated by the old fanaticism of the League; and at last he was stabbed to death in his carriage, by Ravaillac, on the 14th May, 1610. He was succeeded by his son Louis XIII. under the guardianship of his consort Maria de' Medici. The grief for his death was deeply felt all over France. (*Mémoires de Sully;* Hénault and the other French historians; Thomas, *Essai sur les Eloges;* and a collection of Henri's most remarkable sayings and doings, entitled *L'Esprit de Henri IV.*, Paris, 1769.) Lenglet du Fresnoy, in the 4th vol. of his *Journal de Henri III.*, has published many letters of Henri IV. When the royal tombs at St. Denis were ransacked in the time of the Revolution, 1793, the body of Henri IV. was found in very good preservation: his features appeared hardly changed.

HENRY I., King of England, surnamed Beauclerc, or the Scholar, was the fourth and youngest son of William the Conqueror, by his queen Matilda of Flanders, and was born in 1068 at Selby in Yorkshire, being the only one of the sons of the Conqueror who was an Englishman by birth. His surname attests that he had received a more literary education than was then usually given either to the sons of kings or to laymen of any rank; and this advantage was seconded by natural abilities of a superior order. From an early age he and his next brother, William, appear to have monopolized the favour of their father to the exclusion of his eldest son, Robert Richard, the second son, died in his youth); and Robert's first recourse to arms is even attributed to his indignation at having one day had a pitcher of water thrown down upon his head, in mockery or sport, at the town of L'Aigle in Normandy, by his two younger brothers, and at his father's refusal to punish them for the insult. If this incident took place at all it must have been when Henry was a mere child, not beyond his eighth or ninth year:—his brother William was about twelve years his senior. In the last days of their father's reign jealousies arose between these two brothers; and in this new family quarrel the father seems to have attached himself to the one who was on the whole most like himself in character. At his death in 1087, the Conqueror expressed his wish that William should be his successor in the crown of England, and only left Henry a legacy of 5000*l.* of silver. With 3000*l.* of this however Henry soon after obtained, from the facility of his brother Robert, the whole of the district of Cotentin, comprehending nearly a third of Normandy. Although in the first instance a quarrel between the two arose out of this bargain, they were afterwards reconciled; and in 1090, when the intrigues of William, now king of England, had excited a revolt of the Norman barons against Robert, Henry came to the assistance of the latter, and was chiefly instrumental in putting down the insurrection. Upon this occasion Henry gave a striking proof of the relentless determination of his character. Conan, a rich burgess of Rouen, one of the most active and powerful of those who had taken part in the treason, having fallen into the hands of his enemies, Duke Robert thought it punishment enough to condemn him to perpetual imprisonment; but Henry, deeming it expedient to have better security against his future attempts, led the unfortunate man, on pretence of giving him a view of the surrounding country, to the highest tower of the castle in which he was confined, and threw him over the battlements. When Robert and William made peace the following year, they turned their united arms against Henry, who was soon compelled to evacuate even his last stronghold, the fortress built on the lofty rock of St. Michael, after which he wandered about for some two years in a state of nearly complete destitution. At length, on the invitation of the inhabitants of the town of Domfront, he assumed the government of that place; and it would appear that from this *point d'appui* he gradually raised himself to the repossession of nearly all the territory that he had lost. He also became reconciled to Rufus, and was in England and in the New Forest with that king when he came by his death (2nd August, A.D. 1100). That sudden and mysterious event (which very possibly his hand or his contrivance may have caused, and into which at least he never instituted any inquiry), made Henry king of England. His reign is reckoned from Sunday the 3rd of August, on which day he was crowned in Westminster Abbey by Maurice, bishop of London. The next day he published a charter confirming the rights and liberties both of the church and of the nation, and promising the restoration of the laws of the Confessor, with only such alterations as had been made in them by his father. All the circumstances of Henry's accession furnish strong evidence of the great importance which the Saxon population had already recovered since the Conquest. Henry from the first put forward his English birth as one of his chief claims to acceptance with his subjects; and he hastened to strengthen this title by an act which almost amounted to a tacit admission that the rights of the old Saxon line were not yet extinct, his marriage with Maud, or Matilda, daughter of Malcolm, king of Scotland, and niece of Edgar Atheling, which, after a delay occasioned by the reluctance of the princess to unite herself to the supplanter of her house, and by the circumstance of her having been at least designed to pass her days as the inmate of a nunnery, if she had not actually taken the veil, was at last celebrated on Sunday the 11th of November. As soon as he assumed the crown Henry affected a complete change of manners, laying aside the open licentiousness in which he had heretofore indulged, and with much apparent zeal clearing the court of the mistresses and profligate minions of the late king; but this show of reformation, like most of his other professions, was soon found to be merely an expedient adopted for the purposes of the moment.

The history of the reign opens with the contest between Henry and his elder brother for the crown. At the moment of the death of Rufus the gallant and thoughtless Duke Robert, after a brilliant career of arms in the Holy Land, was lingering on his return home in the south of Italy, detained there by the fascinations of the beautiful Sibylla, daughter of the count of Conversano, whom he eventually married and brought with him to Normandy. After his arrival in his own territories he threw away more time in a succession of festive displays; but at last he prepared to make a descent upon England. He landed with a considerable force at Portsmouth, soon after Whitsuntide, A.D. 1101. But this effort ended in nothing: Henry, having an army assembled at Pevensey, marched forward, and overtook his brother before he could reach Winchester, of which it was his object to obtain possession. After some negotiation the two princes met in a vacant space between the armies, and in a few minutes agreed to make up their differences on the terms of Henry retaining England, and Robert Normandy, with the proviso that, if either died without legitimate issue, the survivor should be his heir. The easy temper of the one brother and the craft of the other are equally conspicuous in this treaty, by which Henry extricated himself, at little or no cost, from all the inconveniences and hazards of his present position, while Robert at once relinquished the whole object in dispute, bating only what part of it he may have conceived was made over to him in his qualified and precarious reversionary right. It was by no means Henry's intention however that he should escape even at this sacrifice. Several of the English barons who possessed estates in Normandy, anxious for their own interests to secure the union of the two countries, had taken part in Robert's attempt: it was one of the stipulations of the treaty that a full pardon should be extended to all the subjects of either brother who might thus have gone over to the other; but no sooner was the duke returned to Normandy than Henry proceeded to take systematic measures for effecting the ruin of the leading barons who had deserted him. In this way he soon provoked a series of petty insurrections in England, which he easily crushed, extinguishing thereby, one after another, all the persons that were most obnoxious to him, and acquiring their estates to distribute among new men that were his devoted adherents. These proceedings could not fail to rouse the indignation of Robert; and Henry was not slow in taking advantage of the courses into which his irritated feelings drove him, to declare that the peace between them was for ever at an end. Circumstances were now in every way much more favourable for the English king than when he formerly contrived to avoid a contest of arms with his brother: on the one hand, some years of possession had established him more firmly on his throne; on the other, the strength of Duke Robert was broken and wasted, and his extravagance and misgovernment had both dissipated his means of every description and loosened the very tenure of his sovereignty. Henry, in the first instance, called upon him to cede the duchy for a sum of money or an annual pension: he then (A.D. 1105), on this demand being scornfully rejected, crossed over to Normandy at the head of an army, and speedily made himself master of many of the chief places of strength.

The following year the English king, who had returned home, again crossed the seas with a more numerous force than before. About the end of July he commenced the siege of the castle of Tenchebrai; Robert, after some time, advanced to its relief; and on the 28th September a long and sanguinary battle was fought between the two brothers before the walls of that fortress, the result of which was the utter ruin of Robert and his cause. He himself, after a last splendid display of the heroic valour which he had always shown, was taken prisoner, with 400 of his knights. He was condemned by his brother to confinement for life. According to Matthew Paris, an unsuccessful attempt which he soon after made to effect his escape was diabolically punished, on the order of his merciless brother, by the extinction of his sight: a basin of iron made red-hot was held before his eyes, which were kept open by force, until they were burned blind; and in this state the miserable prince survived for twenty-eight years, dying in Cardiff Castle, at the age of eighty, in February, 1135, not quite twelve months before Henry. Immediately after the victory of Tenchebrai Henry was, without opposition, acknowledged their duke by the Norman barons. About the same time also was terminated by a compromise, for the present, the dispute with Anselm, the archbishop of Canterbury, on the subject of investitures, which had been proceeding ever since the commencement of the reign. [ANSELM.]

The next six or seven years passed without any events of much moment. In 1113 however Henry was attacked in Normandy by Louis VI. of France, and Fulk, earl of Anjou, acting in confederacy in support of the interests of William, styled Fitz-Robert, the son of Duke Robert, who had escaped the vengeance of his uncle, and became from this time a rallying-point for the friends of his father's house and the enemies of the English king. The war lasted for about two years, and was on the whole adverse to Henry; but he then managed, with his usual dexterity, to bring it to a close by a treaty, which restored to him all that he had lost, and for the present wholly detached the earl of Anjou from the cause of his young protégé. It had been agreed that a marriage should take place between William and the earl's daughter Sibylla. That project was now given up, and it was arranged instead that Matilda, another daughter of the earl, should be united to Henry's only son, Prince William of England. But Henry seems to have made this engagement with no intention of ever fulfilling it: as soon as it had served its immediate purpose, he showed in the most open manner his disregard of every stipulation of the treaty. The consequence was the formation against him of a second Continental confederacy, in which the earl and the king of France received the active and zealous co-operation of Baldwin, earl of Flanders. Another war of about two years followed, in which success inclined sometimes to the one side, sometimes to the other; but the death of the earl of Flanders of a wound received at the siege of Eu, the secession of the earl of Anjou, again drawn off by a renewal of the proposal for the marriage of his daughter, the intrigues of Henry with the disaffected Norman barons, and, finally, the mediation of the pope, brought it also, in 1120, to a termination entirely favourable to the English king.

Immediately after this peace Henry's brightest hopes were turned to sudden night by the frightful calamity of the loss, on Friday, the 25th November, of the ship in which his son had embarked at Barfleur for England: with the exception of one individual, a butcher of Rouen, all on board perished, to the number of nearly 300 persons, including the prince, his half-brother Richard, his half-sister Marie, and the earl of Chester, with his wife and her brother, who were the niece and nephew of the king, among 140 of the members of the most noble houses of England and Normandy, of whom eighteen were females. Henry is said never to have been known to smile after this blow. It did not however extinguish his spirit of ambition. Two years before this he had lost his consort, the good Queen Maud; and a daughter, Matilda, married in 1114 to the Emperor Henry V., was now his only legitimate progeny. In the hope of male offspring, he now (2nd February, 1121) espoused the young and beautiful Adelais, or Alice, daughter of Geoffrey, duke of Louvaine. Scarcely had he entered into this alliance when he found himself called to meet a new revolt in Normandy, excited by the restless Fulk, earl of Anjou, who now having lost all hope of the English marriage, had renewed his connection with Fitz-Robert, and again affianced to him his younger daughter Sibylla, putting him in the mean time in possession of the earldom of Mons. But this movement was very soon put down by Henry, who also contrived once more to gain over the fickle and venal earl of Anjou, and so to deprive the Norman prince of the hand of the fair Sibylla, when he had it almost in his grasp.

When four or five years of his second marriage had passed without producing any issue, Henry determined upon the bold enterprise of endeavouring to secure the succession to his dominions for his daughter, the empress Matilda, who had become a widow by the death of her husband in 1125. On Christmas-day, 1126, she was unanimously declared his heir, in a great council of the lords spiritual and temporal assembled at Windsor Castle. The following year, in the octaves of Whitsuntide, she was married to Geoffrey, surnamed Plantagenet, the son of Fulk, earl of Anjou, to whom, although only a boy of sixteen, his father had renounced that earldom on his departure for the Holy Land, where he was a few years afterwards elected king of Jerusalem. Soon after this settlement of his daughter, Henry was relieved of a source of perpetual annoyance and apprehension by the death of his nephew William Fitz-Robert, which took place 27th July, 1128, in the twenty-sixth year of his age. This prince had not been abandoned by King Louis of France, who, after giving him in marriage Joan of Morienne, the sister of his queen, had first put him in possession of the countries of Pontoise, Chaumont, and the Vexin, and then, on the murder of Charles the Good, had invested him with the earldom of Flanders. The intrigues and the money of Henry however speedily stirred up against him a revolt of a party of his Flemish subjects, who putting Thiodric, or Thierry, landgrave of Alsace, at their head, endeavoured to drive him from the country; and it was in a battle with Thierry, under the walls of Alost, that, in the moment of victory, he received the wound of which he soon after died in the monastery of St. Omer. It was not however till March, 1133, that Henry's longings for a grandchild were gratified by the birth of Matilda's first child, Henry, styled Fitz-Empress, afterwards Henry II. Two other sons, Geoffrey and William, were born in the course of the next two years. These events had been preceded by such dissensions between the ex-empress and her husband as at one time occasioned their separation; and now that they were again living together, Henry and his son-in-law quarrelled about the Norman duchy, of which the latter wished to be put in immediate possession, according to a promise which he said had been given on his marriage. From these family broils Henry was only delivered by his death, which took place at Rouen on Sunday, the 1st December, 1135, being the seventh day of an illness brought on by eating to excess of lampreys, after a day spent in hunting. He had completed the 67th year of his age and the 35th of his reign.

Besides the son and daughter born in wedlock that have already been mentioned, the genealogists assign to Henry I. the following natural children:—1. Robert, earl of Gloucester, who died, after a distinguished career, in 1146, by Nesta, daughter of Rhees-ap-Tudor, prince of South Wales,; 2. Richard, drowned in 1120 with Prince William, by the widow of Anskil, a nobleman of Berkshire; 3. Reginald, earl of Cornwall, who died in 1176, by Sibylla, daughter of Sir Robert Corbet, and wife of Henry Fitzherbert; 4. Robert, by Editha, daughter of Sigewolf, a Saxon nobleman; 5. Gilbert; 6. William, surnamed de Tracy; 7. Henry Fitz-Herbert, who was killed in battle in 1197, also, according to one account, by Nesta; 8. Marie (otherwise called Maud, or Adela), countess of Perche, another of those who perished in the shipwreck of 1120; 9. Maud, married to Conan the Gross, earl of Brittany; 10. Juliana, married to Eustace of Breteuil, earl of Pacie in

Normandy; 11. Constance, married to Roscelin, Viscount Beaumont in France; 12. another daughter, married to William Goet, a Norman; 13. another, married to Matthew Montmorency, the founder of the illustrious French family of that surname; and 14. Sibylla (otherwise called Elizabeth), who was married in 1107 to Alexander I. of Scotland, and died in 1122, by Elizabeth, wife of Gilbert de Clare, earl of Pembroke, and father by her of the famous Strongbow. (See accounts of these personages and their descendants in Fisher's *Companion and Key to the History of England*, 8vo., London, 1832.)

The character of Henry is sufficiently indicated by the facts that have been detailed. In a moral point of view it was detestable, but in the line of policy and craft it evinced superlative ability. In the midst of all his profligacy and unscrupulous ambition however he cherished a love of letters, and in his hours of leisure was fond of the society of learned men. It must be admitted also that his government, though still arbitrary and tyrannical in a high degree, appears to have been on the whole a considerable improvement on that of his father and his elder brother. He may be said to have led the way in the reformation of the law and the constitution by his re-establishment, partial as it was, of the Saxon laws, and by his charter, the example of that series of subsequent royal concessions, the same in form though much more extended in amount, which lie at the foundation of the national liberties. There can be no doubt that the country made considerable social progress in his reign, undisturbed as it was by any internal commotion, and enjoying, notwithstanding much oppression on the part of the crown, probably a more regular dispensation of justice between man and man, and more security from disorder and violence, than it had known since the coming over of the Normans. Henry I. was succeeded on the throne of England by Stephen.

HENRY II., surnamed Fitz-Empress, was the eldest son of Geoffrey Plantagenet (so named from a sprig of broom—in Latin, *planta genista*—in French, *plante genêt*—which he used to wear in his cap), earl of Anjou, and of Matilda, daughter of Henry I. king of England, whose first husband had been the Emperor Henry V. [HENRY I.] He was born at Le Mans, the capital of his father's dominions, in March, 1133. In the struggle between Stephen and Matilda for the English crown [STEPHEN], Matilda's husband Geoffrey had, by the year 1141, reduced nearly the whole of Normandy, and his infant son Henry had been acknowledged by the majority of the nobility of that country as their legitimate duke. In June of the following year Matilda's great supporter, her bastard half-brother Robert, earl of Gloucester, passed over to Normandy, and returned to England in December, bringing Prince Henry along with him, together with a small body of troops, obtained from the earl his father. Here the boy remained for nearly five years shut up for safety in the strong castle of Bristol, where his education was superintended by his excellent uncle Gloucester, who was distinguished for his scholarship and love of letters. He returned to his father in Normandy about Whitsuntide, 1147. In 1149 however, being now sixteen years of age, he recrossed the seas, and, at an interview held on Whitsuntide in Carlisle with his uncle David I. of Scotland, received from that prince the honour of knighthood, and concerted measures with him and his other friends for recovering his grandfather's throne. He returned to Normandy in the beginning of the following year, and was a few months afterwards, with the consent of his father, formally invested with that dukedom by Louis VII. of France, the portion of the country called the Vexin being ceded to Louis as the price of his consent to such arrangement. By the death of his father, 10th September, 1151, Henry became earl of Anjou, Touraine, and Maine. On Whitsunday of the year following, within six weeks after she had been divorced from her first husband, King Louis of France, he married Eleanor, in her own right countess of Poitou and duchess of Guienne or Aquitaine, an alliance which made him master of all the western coast of France, with the exception only of Brittany, from the Somme to the Pyrenees. Soon after this Henry sailed for England at the head of a small but well-appointed force. He and Stephen, having advanced, the one from the west, the other from the east, came in sight of each other at Wallingford, and in an interview which they had there, standing on opposite sides of the Thames, agreed to a truce. The death of Eustace, Stephen's eldest son, having removed the chief obstacle to a permanent arrangement between the two competitors, a peace was finally adjusted in a great council held at Winchester, 7th November, 1153, in which Stephen, adopting Henry for his son, appointed him his successor and gave the kingdom of England, after his own death, to him and his heirs for ever. The death of Stephen, 25th October, 1154, made Henry, in conformity with this agreement, king of England without opposition.

The commencement of the reign of Henry II. is reckoned from his coronation at Westminster along with his queen, 19th December, 1154. His first proceedings were strikingly indicative of the system of combined energy and policy which continued to characterize his government. He dismissed the foreign troops which Stephen had brought into the kingdom; razed to the ground nearly all the numerous castles that had been erected throughout the country by the barons in the preceding twenty years of anarchy; and resumed with remorseless determination all the lands that had been alienated from the crown since the death of Henry I., the grants only excepted that had been made to the church and to William, the second son of Stephen. This last act o rigour, the most daring upon which he adventured, was undertaken with the express concurrence of the great council or assembly of the immediate tenants of the crown. He next proceeded to settle the succession, and for that purpose a great council was assembled at Wallingford, soon after Easter, 1155, which ordained that after his death the crown should descend to his eldest son William, now in his third year, and in case of the death of William (which in fact took place the following year), to his younger brother Henry, who was as yet only a few months old. Oaths of fealty were at the same time taken to both the young princes; 'and we may undeniably infer from this,' observes Lord Lyttleton, 'as well as many other facts, that no right of birth, how indisputable soever, was thought in those days a sufficient title to convey the succession, without a parliamentary acknowledgment of it, followed and confirmed by feudal engagements.' Such ratifications were at least regarded as an important security, if not as essential. It was in another council, or parliament, as some writers call it, held at London after these arrangements had been made, that Henry, in conformity with the now established practice, granted a short charter, confirming, for himself and his heirs, to the clergy, the nobility, and the commonalty, all the rights, liberties, and customs (*consuetudines*) which had been conceded by his grandfather Henry I.

His presence was now called for across the seas by the attempt of his younger brother Geoffrey to wrest from him his paternal inheritance of Anjou, Touraine, and Maine, on the pretence, as stated by some authorities, that the will of their father had directed that Henry should resign these earldoms as soon as he should have obtained possession of the English crown. After a very short contest Geoffrey was forced to give up his claim in exchange for a pension of 1000 English and 2000 Angevin crowns, which he enjoyed little more than a year. He died in 1158 at Nantes, the inhabitants of which city had chosen him for their governor, in consequence of which circumstance the place was immediately claimed by Henry, as having devolved to him as his brother's heir. Partly by force, partly by management, Henry succeeded in acquiring through this claim first the virtual and eventually the actual possession of the whole of Brittany; the only portion of territory that was wanting to complete his sovereignty over all the western coast of France, and indeed over nearly the entire half of that kingdom. Conan, the hereditary count or duke of Brittany, who was also earl of Richmond in England, was now in the first instance induced, or compelled, to sign a treaty by which he bequeathed the country after his death to his daughter Constantia, an infant, whom he affianced to Henry's youngest son Geoffrey. At the same time the neutrality of Louis of France was secured by another arrangement, according to which it was agreed that Henry's eldest son, William, should marry that king's infant daughter Margaret (her mother was Constance of Castile, whom Louis had married after his separation from Eleanor), three castles in the Vexin being made over along with the princess as her dower. Henry had already recovered from the young Malcolm IV. of Scotland the northern counties which had been taken possession of by his predecessor David I., and the cession of which in perpetuity had been one of Henry's engagements with his uncle in 1149; he had also driven back the Welsh from those parts of the English territory which they had seized during the reign of Stephen, and even, as it would appear, compelled the princes of North and South Wales to acknowledge him as their feudal superior. His next attempt was upon the great French earldom of Toulouse, which he claimed in right of his wife Eleanor, whose grandfather William, duke of Aquitaine, had married Philippa, the only child of William, the fourth earl of Toulouse. He was here opposed both by Raymond de St. Gilles, the descendant of a brother of earl William, in whose line the principality had descended for nearly a hundred years, and by Louis of France, whose sister had married Raymond, and to whom, besides, the progressive aggrandizement of his ambitious vassal was every day becoming a subject of more serious alarm. Henry's expedition to France in support of this claim is memorable for the introduction of the practice of commuting the military service of the vassals of the crown for a payment in money, an innovation the credit of which is attributed to Thomas à Becket, recently elevated to the place of chancellor of the kingdom. [ESCUAGE.] The contest which ensued was suspended by a peace in May, 1160, by which Henry was allowed to retain a few places he had conquered in Toulouse; and although it soon broke out anew, it was after a few months put an end to by a second peace, concluded in 1162 by the mediation of pope Alexander III.

The history of the reign of Henry II. for the next eight years is principally that of his contest with the haughty and intrepid churchman, who, from an obscure origin having advanced through the degrees of royal favourite, prime minister, and chancellor, to the ecclesiastical sovereignty of archbishop of Canterbury, forthwith proceeded to assume the bearing of a rival monarch, and made his former master feel that he was only half king in the dominions he called his own. [BECKET.] This struggle for supremacy between the church and the state was not even terminated by the murder of Becket, 29th December, 1170: the blood of the martyr crying from the ground was found to be still more powerful than had been his living voice. In 1174 Henry performed an abject penance at his tomb for having been the unintentional instigator of his slaughter; and two years after, the famous constitutions of Clarendon, passed in 1164, by which the clergy had been made amenable to the civil courts, and the church in other respects subjected to the royal authority, were, after having been long practically disregarded, at last formally repealed in a great council held at Northampton.

Meanwhile two formidable insurrections of the Welsh in 1163 and 1165 had been repressed with great devastation of their country, and, in the second instance especially, with unusual cruelty. In 1166 a revolt of the people of Brittany against their duke Conan afforded Henry, after putting it down with his customary promptitude and vigour, a pretext for taking the government of the country out of the hands of that feeble dependent, and assuming to himself the direct administration of affairs in the name of his son Geoffrey and Conan's daughter Constantia, between whom, young as they both still were, the marriage ceremony was now solemnized for the sake of this arrangement. On the 10th of September, 1167, Henry's mother, the ex-empress Matilda, died at Rouen. Some further hostilities in which he now became involved with the French king were, before producing any important result, terminated by a new peace concluded at Montmirail, 6th January, 1169. By this treaty it was arranged that Henry, the king of England's eldest son, should do homage to Louis for the earldoms of Anjou and Maine, and that his second son Richard should in like manner hold the duchy of Aquitaine of the French king, and espouse Adelais, or Alice, the youngest daughter of Louis. But the greatest event which divided the manifold activity of king Henry with the affairs of Becket was the conquest of Ireland, which was begun in 1169 by a body of private adventurers, headed by Richard de Clare, earl of Pembroke, the celebrated Strongbow, and completed by Henry in person, who crossed over from Milford to Waterford with a powerful armament, 18th October, 1171, and after making an unresisted progress through the country, during which he received the submission of the princes of all parts of it except Ulster, and holding his court or assembling councils at Dublin, Cashel, and elsewhere, sailed back from Wexford to Portfinan in Wales, on Easter Monday, the 17th of April, 1172. The national spirit however recovered itself after this first prostration, and a protracted struggle ensued between the people and their invaders; but the acquisition of Ireland was finally sealed by a formal treaty concluded in 1175 with Roderick O'Connor, considered the head king of the country, in which he consented to become Henry's liegeman, to pay an annual tribute, and, although he was still to retain his nominal royalty for his life, to hold his crown in subjection to the English king.

Much of the remaining portion of Henry's life and reign presents an involved and deplorable scene of family discord and contention; sons against their father, wife against husband, brother against brother. His eldest son Henry had not only been invested, as mentioned above, with the earldoms of Maine and Anjou, but, being then sixteen years of age, had, after the custom which prevailed in the French monarchy, been, as heir apparent, solemnly crowned in Westminster Abbey on Sunday, 15th of June, 1170. On this account that prince is in old writings sometimes styled Henry III., and his common title during his life was from this date the junior or younger king; that of the senior or elder king being given to his father. In 1172 the ceremony of his coronation was repeated, his wife Margaret of France being this time crowned along with him. Soon after this, at the instigation, it is said, of his father-in-law king Louis, the prince advanced the extraordinary pretension that he had become entitled actually to share the royal power with his father, and he demanded that Henry should resign to him either England or Normandy. His refusal was speedily followed (in March, 1173) by the flight first of the prince, then of his younger brothers Richard and Geoffrey, to the French court. Richard professed to consider himself entitled to Aquitaine in virtue of the homage he had performed to Louis for that duchy after the peace of Montmirail, and Geoffrey founded on his marriage and his investiture some years before with the principality of Brittany a similar claim to the immediate possession of that territory. About the same time queen Eleanor also left her husband to associate herself openly with the rebellion of her sons, of which she had in fact been the prime mover, for Henry's infidelities and neglect—the appropriate retribution of the indecent precipitancy with which she had thrown herself into his arms—had long changed this woman's love into bitter hatred and thirst of revenge. She was also making her way for the French court, nothing perplexed, as it would seem, by the awkwardness of seeking the protection of her former husband, when she was caught dressed in man's clothes and brought back to Henry, during the rest of whose life she remained in confinement. Her capture however did not break up the unnatural confederacy of her sons. We can only notice the leading incidents of the confused and revolting drama that ensued. The cause of young Henry was supported not only by Louis, but also by William of Scotland, and by some of the most powerful both of the Norman and the English barons. With his characteristic energy and activity however the English king made ready to meet his various enemies at every point. Hostilities commenced both on the Continent, whither Henry proceeded in person, and on the Scottish borders, in the summer of this same year. Occasionally suspended, and again renewed, the war continued for about two years, during which the most important event that happened was the capture of king William of Scotland at Alnwick Castle, by the famous chief-justiciary Glanville, 12th July, 1174, which appears to have been the Saturday following the Thursday on which Henry did penance before the tomb of Becket at Canterbury. Soon after this Henry, who had throughout decidedly the best of the contest, assented to the petition of his sons for a peace; he and king Louis restored whatever they had taken from each other, and young Henry, Richard, and Geoffrey were gratified with the possession of one or two castles each, and liberal allowances from the revenues of the provinces to which they had severally laid claim. A new quarrel broke out between Henry and his eldest son the following year, but they were reconciled before they had time to betake themselves to arms. Meanwhile in December, 1174, a treaty with Scotland had been signed at the castle of Falaise, in Normandy, by which the Scots agreed to make acknowledgment of the feudal dependence of their crown on that of England, in return for the liberation of king William. The period of seven or eight years that followed was the most tranquil of Henry's reign, and that in which his greatness stood at the highest. With his ancestral dominions of England, Normandy, and

Anjou undisturbed by any rival claimant, his matrimonial acquisitions of Aquitaine and Poitou bound in the subjection of fear, if not of attachment, his conquest of Ireland secure, the Welsh and the Scotch reduced to submission and to the acknowledgment of his supremacy, he was undoubtedly at this time the most powerful of the European sovereigns. In 1183 however another outbreak of the fierce and turbulent spirit of the princes led the way to a new succession of family wars. This time Richard took up arms against Henry and Geoffrey, because his father called upon him to do homage to Henry for Aquitaine. A reconcilement between the brothers, effected by their father's interference, only suspended hostilities for a few months; the old king and his son Richard were then compelled to take the field against the other two. After deserting his father and his youngest brother alternately about half a dozen times, Prince Henry was suddenly taken ill, and died at Château-Martel, 11th June, 1183, in the twenty-seventh year of his age. Geoffrey still held out, supported by the chief nobility of Aquitaine, where there was a strong feeling of the people against the English king for his treatment of their hereditary chieftainess Eleanor; but he too in a short time made his submission and implored his father's pardon. A solemn family reconciliation then took place, at which even Eleanor was released from her prison and allowed to be present. But it did not last for more than a few months; Geoffrey then, in consequence of his father refusing to surrender to him the earldom of Anjou, fled to the court of France, where Philip II. was now king, and prepared for a new war; but before he could carry his design into execution he was, in August, 1186, thrown from his horse at a tournament, and so severely injured that he died in a few days after. No sooner was Geoffrey thus removed than his brother Richard hastened to the French court to take his place; but after unsuccessfully attempting to excite a new revolt in Aquitaine, he was compelled to throw himself upon his father's clemency. A project of a new crusade, at the call of pope Clement III., in the beginning of 1188, for a moment united Henry and Philip; the impetuous Richard actually took the cross, carried away by the feeling which thrilled all Europe on the arrival of the news of the capture of Jerusalem by Saladin in the preceding September; but before the end of the same year the unhappy father saw his son again bearing arms against him in alliance with the French king. The pretext on the part of Philip and of Richard for this new war was Henry's refusal to deliver up the princess Alice, the sister of the former, and the affianced bride of the latter, whose person as well as part of her dowry he had for many years had in his possession. Richard pretended to believe that his father wished to marry the princess himself, and even asserted or insinuated that her honour had already fallen a sacrifice to Henry's passion; it appears to be certain however that her restitution was only made a demand of the two confederates for popular effect, and was a very small part of their real object. Richard, having first done homage to Philip for all his father's Continental possessions, immediately proceeded to wrest them from the old man by the sword. Henry's spirit seems now to have given way at last, and the resistance he offered to his son was feeble and ineffective. The pope made an attempt to bring about a reconciliation, which failed; in the end Henry was compelled to sue for peace, on which he and Philip met on a plain between Tours and Azay-sur-Cher, when it was agreed, among other humiliating conditions, that all Henry's vassals, both Continental and English, should do homage to Richard, in acknowledgment of his rights as heir apparent, and that all those persons who had taken his side should from that time be considered as his liegemen, unless they should of their own accord return to his father. Henry was stretched on a sick-bed when this treaty was read to him; but when he found in the list of those that had deserted him to join Richard, his youngest and favourite son John, whose fidelity till now he had never had cause to suspect, the discovery appears to have broken his heart; he turned himself to the wall, saying that all his interest in the world was over. He was soon after removed to Chinon, on the Loire; and there, after a few days more of suffering, he died, 6th July, 1189, in the fifty-seventh year of his age and thirty-fifth of his reign. He was buried in the choir of the abbey of Fontevraud, in the presence of his son Richard, who succeeded him on the throne.

The character of this great king is a mixture of all the qualities, good and bad, naturally arising out of a strong intellect, a strong will, and strong passions. His faculties had in early life received a learned training, and to the end of his days he preserved an attachment to literature and to the conversation of scholars. The age was distinguished throughout Western Europe, both from that which preceded and from that which followed it, by a revival of elegant letters, which, from its speedy evanescence, appears to have been premature; and Henry drew around him many of the chief lights of the time, both natives of England and of other countries. Among these two of the most conspicuous names were John of Salisbury and Peter of Blois, both of whom have left us ample testimony, in their writings, how greatly they were dazzled by his brilliant and commanding genius. And if on the one hand he was ambitious, unscrupulous, licentious, and easily kindled to frantic excesses of rage, it must be admitted on the other that he was neither a cruel nor a vindictive or unforgiving enemy, and that he was far from incapable of generous and kindly emotions. He has that hold upon our sympathies which springs from the feeling that his enemies were worse men than himself, and from the pity excited by the tragic close as contrasted with the earlier course of his history, which taken altogether is one of the saddest and most affecting of those which preach to us the instability of fortune and the vanity of human ambition.

The government of England during this reign was still nearly as despotic in principle as in the days of the Conqueror and his sons, but the more advanced social condition of the country and the firmer establishment of the new dynasty combined with the temper of the king to render it considerably less oppressive in practice. The augmented security and strength of the crown, and the measures which Henry took to depress or curb the aristocracy, had the effect of relieving the people to some extent of one, and that perhaps the most severe, of the two tyrannies under which they suffered, without adding to the weight of the other. While the power of the barons was curtailed or restrained, that of the throne was certainly not exercised with more, but rather with less, insolence and rapacity than formerly. The laws were also administered with greater regularity during this reign than they had been since the Conquest; if the original *curia regis*, or royal court, was not already separated into the subdivisions out of which have sprung the present Courts of King's Bench and Common Pleas (which is doubtful), the important institution of justices itinerant, or justices in eyre, as they were styled, that is, judges making periodical circuits through the kingdom for the trial of causes, was now made a permanent part of the judicial establishment of the country. [Eyre.] Another important legal improvement now introduced was the substitution in the trial of the species of action called a writ of right of the grand assize, for the old ordeal of battle. [Assize.] The earliest of the English law-writers, Ranulf de Glanville, the supposed author of the Latin treatise entitled 'Tractatus de Legibus et Consuetudinibus Angliæ,' held the office of chief-justiciary in the time of Henry II. To this reign also belong the 'Dialogus de Scaccario,' and the two collections of charters, &c., known as the 'Liber Niger' and the 'Liber Ruber.'

Henry's children by his queen Eleanor were: 1, William, born 1152, died 1156; 2, Henry, born 28th February, 1155, died 11th June, 1183; 3, Maud, born 1156, married to Henry V., duke of Saxony, died 1189, a few days after her father; 4, Richard, who succeeded him on the throne; 5, Geoffrey, born 23th September, 1158, died 19th August, 1186; 6, Eleanor, born 13th October, 1162, married to Alphonso VIII., king of Castile, died 1214; 7, Joan, born October, 1164, married to William II., king of Sicily, died 4th September, 1195; and 8, John, who succeeded Richard as king. His illegitimate children were: 1, by the famous Rosamund, daughter of Walter, lord Clifford, William, surnamed De Longespee, who became earl of Salisbury in right of his wife Ela, daughter and heiress of William Devereux, died 1226; 2, by the same, Geoffrey, who became bishop of Lincoln, lord chancellor, and afterwards archbishop of York, and died 18th December, 1212; and 3, by the wife of Rodolph Blewit, Morgan, a churchman, who held the office of provost of Beverley.

HENRY III., surnamed of Winchester, from the place of his birth, was the eldest son of King John by his queen, Isabella of Angoulême, and was born 1st October, 1206. His father having died 18th October, 1216, the boy was, chiefly through the influence of the earl of Pembroke, lord marshal, acknowledged heir to the throne by those of the barons who were opposed to the French party; and on the 28th he was solemnly crowned in the abbey-church of St. Peter, at Gloucester, by the papal legate Gualo. His reign is reckoned from that day.

On the 11th November following, at a great council held at Bristol, Pembroke was appointed protector or governor of the king and kingdom (Rector Regis et Regni); and this able and excellent nobleman continued at the head of affairs till his death in May, 1219; long before which event the dauphin Louis and the French had been compelled to quit the country, their evacuation having been finally arranged in a conference held at Kingston 11th September, 1217. After the death of Pembroke the administration of the government fell into the hands of Hubert de Burgh, who had greatly distinguished himself in the expulsion of the foreigners, and Peter des Roches, bishop of Winchester. De Burgh however and the bishop, who was not an Englishman, but a native of Poitou, from coadjutors soon became rivals, and their attempts to throw each other down at length led, in 1224, to the resignation of Des Roches and his retirement from the kingdom. Meanwhile, on the 17th May, 1220, Henry, in consequence of some doubts being entertained about the efficacy of the former ceremony, had been crowned a second time at Westminster by Langton, archbishop of Canterbury. In 1221 the relations of peace and alliance with Scotland, which had subsisted ever since the departure of the French, were made closer and firmer by the marriages of Alexander II., the king of that country, with Jane, Henry's eldest sister, and of De Burgh with the Princess Margaret, the eldest sister of Alexander. About the same time Pandulf, who had succeeded Gualo as papal legate, left the country, which was thus practically freed from the domination of Rome, although that power still persisted in asserting theoretically the vassalage of the crown which had been originally conceded by John, and which had also been acknowledged at his accession by the present king.

In 1222 Henry had been declared of age to exercise at least certain of the functions of government; but his feeble character was already become sufficiently apparent, and this formality gave him no real power. It only served to enable De Burgh the more easily to get rid of his colleague. That minister, now left alone at the head of affairs, conducted the government with ability and success on the whole, though in a spirit of severity, which, whether necessary or not, could not fail to make him many enemies. A war broke out with France in 1225, which however was carried on with little spirit on either side, and produced no events of note, although Henry, in May, 1230, conducted in person an expedition to the Continent, from which great things were expected by himself and his subjects; but he returned home in the following October, without having done anything. At this time France was suffering under the usual weakness and distraction of a regal minority, Louis IX., afterwards designated St. Louis, having, while yet only in his twelfth year, succeeded his father in 1226. A growing opposition to De Burgh was at length headed by Richard, earl of Cornwall, the king's brother, who possessed very great influence, not only from his nearness to to the throne, but from his immense wealth; and the consequence was the sudden expulsion of that minister from all his offices, and his consignment to prison, with the loss of all his honours and estates, in the latter part of the year 1132. Des Roches, the bishop of Winchester, who had returned to the country some time before this crisis, was now placed at the head of affairs; but his administration, a course of insulting preference for his countrymen and other foreigners, and of open hostility to the great charter and the whole body of the national liberties, speedily proved unbearably distasteful to both barons and commons; and a confederacy of the laity and the clergy, with Edmund, archbishop of Canterbury, at its head, compelled his dismissal within little more than a year after his restoration to power. The archbishop now became chief minister. In 1236 Henry, being now in his thirtieth year, married Eleanor, the daughter of Raymond, count of Provence; and this connection soon gave new and great umbrage to the nation, in consequence of the numbers of her relations and countrymen who came over with or followed the queen, and with whom she surrounded her weak husband, besides inducing him to gratify their rapacity with pensions estates honours, and the most lucrative offices in the kingdom. In the midst of the contests thus occasioned between the crown and the nobility, whose meetings for deliberation on national affairs were now commonly called parliaments, a renewal of active hostilities with France was brought about through a private resentment of Henry's mother Isabella, who, after the death of John, had returned and been remarried to Hugh, count of La Marche, to whom she had been espoused before she gave her hand to John: she had instigated La Marche to insult and defy Alphonse, count of Poitou, the brother of the French king, after doing homage to him, and had then prevailed upon her son, the king of England, to take her part in the war with France that ensued. Henry again sailed for the Continent; but this expedition was still more unfortunate and disgraceful than the former: after being beaten by Louis in a succession of actions, he was glad to get home again, with the loss of army, money, baggage, and everything. A new truce for five years was then agreed to between the two countries.

These events of course did not tend to put the nation in better humour with the king, or to dispose the parliament to greater liberality. The contest with the crown however ended for the present in an attempt on the part of Henry to govern by the prerogative, which was so far successful that no effective resistance was made to it for many years. In the pressure of his embarrassments he several times reassembled the legislative body, but no accommodation was effected by these advances; the parliament was found as impracticable as ever, and the king resumed his arbitrary courses. In 1253 he succeeded in obtaining a grant of money by consenting to a solemn ratification of the great charters; a ceremony which had already been repeatedly performed in the course of the reign; and this enabled him to proceed at the head of a military force to Guienne, where a revolt against the English dominion had been excited by Alphonso, king of Castile. The dispute was soon settled by the arrangement of a marriage between Henry's eldest son Prince Edward, and Eleanor, the sister of Alphonso. [EDWARD I.] After this Henry engaged in a project which speedily involved him in a complication of difficulties—the acceptance of the nominal crown of Sicily for his second son Edmund from pope Innocent IV., who pretended to have it at his disposal in consequence of Frederick II., the late king, having died (A.D. 1250) in a state of excommunication, and who had ever since been hawking about the empty title among the princes of Europe, without finding any one simple enough to close with his proposals till he applied to the king of England. The exorbitant extent to which Henry was forced to carry his exactions in order to meet his engagements with the pontiff raised a spirit of resistance, which grew stronger and stronger, till it broke out into an open revolt against the supremacy of the crown. What is called by most of the old chroniclers 'the mad parliament' assembled at Oxford, 11th June, 1258, by adjournment from Westminster, where it had met on the 2nd of May previous; and placed the whole authority of the state in the hands of a committee of government, consisting of twelve persons appointed by the barons and as many by the king. The leader of the barons on this occasion was the famous Simon de Montfort, who was a Frenchman by birth, being the youngest son of the Count de Montfort, but who, in right of his mother, had succeeded to the English earldom of Leicester, and had so long ago as the year 1238 married Eleanor, countess-dowager of Pembroke, a sister of king Henry. After the enjoyment however of a long course of court favour he had quarrelled with and been insulted by his royal brother-in-law in 1252, and although they had been apparently reconciled, it is probable that the feelings then excited had never been extinguished in either. From the imperfect accounts and the partial temper of the annalists of the time, it is difficult to obtain a clear view of De Montfort's character and objects; but if his position may be reasonably suspected to have acted upon him with its natural temptations, and led him to form designs more ambitious than he could venture openly to profess, it must be admitted that he stands remarkably free from any well-established or even probable imputation affecting his actual conduct, and that he was undoubtedly a person both of eminent ability and of many excellent as well as popular moral qualities. His cause was also undoubtedly in the main that of the national liberties, and he appears to have had throughout the national voice and heart with him. He and his friends soon contrived to monopolize the whole power of the committee of government, and compelled the principal nominees of the king not only to relinquish their functions, but to fly from the kingdom. Dissensions now however broke out in the dominant party, and De Montfort found a rival aspirant to the supreme power in another of the great barons, Richard de Clare, earl of Gloucester. The quarrels of the adverse factions enabled Henry, in the beginning of the year 1261, altogether to throw off the authority of the committee of government; and although the parliamentary party was on this occasion joined by Prince Edward, it was for the present effectually put down, De Montfort himself being obliged to take refuge in France. He returned however in April, 1263, and being now supported by Gilbert, earl of Gloucester, the son of his late rival, proceeded to prosecute his quarrel with the crown by force of arms. Henry had now his son Edward on his side; but the success of the insurgents nevertheless was such as to threaten the complete overthrow of the royal power, when an accommodation was effected through the interference of the king's younger brother, Richard, earl of Cornwall, called King of the Romans, to which dignity he had been elected a few years before. The result was to place De Montfort and his friends once more at the head of affairs, the king being reduced to a cipher, or a mere puppet in their hands. In the course of a few months however we find the war between the two parties renewed. The contest of arms was suspended for a short time in the beginning of the following year (1264) by an appeal on the part of a number of the most influential barons and bishops to the arbitration of Louis IX. of France; but his award, which was upon the whole favourable to Henry, was very soon disregarded. On the 14th of May the forces of the barons, led by De Montfort, and those of the royalists, commanded by the king in person, and by his son Edward, met at Lewes, in Sussex, where the former gained a complete victory, both Henry and his son being taken prisoners. This success of course once more placed all the power of the kingdom at the feet of the great baronial leader. His arrogance and assumption of superiority however, it is said, had already alienated from him some of his most powerful adherents, and disposed them to take measures for the restoration of the royal authority, when, on the Thursday of Whitsun-week, 1265, Prince Edward contrived to make his escape from Dover Castle, and to join the earl of Gloucester, who had now deserted the interest of De Montfort, and waited to receive him with an army at Ludlow in Shropshire. This event immediately led to the renewal of the war. On the 4th of August the two parties again encountered at Evesham; Edward here gave brilliant proof of the military talent which distinguished his future career; and the result was the defeat of the baronial forces with immense slaughter, De Montfort himself and his son Henry being both in the number of the slain. In this battle the king is said to have had a narrow escape; the earl, in whose camp he was, had compelled him to put on armour and mount a war-horse, from which he was thrown down in one of the charges, and would probably have been put to the sword or trampled to death had he not called out that he was 'Harry of Winchester,' when his voice was heard by his son, who came up and rescued him.

The victory of Evesham however, although it liberated Henry and re-established the royal government, did not completely put down the defeated party. The adherents of De Montfort maintained themselves, notwithstanding all the efforts of Prince Edward, in various parts of the kingdom, for more than two years longer. Even after the parliament, in October, 1267, had passed an Act of Concord, known by the name of the 'Dictum de Kenilworth,' by which easy terms of pardon were offered to all who would submit themselves, the insurrection was renewed by the people of London, with the earl of Gloucester at their head; but that rash and fickle personage almost immediately threw himself upon the king's mercy without drawing the sword, and was glad to obtain pardon through the mediation of the King of the Romans, leaving his followers to their fate. A final arrangement was at last effected in a parliament which met at Marlborough on the 18th of November. The short remainder of the reign of Henry after this date passed without disturbance, or any remarkable events. His son Edward, leaving everything tranquil, set out for the Holy Land in July, 1270, from which he had not returned when Henry died at Westminster on the Feast of St. Edmund, being the 16th of November, 1272, in the sixty-seventh year of his age, and the fifty-seventh of his reign.

The children of Henry III., by his wife, Eleanor of Provence, were,—1, Edward, who succeeded him; 2, Margaret, born in October, 1240, married to Alexander III. of Scotland, at York, 26th December, 1251, died 26th February, 1275; 3, Beatrice, born at Bordeaux, 25th June, 1242, married to John de Dreux, duke of Brittany and earl of Richmond, at London in 1260, died 1273; 4, Edmund, surnamed Crouchback (probably from the crouch or cross which he wore upon his back, as having made the voyage to Jerusalem), born 16th January, 1245, created earl of Chester 1253, earl of Leicester 1264, earl of Lancaster 1267, died 1295; 5, Catherine, born 25th November, 1253, died in 1258; and four sons, Richard, John, William, and Henry, who died in infancy.

The reign of Henry III. is especially memorable in the history of the constitution as affording us the first distinct example of a parliament constituted as at present, of representatives from the counties, cities, and boroughs, as well as of the barons and higher clergy, or great tenants of the crown, lay and ecclesiastical. The assembly in question met at London, 22nd January, 1265, having been summoned in the name of king Henry, while he was in the hands of De Montfort, a few weeks before. Hence this great leader of the barons has been regarded as the introducer of the principle of popular representation into the English constitution, and the founder of the House of Commons. The fact simply is however that the writs for his parliament of 1265 are the earliest extant directing the return of knights of the shire, and representatives of cities and boroughs. There is nothing either in the writs themselves, or, what is more important, in the notices of any of the contemporary historians, from which it could be gathered that what took place was an innovation. Moreover, county representation, as at least an occasional usage, may certainly be distinctly traced to a date half a century earlier than this.

Our statute law also begins with this reign—the earliest enactment on the statute-book being that entitled the 'Provisions of Merton,' passed in the 20th year of Henry III., A.D. 1235-6. Only two of the statutes passed in this reign however are extant on the rolls in the Tower, namely, 'Magna Charta' and the 'Charta de Foresta,' and even these are only found in charters of inspeximus, or confirmation, of the next reign. The 'Charta de Foresta' was first made a distinct charter in the 2nd of Henry III., A.D. 1217 (not in his 9th year, as stated by mistake in the article FOREST LAWS). For an enumeration of the repeated confirmations both of that and of the great charter which were obtained in this reign, and which form the principal legislation of the period, the reader is referred to the account by Blackstone in the Fourth of his *Law Tracts*, or to the *Introduction* to the *Statutes at Large* in the edition of the Record Commissioners. Bracton's law treatise entitled *De Consuetudinibus et Legibus Anglicanis* is assigned to the reign of Henry III.

HENRY IV., surnamed Bolingbroke, was the eldest son of John of Gaunt, duke of Lancaster, the fourth son of king Edward III. His mother was the Lady Blanch, younger daughter and eventually heiress of Henry Plantagenet, duke of Lancaster, who was grandson of Edmund, second son of King Henry III. He was born at Bolingbroke in Lincolnshire in 1366, and as early as 1380 is styled earl of Derby, which was one of his father's titles. In 1397 he was created duke of Hereford, having married Mary, daughter and coheir of Humphrey de Bohun, the last earl of Hereford. He became duke of Lancaster on the death of his father, February 3, 1399.

The first occasion on which the earl of Derby appears in English history is as one of the lords associated with Thomas, duke of Gloucester, the uncle of Richard II., in the insurrection of 1387. It appears however that whatever may have been the designs of the duke, the earl contemplated nothing more than the temporary control of the royal authority. Accordingly, in May, 1389, when the king recovered his authority, his cousin Derby was one of the persons whom he immediately took into his confidence. Some of the years immediately following these events, the earl is supposed to have spent on the Continent. We find him again in England in 1397 at the time of the seizure of Gloucester, which act, Richard, in a proclamation which he issued on the occasion, stated to have been done with his approbation. Within a few months, after being raised to the rank of duke of Hereford, he and the duke of Norfolk, formerly the earl of Nottingham, who had also participated in Gloucester's rebellion ten years before, were involved in the same ruin with their former associates, in circumstances leading to a strong suspicion that, notwithstanding the forgiveness and even favour which he had apparently shown them, the insidious king had never forgotten their offence, but had still cherished a secret determination of revenge. It appears that while Hereford was riding from Brentford to London he was overtaken by Norfolk, who, entering into conversation with him, expressed his conviction, on grounds which he stated, that the king was preparing to destroy them. In some way or other, but how is doubtful, a report of this conversation reached the ears of the king. The consequence was that Hereford in obedience to a royal order appeared before Richard and the parliament at Shrewsbury, January 30, 1398, and there formally accused Norfolk of having spoken to him in the terms that have been mentioned. Apparently he had been induced to take this course as affording his only chance of escape from destruction; but it did not save him, although it perfectly answered the ond the king probably had in view. The charge against Norfolk was in the first instance roferred to a committee of twelve peers and six commoners, and eventually it was determined that it should be brought before a high court of chivalry. That court assemhled at Windsor on the 29th of April, and awarded that wager of battle should be joined between the two dukes at Coventry on the 16th of September. When the day arrived and the combatants had entered the lists, and were on the point of advancing to the encounter, tho king, who presided, suddenly threw down his warder, and so arrested both where they stood. Norfolk was ordered to go on a pilgrimage to the Holy Land, and banished from England for life; Hereford was also senteneed to quit the kingdom within four months, and to remain abroad for the next ten years. He retired to Paris, and while he was resident in that city his father the duke of Lancaster died, February 3, 1399, on which Richard immediately seized his estates, on the pretence that tho banishment of the son disqualified him from inheriting. This injury determined the latter immediately to return home, with the avowed object of maintaining his rights as duke of Lancaster, but doubtless with a real design of a higher pitch. He landed with a few attendants at Ravenspurn in Yorkshire on the 4th of July, while Richard was in Ireland. The events that followed belong to the history of the reign of that king; it is sufficient to state here that Henry, who was immediately joined by tho two powerful earls of Northumberland and Westmoreland, carried everything before him, and, the deposition of Richard having been pronounced by the parliament, was on the 30th of September solemnly acknowledged as king by the estates of the realm assembled in Westminster Hall. The commencement of his reign is reckoned from that day.

This change was undoubtedly in tho highest degree acceptable to the great body of the peoplo, among whom the vices and misgovernment of Richard had made him an object of hatred or contempt, while Henry of Lancaster had long been the idol of their affections and hopes. The new settlement was first disturbed by a plot of a few of the nobility, the lords who had appealed the duke of Gloucester, and who for that act had now been deprived of the titles and estates they had received as the reward of their services from Richard. Their scheme to assassinate the new king however was detected in time, and when they afterwards flew to arms they were everywhere fallen upon and easily overpowered hy tho spontaneous loyalty of the people. A war with France, of which some apprehension was for a moment entertained, from the feelings naturally excited in the king and people of that country by the treatment of Richard II., who had lately married Isabella, the young daughter of Charles VI., was averted by the restoration of that princess. Military operations however speedily commenced on the side both of Wales and Scotland, in the former of which countries an insurrection, headed by the famous Owen Glendower, baffled all Henry's efforts during several successive campaigns to put it down; while two Scottish armies, that marched across the horders pretending that they came to restore king Richard, who, it was said, was still alive and resident at the northern court, were defeated, the first on the 22nd of June, 1402, at Neshet Moor, the second on the 14th of September, in the same year, in the much more destructive fight of Homildon Hill. The victorious commander in this last affair was Harry Percy, the renowned Hotspur, eldest son of the earl of Northumberland, the nobleman to whom more than to any other individual Henry owed his throne. That great house, conscious of its power and its services, now broke with the king of its own making, on his refusal to permit the ransoming of Henry Percy's wife's brother, Sir Edmund Mortimer, who had been taken prisoner by Glendower, and whom, as the uncle and natural guardian of the young earl of March, the legitimate heir by lineal descent to the crown, Henry had his own reasons for wishing out of the way.* A most formidable rebellion followed, in which the Percies were joined hy Hotspur's uncle the earl of Worcester, and Scroop, archbishop of York, and leagued both with Owen Glendower, who now gave his daughter in marriage to his prisoner Mortimer, and with the Scottish Earl Douglas, whom Percy liberated without ransom, on condition of his aiding them, with all his power. The mighty confederacy however was annihilated, 21st July, 1403, by the battle of Shrewsbury, in which Henry Percy, the commander of the rebel force, was himself slain. This decisive victory established the throne of Henry of Lancaster. Some further hostilities with the Scots and tho Welsh, the latter being assisted by a force from France, continued to give him occupation for two or three years longer; but before the end of 1405 Owen Glendower was effectually put down, prinoipally by the activity and military skill of Henry, Prince of Wales, the eldest son of the English king, and a truce with Scotland had restored quiet for the present in that quarter. It was in the time of this truce that on the 30th of March, 1405, an English cruiser captured the ship in which James, the eldest son of king Robert of Scotland, was proceeding to France, on which Henry rotained possession of the young prince, who, becoming king tho following year by the death of his father, remained a prisoner in England till 1424. About the same time Henry detected a conspiracy against his life, one of the principal persons engaged in which was his cousin Edward, duke of York, whose estates were immediately forfeited to the crown, and quelled another insurrectionary attempt of the Percies, headed by Scroop, archbishop of York, who expiated his treason by a death on tho scaffold. A third northern insurrection, the last effort of the crafty old earl of Northumberland, who had some years before been deprivod of his estates and outlawed, was put down, 28th February, 1408, at the battle of Branham Moor, near Tadcaster, in which the earl himself fell.

Meanwhile an irregular war with France, which had at first been carried on principally at sea, had led at last to some military operations in Guienne, where the English possessions were attacked hy the French; and this involved Henry to a slight degree in the contest between the two great factions that then distracted France, the Bourguignons and the Orleanists, or Armagnacs. Having first sent a small body of troops to the assistance of the former in 1411, the next year he changed sides and entered into alliance with the latter, his principal object apparently being to keep up the anarchy which their quarrel occasioned; but these transactions led to no important national results during this reign.

In his latter years Henry, whose character tho more it hecame known developed a harsher and more unamiable aspect, lost all the popular favour that had greeted his accession; and he had the unhappiness of seeing not only his chief friends transformed into enemies, but the affections of his subjects generally transferred to his son. To ill health of body is also said to have been added remorse for many of the actions of his unscrupulous career, and especially for the means by which he had acquired a crown that sat so heavy on his hrow, and which he superstitiously dreaded heaven would not permit to be long worn by his descendants. He had endeavoured to soothe his conscience with the project of a crusade to the Holy Land, hut death took him off before he could execute that design. He breathed his last on the 20th of March, 1413, in the forty-seventh year of his age and the fourteenth of his reign.

By his first wife, Mary de Bohun, Henry IV. had the following children:—1, Henry, who succeeded him; 2, Thomas, born 1389, created earl of Alhemarle and duke of Clarence,

* For the respective positions in relation to the throne of the families of March (afterwards York) and Lancaster, see the genealogical table in EDWARD IV., in which however the line drawn from Lionel, duke of Clarence, ought to descend upon his daughter Philippa, and not, as it has been printed by mistake, upon her husband Edmund Mortimer.

1411, died 1421; 3, John, created earl of Kendal and duke of Bedford, 1414, afterwards regent of France, died 1435; 4, Humphrey, created earl of Pembroke and duke of Gloucester, 1414, died 1446; 5, Blanch, married successively to Lewis Barbatus, elector palatine and duke of Bavaria, to the king of Aragon, and to the duke of Bar; and 6, Philippa, married to Eric X., king of Denmark and Norway. By a second wife, Joanna, daughter of Charles II., king of Navarre, and widow of John V., duke of Brittany, whom he married in 1403, he had no issue.

Of the laws made in this reign the most memorable is the statute against the Lollards (the 2 Henry IV., c. 15), one of the enactments of which was that persons guilty of heresy, and refusing to abjure, or relapsing after abjuration, should be publicly burned. It is commonly supposed however that the writ 'De Hæretico Comburendo' was a common-law process before the passing of this statute. Several executions took place upon the new law in the course of the reign. In Henry's first parliament also the law of treason was brought back (by the 1st Henry IV., c. 10) to the state in which it had been placed by the act of the 25th of Edward III., certain new treasons created in the 21st year of the preceding reign being all repealed. The defects of Henry's title to the crown, and the repeated applications he was obliged to make to parliament for the means of putting down the insurrections by which the new settlement was assailed, had the effect of greatly enhancing the importance and power of the House of Commons under this king and the other Lancastrian princes.

HENRY V., surnamed of Monmouth, from the place of his birth, was the eldest son of king Henry IV., by his first wife, Mary de Bohun, and was born in the year 1388. He was educated at Queen's College, Oxford, under the superintendence of his half-uncle, the great cardinal Henry Beaufort. When his father was in exile in 1399, he and a son of the late Duke of Gloucester were carried by king Richard to Ireland, and placed in custody in the castle of Trim, where they remained till the deposition of Richard. On his father's accession he was created prince of Wales, duke of Guienne, Lancaster, and Cornwall, and earl of Chester, and declared by act of parliament heir-apparent to the throne. He was introduced to arms, while yet only in his sixteenth year, at the battle of Shrewsbury, where, though severely wounded in the face, he fought gallantly to the close of the bloody day. Immediately after this he was sent to Wales in command of the army employed against Glendower, and for some years he was occupied in the contest with that able and active leader, in the course of which he evinced extraordinary military genius, defeating his adversary in a succession of engagements,—in one of which, fought at Grosmont in Monmouthshire, in March, 1405, he took his son Griffith prisoner,—and driving him from fastness to fastness, till all Wales, except a small part of the north, was reduced to submission. It is said that the renown and popularity the prince acquired by these successes so inflamed the jealousy of his father as to occasion his recal from the army, and that after this, allowing the energies of his ardent mind to run to waste in riotous intemperance and debaucheries, he drew upon himself as much reprobation and odium by his wild and dissipated life, as he had gained glory and favour among his countrymen by his previous conduct. The story of his being sent to prison by the lord-chief-justice Sir William Gascoigne, for striking him in open court, and other accounts of his disorderly and reckless courses, are familiar to every reader. These anecdotes however are not recorded by the more antient chroniclers, and do not appear to have found their way into our written history before the middle of the sixteenth century, though they may have floated among the people as traditions from a considerably earlier date. It is likely that they had some general foundation, though many or most of the details are probably fictitious.

Henry V. was proclaimed king on the 21st of April, 1413, the day after his father's death, amidst universal and enthusiastic joy. He began his reign with several acts of a generous stamp—transferring the remains of Richard II. to Westminster Abbey—releasing the young earl of March from the captivity in which he had been held all the preceding reign—and recalling the son of Hotspur from his exile in Scotland to be reinstated in his hereditary lands and honours. He had been seated on the throne little more than a year when, warmly supported by the church, the parliament, both Lords and Commons, and by the nation generally, he entered upon the enterprise of the conquest of France, which forms nearly the whole history of his reign. The claim which he advanced to the French crown was the same that had been put forward in the preceding century by Edward III., to whose rights he seems to have regarded himself as the legitimate successor in virtue of his possession of the throne, although he was certainly not the heir of that king by lineal descent, and this particular pretension was one that stood wholly upon descent by blood. After some time spent in negotiations with the French court, which led to no result, Henry, having appointed his brother, the Duke of Bedford, regent of the kingdom during his absence, set sail from Southampton, 13th August, 1415, with a force of 24,000 foot and about 6500 cavalry, in a fleet of from 1200 to 1400 vessels, and reached the mouth of the Seine, about three miles from Harfleur, on the second day following. Three days were spent in disembarking the troops. Henry immediately proceeded to lay siege to the strong and well garrisoned fortress of Harfleur. It capitulated after a siege of six weeks, in the course of which time however a dysentery that broke out in their camp made a frightful devastation among the English.

On the 6th of October Henry set out on his march through Normandy, with a force which at the utmost could not have exceeded 9000 men. On the 19th he succeeded in crossing the Somme by an unguarded ford between Betencourt and Voyenne; on the 24th he crossed the Ternois at Blangi, and then came in sight of a French army, commanded by the constable of France and the dukes of Orleans and Bourbon, the strength of which has been variously estimated at from 50,000 to 150,000 men. The great battle of Azincourt was fought on the next day, in which the English gained one of the most complete as well as wonderful victories on record. [AGINCOURT.] Henry then marched to Calais, and embarked for England. From his landing-place at Dover, where they rushed into the sea to meet him, all the way to London, which he entered on the 23rd of November, his progress was through a confluence of the people intoxicated with tumultuous joy. All seemed to feel that the victory of Azincourt was the conquest of France. But although no nation ever received so great a blow in a single field as France did on that fatal day—when a hundred and twenty of her greatest nobles fell, besides many more that were taken prisoners, including the dukes of Orleans and Bourbon, the commanders-in-chief in conjunction with the constable d'Albret, who was among the killed—it was not till after some years that, torn as she was by the most lamentable civil dissensions, and left nearly without a government, that unfortunate country at last consented to receive the yoke of her invader. Harfleur was attacked by the French the following August; but the attempt was put an end to by a great naval victory gained by the duke of Bedford. In September Henry passed over to Calais, and there had a secret conference with the head of one of the great French factions, John, surnamed Sans-peur, duke of Burgundy, with whom there is no doubt that he came to some understanding about the employment of their united efforts for the destruction of the Orleanists, who now had the government in their hands. It was by thus politically taking advantage of the dissensions of his enemies, rather than by any further very brilliant military operations, that Henry at last achieved the conquest of France. He returned to that country in August, 1417, having under his command a magnificent army of about 35,000 men. With this force he soon reduced the whole of Lower Normandy. He then laid siege to Rouen, 30th July, 1418, and was detained before this town till after a brave resistance it capitulated on the 16th of January in the following year. By this time the duke of Burgundy had obtained the ascendancy in Paris and at the court of the incapable Charles and his profligate queen; and he was not now so much disposed as he had probably been two years before to aid the ambitious project of the English king. From Rouen Henry advanced upon Paris, on which Burgundy and the queen, taking the king with them, left that city, and went, first to Lagny, and afterwards to Provins. It was at last agreed however that a truce should be concluded between the English and the Bourguignons, and that Henry should meet the duke and the king and queen of France on the 30th of May. On that day the conference took place on the right bank of the Seine, near the town of Meulan. But after being protracted for above a month, the negotiation was suddenly broken off by the French party; and then it was discovered that the duke had concluded a treaty with the Dauphin and the faction of the Armagnacs. On this Henry immediately resumed his advance upon Paris. Meanwhile the hollowness of the apparent reconciliation that had been hastily patched up between the two rival factions became abundantly manifest; the formal alliance of the chiefs had no effect in uniting their followers. At length, on the 10th of September, Burgundy having been induced to meet the Dauphin on the bridge of Montereau, was there foully fallen upon and murdered by the attendants, and in the presence, of the treacherous prince. From this time the Bourguignons, and even the people of Paris, who were attached to that party, looked upon the English as their natural allies against the Dauphin and his faction. Philip, the young duke of Burgundy, and the queen in the name of her husband, immediately assented to all Henry's demands, which were—the hand of Charles's eldest daughter, the Princess Catherine, the present regency of the kingdom, and the succession to the throne of France on the death of Charles. It was also arranged that one of Henry's brothers should marry a sister of duke Philip. Several months were spent in the settlement of certain minor points; but at last the treaty of 'Perpetual Peace,' as it was styled, was completed and signed at Troyes by Queen Isabella and Duke Philip, as the commissioners of King Charles, on the 20th of May, 1420; and on the following day the oath to observe it was taken without murmur or hesitation by the parliament, the nobility, and deputies from such of the commonalties as acknowledged the royal authority.

Henry's marriage with Catherine was solemnized on the 2nd June. On the second day after he resumed his military operations, and some months were spent in reducing successively the towns of Sens, Montereau, Villeneuve-le-Roi, and Melun. On the 18th November Henry and Charles entered Paris together in triumph, and here the treaty of Troyes was unanimously confirmed (10th December) in an assembly of the three estates of the kingdom. Henry soon after set out with his queen for England, and on the 2nd February, 1421, entered London amidst such pageants and popular rejoicings as that capital had never before witnessed.

He did not however remain long at home. On the 22nd March his brother the duke of Clarence, whom he had left governor of Normandy, was defeated in a battle fought at Baugé, in Anjou, by a force chiefly composed of a body of Scottish auxiliaries under the earl of Buchan, who slew Clarence with his own hand, an exploit for which the Dauphin conferred upon the Scottish earl the office of constable of France. This victory appears to have produced a wonderful effect in reanimating the almost broken spirits and extinguished hopes of the Dauphin's party. Feeling that his presence was wanted in France, Henry again set sail for Calais in the beginning of June, taking with him a Scottish force commanded by Archibald, earl of Douglas, and also his prisoner, the Scottish king, to whom he promised his liberty as soon as they should have returned to England. His wonted success attended him in this new expedition; and he drove the Dauphin before him, from one place after another, till he forced him to retire to Bourges, in Berry. He then, after taking the strong town of Meaux, which cost him a siege of seven months, proceeded to Paris, which he entered with great pomp, 30th May, 1422, accompanied by his queen, who had come over to join him, after having given birth to a son at Windsor Castle on the 6th of the preceding December. But the end of Henry's triumphant career was now at hand. The Dauphin and the constable Buchan having again advanced from the south, and laid siege to the town of Cosne, Henry, though ill at the time, set out to relieve that place, but was unable to proceed farther than Corbeil, about twenty miles from Paris, when, resigning the command to his brother the duke of Bedford, he was carried back in a litter to the Bois de Vincennes, in the vicinity of the capital, and there, after an illness of about a month, he breathed his last, on the 31st of August, in the 34th year of his age, and the 10th of his reign.

It is unnecessary in the present day to waste a word on either the injustice or the folly of the enterprise on which Henry thus threw away the whole of his reign. In estimating his character it is of more importance to remember that the folly and injustice, which are now so evident, were as little perceived at that day by his subjects in general as by himself, and that there can be no doubt whatever that both he and they thought he was, in the assertion of his fancied rights to the crown of France, pursuing both a most important and a most legitimate object. That motives of personal ambition mingled their influence in his views and proceedings must no doubt be admitted; but that is perfectly consistent with honesty of purpose, and a thorough belief in the rightness both of the object sought and the means employed to secure it. In following the bright though misleading *idea* that had captivated him, he certainly displayed many endowments of the loftiest and most admirable kind—energy, both of body and mind, which no fatigue could quell; the most heroic gallantry; patience and endurance, watchfulness and activity, steadiness, determination, policy, and other moral constituents, as they may be called, of genius, as well as mere military skill and resources. Nor does any weighty imputation dim the lustre of these virtues. His slaughter of his prisoners at the battle of Azincourt, almost the only stigma that rests upon his memory, was an act of self-preservation justified by what appeared to be the circumstances in which he was placed. No monarch ever occupied a throne who was more the idol of his subjects than Henry V.; nor is any trace to be found of popular dissatisfaction with any part of his government, from the beginning to the end of his reign.

HENRY VI., surnamed of Windsor, was born there 6th December, 1421, being the only issue of Henry V. by his queen the Princess Catherine of France. He was consequently not quite nine months old when the death of his father left him king of England. His reign is reckoned from the 1st of September, 1422, the day following his father's death.

In the settlement of the government which took place upon the accession of the infant king, the actual administration of affairs in England was entrusted to the younger of his two uncles, Humphrey, popularly called 'The Good,' duke of Gloucester, as substitute for the elder, John, duke of Bedford, who was appointed president of the council, but who remained in France, taking his late brother's place as regent of that kingdom. Gloucester's title was 'Protector of the Realm and Church of England.' The care of the person and education of the king was some time after committed to Richard De Beauchamp, earl of Warwick, and to the king's great-uncle bishop (afterwards cardinal) Henry Beaufort.

The history of the earlier and longer portion of this reign is the history of the gradual decay and final subversion of the English dominion in France. The death of Henry V. was followed in a few weeks (22nd October) by that of his father-in-law, the imbecile Charles VI. Immediately on this event the Dauphin was acknowledged by his adherents as Charles VII.; and Henry VI. was also proclaimed in Paris, and wherever the English power prevailed, as king of France. The next events of importance that occurred were the two great victories of Crevant and Verneuil obtained by the English over the French and their Scottish allies, the former on the 31st of July, 1423, the latter on the 17th of August, 1424. In the interim king James of Scotland, after his detention of nearly twenty years, had been released by the English council, and had returned to his native country after marrying a near connexion of the royal family, the Lady Jane Beaufort, daughter of the duke of Somerset. One of the engagements made by James on his liberation was that he should not permit any more of his subjects to enter into the service of France: the Scots who were already there were for the most part destroyed a few months afterwards in the slaughter of Verneuil.

This however was the last great success obtained by the English in France. From this time their dominion began to loosen and shake, and then to crumble faster and faster away, until it fell wholly to ruin. The first thing which materially contributed to unsettle it was the disgust given to the duke of Burgundy by the marriage of the duke of Gloucester with Jacqueline of Hainault, and their subsequent invasion and seizure of her hereditary states, then held by her former husband John, duke of Brabant, who was the cousin of the duke of Burgundy. Although Burgundy, on being left to pursue his quarrel with Jacqueline, whom he soon succeeded in crushing, after she had been abandoned by Gloucester, did not go the length of openly breaking with the English on account of this matter, his attachment was never afterwards to be much relied upon, and he merely waited for a favourable occasion to change sides. Meanwhile another of the most powerful of the English allies, the duke of Brittany, openly declared for Charles VII. Other embarrassments also arose about the same time out of the mutual jealousies and opposition of Gloucester and Bishop Beaufort, which at last blazed up into open and violent hostility. It required all the moderating prudence and steadiness of the duke of Bedford to break as much as possible the shock of these various adverse occurrences. For some years accordingly he had enough to do in merely maintaining his actual position. It was not till the close of 1428 that he proceeded to attempt the extension of the English authority beyond the Loire. With this view the siege of Orleans was commenced on the 12th of October in that year, by the earl of Salisbury, and, on his death from a wound received a few weeks after, carried on by the earl of Suffolk. The extraordinary succession of events that followed—the appearance of Joan of Arc on the scene; her arrival in the besieged city (29th April, 1429); the raising of the siege (8th May); the defeat of the English at the battle of Patay (18th June); the coronation of king Charles at Rheims (15th July); the attack on Paris (12th September); the capture of Joan at Compiegne (25th May, 1430); her trial and execution at Rouen (30th May, 1431) —all belong to the singular story of the heroic maid. [Arc, Joan of.]

The young king of England, now in his ninth year, had in the meantime been brought to Rouen (May, 1430), and was about a year and a half afterwards solemnly crowned at Paris (17th December, 1431). The death of the duchess of Bedford, the sister of the duke of Burgundy, in November, 1432, and the marriage of Bedford in May of the following year with Jacquetta of Luxembourg, aided materially in still further detaching Burgundy from the English connection, till, his remaining scruples gradually giving way under his resentment, in September, 1435, he concluded a peace with king Charles. This important transaction was managed at a great congress of representatives from all the sovereign powers of Europe assembled at Arras, with the view of effecting a general peace under the mediation of the pope. On the 14th of September, a few days after the treaty between Charles and Burgundy had been signed, but before it was proclaimed, died the great duke of Bedford. This event gave the finishing blow to the dominion of the English in France. In April, 1436, the English garrison in Paris was compelled to capitulate. The struggle lingered on for about fifteen years more; but although some partial successes, and especially the brilliant exertions of the famous Talbot (afterwards earl of Shrewsbury), in Normandy and elsewhere, gave a check from time to time to the progressive dissolution of the English power, the prevailing current of events ran decidedly in the contrary direction. In 1444 a truce was agreed upon, to last till 1st April, 1446; and in this interval a marriage was arranged between king Henry and Margaret, the beautiful daughter of René, king of Sicily and Jerusalem, and duke of Anjou, Maine, and Bar. These lofty dignities however were all merely titular; with all his kingdoms and dukedoms, René was at this time nearly destitute both of land and revenue. Thus circumstanced, in return for the hand of his daughter, he demanded the restoration of his hereditary states of Maine and Anjou, which were in the possession of the English, and the proposal was at length assented to. Nor was this cession of territory the only thing that tended from the first to excite popular feeling in England against the marriage. Margaret was a near relation of the French king, and had been in great part brought up at the court of Charles. The connexion therefore seemed to be one thoroughly French in spirit, and it is no wonder that the earl of Suffolk, by whom it had been negotiated, became from this time the object of much general odium and suspicion, the more especially when it was found that Margaret, who soon evinced both commanding talent and a most imperious temper, distinguished him by every mark of her favour, and made him almost exclusively her confidential adviser and assistant in winding to her purposes her feeble and pliant husband. The marriage was solemnized in the abbey of Tichfield, 22nd April, 1445, Suffolk having a few months before, on the conclusion of the negotiations, been created a marquess. The truce with France was now prolonged till the 1st of April, 1449. The first remarkable event that followed was the destruction of the duke of Gloucester, who, although he appears not to have openly opposed the marriage, was certainly the most formidable obstacle in the way of the complete ascendancy of Suffolk and the queen. Having been arrested on a charge of high treason, 11th February, 1447, he was on the seventeenth day thereafter found dead in his bed. In the popular feeling, which however may very possibly have been mistaken, his death was generally attributed to the agency of Suffolk, who now, raised to the dignity of duke, became, ostensibly as well as really, prime, or rather sole minister.

Soon after hostilities were renewed in France, and a numerous force having been poured by king Charles into Normandy, through the adjacent country of Maine, no longer a hostile frontier, town after town was speedily reduced, till at last Rouen, the capital, surrendered, 4th November, 1449. Early in the next year another heavy reverse was sustained in the defeat of Sir Thomas Kyriel at Fourmigny; and at last the fall of Cherbourg, 12th August, 1450, completed the loss of the duchy. Before this catastrophe however the public indignation in England had swept away the unhappy minister on whose head all this accumulation of disasters and disgraces was laid; the duke of Suffolk, after having been committed to the Tower, on the impeachment of the House of Commons, and banished from the kingdom by the judgment of his peers, was seized as he was sailing across from Dover to Calais, and being carried on board one of the king's ships, was there detained for a few days, and at last had his head struck off by an executioner who came alongside in a boat from the shore, May 2nd, 1450. The murder of Suffolk was immediately followed by a popular insurrection, unparaleled in its extent and violence since the rebellion of Wat Tyler, seventy years before. [Cade, John.] Before the close of the following year the French, in addition to Normandy, had recovered all Guienne; and with the exception of Calais, not a foot of ground remained to England of all her recent Continental possessions. Bordeaux, which had been subject to the English government for three centuries and a half, revolted the following year; and the brave Talbot, now eighty years of age, was sent to Guienne to take advantage of that movement; but both he and his son fell in battle, 20th July, 1453; and on the 10th of October following Bordeaux surrendered to Charles.

The remainder of the history of the reign of Henry VI. is made up of the events that arose out of the contest for the crown which eventually placed another family on the throne. [Edward IV.] It is only necessary here to enumerate in their chronological order the leading facts in the story of Henry's personal fortunes. On the 13th of October, 1453, Queen Margaret was delivered at Westminster of a son, who was named Edward, and early in the next year, according to custom, created prince of Wales and earl of Chester. About the same time the king sunk into a state of mind amounting to absolute incapacity. By the beginning of the year 1455 however he had recovered such use of his faculties as he had formerly had, and again took upon him the nominal administration of the government, which during his malady had been committed to the duke of York. In the contest of arms that soon ensued, he was taken prisoner by the earl of Warwick at St. Albans, 23rd May, 1455, and towards the end of that year he was again declared to be in a state of incapacity, and the duke of York resumed the management of affairs with the title of protector. Again however in a few months Henry recovered his health, and the government was conducted in his name till his second capture by the young earl of March (afterwards Edward IV.) at Northampton, 10th July, 1460. On this occasion the queen escaped with her son, and eventually made her way to Scotland. The victory obtained by Margaret over the earl of Warwick at Barnet Heath, 17th February, 1461, again liberated her husband; after which, and the issue of the battle of Towton, 29th March, which established Edward on the throne, he retired with the queen and Prince Edward to Scotland. Here he fixed his residence in the first instance at Kirkcudbright; but it appears that he afterwards, as well as his queen, proceeded to Edinburgh. (See Note by Sir W. Scott, on the fifth canto of *Marmion.*) When Margaret again took up arms and invaded England in 1462, Henry was placed for security in the Castle of Hardlough in Merionethshire; and here he remained till the spring of 1464, when he was brought from Wales to join a new insurrection of his adherents in the north of England. After the two final defeats of the Lancastrians at Hedgley Moor, 25th April, and at Hexham, 15th May, the deposed king lurked for more than a year among the moors of Lancashire and Westmorland, till he was at last betrayed by a monk of Addington, and seized as he sat at dinner in Waddington Hall in Yorkshire, in June, 1465. He was immediately conducted to London and consigned to the Tower, where he remained in close confinement, till the extraordinary revolution of October, 1470, again restored him, for a few months, to both his liberty and his crown. He was carried from London to the battle of Barnet, fought 14th April, 1471, and there fell into the hands of Edward, who immediately remanded him to his cell in the Tower. The old man survived the final defeat of his adherents, and the murder of his son at Tewkesbury, 4th May; and a few days after an attempt, which had nearly succeeded, was made by Thomas Nevil, called the Bastard of Falconberg, to break into his prison and carry him off by force. This probably determined Edward to take effectual means for the prevention of further disturbance from the same quarter. All that is further known is that on Wednesday the 22nd the dead body of Henry was exposed to public view in St. Paul's. It was generally believed however that he had been murdered, and that his murderer was the king's brother, the Duke of Gloucester, afterwards Richard III. Henry VI. was after his death revered as a martyr by the Lancastrians, and many miracles were reported to have been wrought at his tomb. An attempt was made in the next century by his successor Henry VII. to prevail upon Pope Julius II. to canonize him; the pope referred the matter to the examination of the archbishop of Canterbury and the bishops of London, Winchester, and Durham; but it came to nothing. 'The general opinion was,' says Bacon (*Life of Henry VII.*), 'that Pope Julius was too dear, and that the king would not come to his rates. But it is more probable that that pope, who was extremely jealous of the dignity of the see of Rome, and of the acts thereof, knowing that King Henry VI. was reputed in the world abroad but for a simple man, was afraid it would but diminish the estimation of that kind of honour, if there were not a distance kept between innocents and saints.'

HENRY VII. was born at Pembroke Castle, 21st January, 1456. His father was Edmund Tudor (or rather Tydor, pronounced Tuddor, that is, Theodore), surnamed of Hadham, who had been created earl of Richmond in 1452, being the son of Sir Owen Tudor and Queen Catherine, widow of Henry V. He was thus paternally descended both from the royal house of France and also, it is said, from the antient sovereigns of Wales, for such is the derivation assigned by the genealogists to the Tudors—if indeed, as Camden remarks (in his 'Remains') that can with any propriety be considered as the family name which was really merely the Christian name of Owen Tudor's grandfather, from whom he and his father assumed it as their patronymic. But it was his maternal extraction that gave Henry Tudor his political importance. His mother was Margaret, the only child of John Beaufort, duke of Somerset, whose father of the same name was the eldest of the sons of John of Gaunt, duke of Lancaster, the root of the Lancastrian house, by his third wife, Catherine Swynford. The Beauforts, as the children of Gaunt by this wife were named, having been born before marriage, and only subsequently legitimated by a patent entered on the rolls of parliament, which appears (though there is some doubt as to that point) not to have opened to them the succession to the crown, were not at first looked upon as in themselves or their descendants forming strictly a branch of the House of Lancaster; their name itself distinguished them as another family. But towards the close of the reign of Henry VI. their royal descent and proximity to the throne began to be spoken of as giving them important pretensions. After the termination of the wars of the roses the Somerset family remained the only representatives of the House of Lancaster, in England: there were indeed in Portugal, Spain, Germany, and Denmark, nearly a dozen descendants of the daughters of John of Gaunt by his two earlier marriages, some of whom at least, namely, those sprung from Henry IV., had clearly a prior place in the line of succession to the Beauforts, had the legitimation of the latter been ever so perfect; but the circumstances of the time were not such as to allow any validity to these foreign titles. After Richard III. obtained the throne, only two really formidable members of the House of Lancaster survived, namely, this Henry, earl of Richmond, and Henry, duke of Buckingham, whose mother was also a Margaret Beaufort, a great-grand-daughter of John of Gaunt. But her father was a younger brother of the father of the Countess of Richmond, whose son therefore undoubtedly stood first in the line of the family succession.

The following anecdotes are related by Bacon at the close of his History of Henry VII.: 'When the Lady Margaret, his mother, had divers grand suitors for marriage, she dreamed one night that one in the likeness of a bishop in pontifical habit did tender her Edmund, earl of Richmond, the king's father, for her husband; neither had she ever any child but the king, though she had three husbands. One day when King Henry VI., whose innocency gave him holiness, was washing his hands at a great feast, and cast his eye upon King Henry, then a young youth, he said, "This is the lad that shall possess quietly that that we now strive for."' Edmund Tudor, earl of Richmond, died in 1456, the same year in which his son Henry was born. Throughout the stormy period that followed the child found a protector in his uncle Jasper Tudor, earl of Pembroke, till on the accession of Edward IV. in 1461, the earl was attainted and obliged to fly the country. Henry appears to have been then consigned by the new king to the charge of Sir William Herbert, Baron Herbert (afterwards created earl of Pembroke), and to have been carried by that nobleman to his residence of Ragland Castle in Monmouthshire. Long afterwards he told the French historian Comines that he had been either in prison or under strict surveillance from the time he was five years of age. He is said however to have been brought to court on the restoration of Henry VI. in 1470, and it is to this date that the story is assigned of his having been prophetically pointed out by Henry as the person that was to bring to a close the contest between the two Houses. It must have been at this time also that he was sent to Eton, if he ever really studied, as is reported by some, at that school. After the battle of Tewkesbury he seems to have been sent back to Ragland Castle, and to have remained there till his uncle, who had fled to France, returned secretly, and found means to carry him off to his own castle of Pembroke. Upon this Edward immediately took measures to recover possession of the boy, but his uncle at last contrived to embark with him at Tenby, with the intention of proceeding to France. They were forced however by stress of weather to put into a port of Bretagne, and there they were detained by the duke, Francis II. But although this prince would not suffer them to pursue their journey, he allowed them an honourable maintenance, and as much liberty as was consistent with his design that they should not pass out of his dominions, nor although repeatedly importuned by King Edward to deliver them up would he ever listen to the proposal. Henry continued resident in these circumstances in the town of Vannes in Bretagne till after the accession of Richard III.

As soon as it came to be known that Edward V. and his brother no longer existed, a fact which Richard III. himself took pains to publish, without any attempt to make it appear that they had not been taken off by violence, the minds of men turned to the young earl of Richmond as the most eligible opponent to set up against the actual possessor of the crown. Morton, bishop of Ely, afterwards archbishop of Canterbury and cardinal, has the credit of having first suggested to the heads of his party, that the crown should be offered to Henry on condition of his engaging to espouse the princess Elizabeth, daughter of Edward IV., and since the death of her brothers the undoubted heiress of the rights of the House of York. The scheme received the assent of the leaders of the various interests already confederated against Richard—of the queen dowager, of her son the marquis of Dorset, and of the duke of Buckingham, whatever were the motives that had induced the last-mentioned nobleman to make his sudden change from the one side to the other. Communications were immediately entered into with Henry's mother the countess of Richmond, and she also entered cordially into the design, although her present husband Lord Stanley had all along steadily adhered to Richard, with whom he at present was. A messenger was now despatched to Henry in Bretagne, September 24, 1483, and he was informed that the general rising in his favour would take place on the 18th of October. The issue of this first attempt was eminently disastrous to the confederacy of the earl's friends. Henry sailed from St. Malo with a fleet of forty sail, which he had been enabled to provide partly by the assistance of the duke of Bretagne; but a storm dispersed his ships as he crossed the Channel, and when he reached the English coast near Poole he deemed it prudent, with the insufficient force that he had remaining, not to land. Meanwhile the hasty, ill-combined revolt of Buckingham and his associates fell to pieces without the striking of a blow. Buckingham himself was taken and executed as a traitor; of the other chief persons engaged in the attempt, several underwent the same fate; others escaped death by flight; many were attainted, among the rest the countess of Richmond, whose life was only spared at the intercession of her husband Lord Stanley. Henry himself returned to Bretagne, and here at Christmas, in the presence of a meeting of the English exiles to the number of five hundred, held in the cathedral of Rhedon, he solemnly swore to marry Elizabeth as soon as he should have triumphed over the usurper, and in return the assembly promised him fealty on that condition, and did him homage as their sovereign. A few months after this however Henry and his friends found it expedient to withdraw from Bretagne to avoid the machinations of the duke's minister Landois, who had been gained over by Richard, and had prevailed upon the duke to take measures for betraying them to the English king. They succeeded in making their escape to the territory of the French king, where they spent another year in making preparations for a new expedition under the countenance and with the assistance of king Charles VIII. At length, on the 1st of August, 1485, Henry sailed with his fleet from Harfleur, and on the 7th landed at Milford-Haven in Wales. The two rivals encountered at Bosworth in Leicestershire, on the 22nd, when the result was that Henry obtained a complete victory, which, with the death of Richard, who fell in the battle, at once placed the crown on his head. This was afterwards reckoned the first day of his reign, an arrangement by which only those who had actually drawn their swords against him at Bosworth were made to be guilty of treason, and whatever acts had been done in the service of the usurper (as Richard was considered) up to the eve of that battle were overlooked. [BOSWORTH; RICHARD III.]

Henry's marriage with Elizabeth was not solemnized till the 18th of January, 1486, before which time it had been enacted by the parliament that 'the inheritance of the crown should be, rest, remain, and abide in the most royal person of the then sovereign lord King Henry VII., and the heirs of his body lawfully coming, perpetually with the grace of God so to endure, and in none other;' the only security taken for the marriage being a request subsequently presented to the king by the Commons along with the grant of tonnage and poundage for life, that he would be pleased 'to take to wife and consort the princess Elizabeth,' with which, after it had been formally concurred in by the lords spiritual and temporal, Henry intimated that he was willing to comply. It has been usually asserted that Henry throughout their union treated his queen with marked coldness and neglect. He must have felt indeed that he owed nothing to any preference that had been shown for him by a woman who was equally ready to give her hand to his deadliest enemy, had the fortune of the contest been different; but it would appear that, from policy, if not from affection, he latterly behaved to her with more attention than he had at first shown; and there is even some evidence that their domestic intercourse came at length to breathe more cordiality and tenderness than has been generally supposed.

It was not to be expected that a reign commencing in such circumstances should be undisturbed by insurrectionary attempts. A succession of such movements kept Henry in disquietude for many years. The first that occurred was that headed by Francis, viscount Lovel, in April, 1486, which was speedily and effectually put down. Before the end of the same year however a new and more formidable commotion was excited by the imposture of the boy Lambert Simnel, the son of a joiner at Oxford, who was put forward as Edward Plantagenet, earl of Warwick, the son and heir of the late duke of Clarence, brother of Richard III. The young prince in question had, in fact, been lodged in the Tower by Henry among the first acts of his reign, and he remained immured in that fortress while the person who had assumed his name was receiving royal honours in Ireland as Edward VI. Simnel was soon joined both by Lord Lovel, who had made his escape from the recent disturbance, and by John de la Pole, earl of Lincoln, whose mother was a sister of Edward IV., and who had been at one time declared heir to the crown by the late king after the death of his own son. The duchess of Burgundy, another sister of Edward IV., also gave her countenance and effective aid to the enterprise of the pretender, whom probably the friends of the House of York merely intended to make use of for effecting their first object, the ejection of the present king. The brief royalty of Simnel however was terminated, June 16th, 1487, by the defeat of his adherents in the battle of Stoke, in which Lincoln himself was slain. The imposture of Simnel was followed after some years by the appearance of the more celebrated pretender Perkin Warbeck, who was asserted by his adherents to be Richard, duke of York, the younger brother of Edward V., and generally supposed to have been murdered along with him in the Tower. Warbeck arrived in Ireland from Lisbon in the beginning of May, 1492, and was afterwards acknowledged as duke of York, or rather as Richard, king of England, not only by the duchess of Burgundy, but by the governments both of France and Scotland. This affair occupied Henry for the next five or six years; for it was not till the end of 1497 that the adventurer was finally put down. Another pretended earl of Warwick next arose, one Ralph Wulford, or Wilford, the son of a shoemaker, whose attempt however was immediately nipped in the bud by his apprehension and execution, in March, 1499. The restless succession of these conspiracies seems at last to have convinced Henry that his throne would never be secure, nor the kingdom at peace, until the persons who were made rallying-points by his enemies were put out of existence. The same year in which Wulford was put to death witnessed the executions of both Perkin Warbeck and the earl of Warwick. From this time Henry's reign was one of complete internal tranquillity, of which he chiefly took advantage to augment his revenue and his hoarded treasures—extracting money from his subjects on all sorts of pretences, which were not the less oppressive for being generally legal in their form and colour. The English law at this time, if only stretched as far as it would go, was abundantly sufficient for the purposes of the most exorbitant tyranny. The chief instruments of Henry's rapacity were two lawyers, Sir Richard Empson and Edmund Dudley, names immortalized by the detestation of their country.

Henry was early in his reign involved in the politics of the Continent by the quarrel which arose between Francis duke of Bretagne and Charles VIII. of France, with both of whom he had been connected before he came to the throne, and each of whom applied to him for his assistance. This quarrel, by the death of Francis, soon after it broke out, leaving only two daughters, one of whom also soon afterwards died, became in fact a contest for the possession of Bretagne on the part of France. [BRETAGNE, v. 401.] This was an object to which the public mind in England was strongly opposed; but although Henry was forced to appear to go along with the national feeling, he deferred taking any steps to prevent the subjugation of the Bretons till it was too late. The money that was eagerly voted by parliament to fit out an expedition, he collected very carefully; but instead of fighting, he endeavoured to manage the matter by the cheaper method of negotiation. Afterwards indeed, in the spring of 1489, he found himself compelled to equip a small force, which proceeded to Bretagne; but he had previously assured the French government that if the troops were sent they should act only on the defensive, an engagement which was faithfully kept. Charles eventually compelled the duchess of Bretagne to marry him, after she had been affianced to Maximilian, the King of the Romans; and the duchy was thus finally annexed to the French crown. The indignation in England at this result forced Henry to conduct an army to France in person, in the beginning of October, 1492; but he had already secretly arranged a peace with Charles, and before there was any fighting the treaty was published in the beginning of November. By this treaty, called the Treaty of Estaples, Charles bound himself to pay Henry the sum of 149,000*l.* sterling, in half-yearly instalments of 25,000 francs. In 1496, notwithstanding this peace, Henry joined the league of the pope, the King of the Romans, the king of Castile, the duke of Milan, and the republic of Venice, which, after Charles had overrun the kingdom of Naples in 1494, had in a few months expelled him from his sudden conquest; but when Charles died, in 1498, the treaty of Estaples was renewed with his successor Louis XII., and continued to regulate the relations of the two kingdoms to the end of the reign

By successive truces with James III. and James IV., the peace with Scotland was preserved till 1495, when, on the recommendation of the French king and the duchess of Burgundy, Perkin Warbeck was received in that kingdom as the rightful heir of the English crown. King James not only assisted the adventurer with money and troops, but gave him in marriage the Lady Catherine Gordon, a relation of his own. After Warbeck's final discomfiture however in 1497, a new truce was concluded between the two countries, to last till the expiration of a year after both kings should be dead; and this led in 1502 to a treaty of perpetual peace, cemented by the marriage of James with Henry's eldest daughter, the princess Margaret. This marriage, from which flowed, after the lapse of a century, the important political result of the union of the two crowns, was solemnized at Edinburgh on the 8th of August, 1503. It was reported, Bacon informs us, that when the project of the marriage was discussed in the council of the English king, an objection was raised on the ground that it might possibly lead to the kingdom of England falling to the king of Scotland. 'Whereunto,' continues the historian, 'the king himself replied, that if that should be, Scotland would be but an accession to England, and not England to Scotland, for that the greater would draw the less; and that it was a safer union for England than that of France. This passed as an oracle, and silenced those that moved the question.'

Nearly two years before this, namely, 14th November, 1501, a marriage, long contemplated and agreed upon, had been solemnized between Henry's eldest son Arthur, prince of Wales, and Catherine, the fourth daughter of Ferdinand, king of Castile. Arthur however, who was a prince of the highest promise, died within six months after this time; and then it was arranged that Catherine should be married to his surviving brother Henry. The marriage of Catherine and Arthur proved still more momentous in its consequences than that of Margaret and James.

Queen Elizabeth died 11th February, 1503, a few days after giving birth to a daughter, on which Henry lost no time in proceeding to turn his widowhood to account in the acquirement of some political advantage, or in the augmentation of his riches, now his ruling passion, by means of a new matrimonial alliance. One disappointment after another however met him in this pursuit; and after having first made application to the widow of the king of Naples; then concluded a treaty with the archduke Philip, husband of Joanna, queen of Castile, for the band of his sister Margaret, widow of the duke of Savoy; and finally, on the death of Philip, in September, 1506, once more changed his ground, and proposed himself as the husband of Philip's widow, the queen Joanna, who was insane,—he died before he could accomplish his object. His death took place at Richmond, as the royal palace at Sheen was now called, 22nd April, 1509, in the twenty-fourth year of his reign, and the fifty-third of his age.

The children of Henry VII. by his queen Elizabeth of York were—1. Arthur, born 20th September, 1486, created prince of Wales 1489, married to Catherine of Spain (to whom he had been contracted eleven years before), 14th November, 1501, died at Ludlow Castle, 2nd April, 1502; 2. Margaret, born 29th November, 1489, married to king James IV. of Scotland, 8th August, 1503, died 1539; 3. Henry, who succeeded his father as Henry VIII.; 4. Elizabeth, born 2nd July, 1492, died 14th September, 1495; 5. Mary, born 1498, married to Louis XII. of France, 5th November, 1514, and secondly, in 1515, to Charles Brandon, duke of Suffolk, died 25th June, 1533; 6. Edmund, born 21st February, 1499, soon after created duke of Somerset, died in infancy; 7. Edward, born February, 1500, died young; and 8. Catherine, born 2nd February, 1503, died a few days after her mother.

Bacon, in his striking and masterly 'History of the Reign of Henry VII.,' has drawn this king as a hero of policy and craft, who may almost compete with the 'Principe' of Macchiavel, if we make allowance for the greater ruthlessness and more sanguinary spirit natural to the Italian blood. It may be admitted that this great writer, in the elaboration of his design, has been drawn into some degree of exaggeration or over-refinement; and he has probably also softened the more repulsive features in Henry's moral character, as much as he has unduly exalted his intellectual endowments. But the difficult position which he occupied, and the success with which he maintained himself in it, vindicate the title of this sovereign to be regarded as at least one of the greatest masters of king-craft that figure in history. Bacon compares him, justly enough, to Louis XI. of France and Ferdinand of Spain, designating the three as 'the *tres magi* of kings of those ages.' The age in which Henry lived was that of the birth of modern policy, and that in which the foundations were laid of the still enduring system of the European states. Nothing that was then established has been greatly shaken since; all the changes that have since taken place have been little more than the growth and development of the arrangements that were then made and the principles that were called into action. This reign therefore may be considered as the beginning of the modern history of England.

HENRY VIII., the second son of Henry VII., by his queen Elizabeth of York, was born at Greenwich, 28th June, 1491. On the 1st of November following he was created duke of York, and in 1494 his father conferred upon him the honorary title of lord-lieutenant of Ireland, Sir Edward Poynings being appointed his deputy. The government of Sir Edward is famous for the enactment of the statute, or rather series of statutes, declaring the dependence of the Irish parliament upon that of England, which passes under his name. Henry's nominal lord-lieutenancy appears to have lasted only till the next year, when he exchanged that dignity for the office of president of the Northern Marches. The king's design in these appointments seems to have been to oppose his son's name to the pretensions of Perkin Warbeck, and the efforts of the supporters of that adventurer, first in Ireland and afterwards from the side of Scotland. Although thus early distinguished by these and other civil titles and appointments, it is stated by Paolo Sarpi, in his 'History of the Council of Trent,' that Henry was from the first destined to the archbishopric of Canterbury; 'that prudent king his father,' observes Lord Herbert (in the 'History of his Life and Reign') 'choosing this as the most cheap and glorious way for disposing of a younger son.' He received accordingly a learned education; 'so that,' continues this writer, 'besides his being an able Latinist, philosopher, and divine, he was (which one might wonder at in a king) a curious musician, as two entire masses composed by him, and often sung in his chapel, did abundantly witness.' As the death of his elder brother Arthur, however, 2nd April, 1502, made him heir to the crown before he had completed his eleventh year, it is evident that his clerical education could not have proceeded very far, and that what he knew either of divinity or of the learned tongues must have been for the most part acquired without any view to the church. There is a contradiction in the statements as to the time when he was created prince of Wales. Bacon says, first, that 'it was half a year's time between the creation of Henry, prince of Wales, and Prince Arthur's death, which was construed to be, for to expect a full time, whereby it might appear whether the Lady Catherine was with child by Prince Arthur or no.' A few lines farther down in the same page, he says, 'the February following, Henry, duke of York, was created prince of Wales and earl of Chester and Flint; for the dukedom of Cornwall devolved to him by statute.' (*History of King Henry VII.*, in Bacon's Works, by Montague, iii. 377.) This last account makes the interval, not half a year, but eleven months. Sir Harris Nicolas (*Synopsis of the Peerage*, i. 7) also, we do not know on what authority, dates Henry's creation as prince of Wales, 18th February, 1503. But there is a patent in Rymer (vol. xiii., p. 11) appointing him warden of the forest of Gualtres in Yorkshire, by this title, 22nd June, 1502, within three months after his brother's death. This is consistent with what we are told by Holinshed, who, after relating the death of Arthur, says, 'his brother, the Duke of York, was stayed from the title of Prince by the space of a month, till to women it might appear whether the Lady Catherine, wife to the said Prince Arthur, was conceived with child or not.'

Very soon after Arthur's death the singular project was started of marrying Henry to his brother's widow. The proposition appears to have originally come from Ferdinand and Isabella, the parents of the princess, who were anxious to retain the connexion with England; and to have been assented to by King Henry in great part from his wish to avoid the repayment of the dower of the princess. The final agreement between the two kings was signed 23rd June, 1503, and, according to the chroniclers, the parties were affianced on Sunday the 25th of the same month, at the bishop of Salisbury's house in Fleet Street, although the dispensation was certainly not obtained from Pope Julius II. till the 26th of December following. This bull however contains a clause legitimatizing the marriage, although it should have been already contracted, or even consummated. It may be observed that nobody at this time seems to have doubted that Catherine's preceding marriage with Arthur had been followed by consummation.

Henry became king 22nd April, 1509, being then in his 19th year. On a memorial being presented by the Spanish ambassador, it was, notwithstanding the opposition of Warham, archbishop of Canterbury, resolved in the council that the marriage with Catherine should be completed; Fox, bishop of Winchester, strongly urging, among other reasons, 'that there was no room to doubt that the princess was still a virgin, since she herself affirmed it, offering even to be tried by matrons, to show that she spoke the truth.' The marriage was accordingly solemnized in the beginning of June, though not so early as the 3rd of that month, the date assigned both by Lord Herbert and by Holinshed and the other chroniclers, as appears from the act of resignation of her dowry by Catherine, signed at Greenwich on the 7th, in which she still styles herself Princess of Wales. (Rymer, xiii., 251.)

Henry was indebted for the warm and general gratulation with which his accession was hailed by his subjects, partly to his distinguished personal advantages and accomplishments, and to some points of manner and character adapted to take the popular taste; partly to the sense of relief produced by the termination of the austere and oppressive rule of his predecessor. One of the earliest proceedings of the new reign was the trial and punishment of his father's ministers, Dudley and Empson. They were indicted for a conspiracy to take possession of London with an armed force during the last illness of the late king, and being convicted on this charge, and afterwards attainted by parliament, were, after lying in gaol for about a year, beheaded together on Tower Hill, 17th August, 1510.

Henry had not been long upon the throne when he was induced to join what was called the Holy League, formed against France by the pope, the emperor, and the king of Spain. A force of 10,000 men was sent to Biscay under the Earl of Dorset in the spring of 1512, to co-operate with an army promised by Ferdinand for the conquest of Guienne; but the Spanish king, after dexterously availing himself of the presence of the English troops to enable him to overrun and take possession of Navarre, showed plainly that he had no intention of assisting his ally in his object; and after having had his ranks thinned, not by the sword, but by disease, Dorset was compelled by discontents in his camp, which rose at last to actual mutiny, to return to England before the end of the year, without having done anything. The next year Henry passed over in person to France with a new army, and having been joined by the Emperor Maximilian, defeated the French, 4th August, at Guinegaste, in what was called the Battle of the Spurs, from the unusual energy the beaten party are said to have shown in riding off the ground, and took the two towns of Terouenne and Tournay. On the 9th of September also the Scottish king James IV., who as the ally of France had invaded England, was defeated by the earl of Surrey in the great battle of Flodden, he himself with many of his principal nobility being left dead on the field. This war with France however was ended the following year by a treaty, the principal condition of which was that Louis XII., who had just lost his queen, Ann of Bretagne, the same who had been in the first instance married to his predecessor Charles VIII. [HENRY VII.], should wed Henry's sister, the Princess Mary. The marriage between Louis, who was in his fifty-third, and the English princess, as yet only in her sixteenth year, was solemnized 9th October, 1514; but Louis died within three months, and scarcely was she again her own mistress when his young widow gave her hand to Charles Brandon, duke of Suffolk, an alliance out of which afterwards sprung a claim to the crown. [GREY, LADY JANE.]

The members of Henry's council, when he came to the throne, had been selected, according to Lord Herbert, 'out of those his father most trusted,' by his grandmother the countess of Richmond, 'noted to be a virtuous and prudent lady.' A rivalry however and contest for the chief power soon broke out between Richard Fox, bishop of Winchester, secretary and lord privy seal, and Thomas Howard, earl of Surrey (afterwards duke of Norfolk), who held the office of lord treasurer. This led to the introduction at court of the famous Thomas Wolsey, who, being then dean of Lincoln, was brought forward by Fox to counteract the growing ascendancy of Surrey, and who speedily made good for himself a place in the royal favour that reduced all the rest of the king's ministers to insignificance, and left in his hands for a long course of years nearly the whole power of the state. [WOLSEY, CARDINAL.] The reign of Wolsey may be considered as having begun after the return of Henry from his expedition to France, towards the close of the year 1513; and henceforth the affairs of the kingdom for fourteen or fifteen years were directed principally by the interests of his ambition, which governed and made subservient to its purposes even the vanity and other passions of his master.

The history of the greater part of this period consists of Henry's transactions with his two celebrated contemporaries, Francis I. of France, the successor of Louis XII., and Charles, originally archduke of Austria, but who became king of Spain as Charles I. by the death of his mother's father, Ferdinand, in 1516, and three years after was elected to succeed his paternal grandfather Maximilian I. as emperor of Germany. [CHARLES V.; FRANCIS I.] His position might have enabled the English king in some degree to hold the balance between these two irreconcileable rivals, who both accordingly made it a principal point of policy to endeavour to secure his friendship and alliance; but his influence on their long contention was in reality very inconsiderable, directed as it was for the most part either by mere caprice, or by nothing higher than the private resentments, ambitions, and vanities of himself or his minister. The foreign policy of this reign had nothing national about it, either in reality or even in semblance; it was neither regulated by a view to the true interests of the country, nor even by any real, however mistaken, popular sentiment. Henry had himself been a candidate for the imperial dignity when the prize was obtained by Charles; but he never had for a moment the least chance of success. For a short time he remained at peace, both with Charles and Francis; the former of whom paid him a visit at Dover in the end of May, 1520; and with the latter of whom he had a few days after a seemingly most amicable interview, celebrated under the name of the 'Field of the Cloth of Gold,' in the neighbourhood of Calais. Wolsey's object at this time however was to detach his master from the interests of the French king; and a visit which Henry paid to the emperor at Gravelines, on his way home, showed Francis how little he was to count upon any lasting effect of their recent cordialities. Before the close of the following year Henry was formally joined in league with the emperor and the pope; and in March, 1522, he declared war against France. In the summer of the same year the emperor flattered him by paying him a visit at London; his vanity having also been a short time before gratified in another way by the title of 'Defender of the Faith' bestowed upon him by pope Leo X. (recently succeeded by Adrian VI.) for a Latin treatise which he had published 'On the Seven Sacraments,' in confutation of Luther. Henry continued to attach himself to the interest of the emperor,—even sending an army to France, in August, 1523, under the duke of Suffolk, which succeeded in taking several towns, though only to give them up again in a few months, —until the disappointment, for the second time, of Wolsey's hope of being made pope through the influence of Charles, on the death of Adrian in September of the last-mentioned year, is supposed to have determined that minister upon a change of politics. Before the memorable defeat and capture of Francis at the battle of Pavia, 24th February, 1525, the English king had made every preparation to break with the emperor; having actually commenced negotiations for a peace with Francis's ally, James V., the young king of Scotland, on condition of giving James in marriage his daughter the princess Mary (afterwards queen), who had been already promised to the emperor. In August he concluded a treaty of peace and alliance with France; and after the release of Francis, in March, 1526, Henry was declared protector of the league styled 'Most Clement and Most Holy,' which was formed under the auspices of the pope for the renewal of the war against Charles.

Before this date two domestic occurrences took place that especially deserve to be noted. The first of these was the execution, in 1513, immediately before Henry proceeded on his expedition to France, of Edmund de la Pole, duke of

Suffolk, whose mother was Elizabeth Plantagenet, sister of Edward IV.; he had lain a prisoner in the Tower ever since a short time before the death of the late king, who had contrived to obtain possession of his person after he had fled to the Continent, and, it is said, had in his last hours recommended that he should not be suffered to live. He was now put to death without any form of trial or other legal proceeding, his crime, there can be no doubt, being merely his connexion with the House of York. Lord Herbert tells us that Henry's going to the Continent at this time was deemed dangerous and inexpedient, on the ground 'that if the king should die without issue, however the succession were undoubted in his sister Margaret, yet the people were so affected to the House of York, as they might take Edmund de la Pole out of the Tower and set him up.' Wolsey was perhaps as yet too new in office to be fairly made answerable for this act of bloodshed; in the next case the unfortunate victim is generally believed to have been sacrificed to his resentment and thirst of vengeance. In 1521 Edward Stafford, duke of Buckingham, son of the duke beheaded by Richard III. [HENRY VII.], was apprehended on some information furnished to Wolsey by a discarded servant, and being brought to trial was found guilty and executed as a traitor. The acts with which he was charged did not according to law amount to treason, even if they had been proved; but the duke is said by certain indiscretions of speech and demeanor to have wounded the pride of the all-powerful minister; and, besides, he was also of dangerous pedigree, being not only maternally of the stock of John of Gaunt, but likewise a Plantagenet by his descent from Anne, the daughter of Edward the Third's youngest son Thomas, duke of Gloucester. With this nobleman came to an end the great office of hereditary lord high constable.*

What may be called the second part of Henry's reign begins in the year 1527, from which date our attention is called to a busy scene of domestic transactions beside which the foreign politics of the kingdom become of little interest or importance. It is no longer the ambition and intrigue of the minister, but the wilfulness and furious passions of the king himself, that move all things. In 1527 Henry cast his eyes upon Anne Boleyn, and appears to have very soon formed the design of ridding himself of Catherine, and making the object of this new attachment his queen. [BOLEYN, ANNE.] Anne was understood to be favourably disposed towards those new views on the subject of religion and ecclesiastical affairs which had been agitating all Europe ever since Luther had begun his intrepid career by publicly opposing indulgences at Wittemberg ten years before. Queen Catherine on the other hand was a good Catholic; and, besides, the circumstances in which she was placed made it her interest to take her stand by the church, as on the other hand her adversaries were driven in like manner by their interests and the course of events into dissent and opposition. This one consideration sufficiently explains all that followed. The friends of the old religion generally considered Catherine's cause as their own; the reformers as naturally arrayed themselves on the side of her rival. Henry himself again, though he had been till now resolutely opposed to the new opinions, was carried over by his passion towards the same side; the consequence of which was the loss of the royal favour by those who had hitherto monopolized it, and its transference in great part to other men, to be employed by them in the promotion of entirely opposite purposes and politics. The proceedings for the divorce were commenced by an application to the court of Rome, in August, 1527. For two years the affair lingered on through a succession of legal proceedings, but without any decisive result. From the autumn of 1529 are to be dated both the fall of Wolsey and the rise of Cranmer. [CRANMER, THOMAS.] The death of the great cardinal took place 29th November, 1530. In January following the first blow was struck at the church by an indictment being brought into the King's Bench against all the clergy of the kingdom for supporting Wolsey in the exercise of his legatine powers without the royal licence, as required by the old statutes of *provisors* and *premunire;* and it was in an act passed immediately after by the Convocation of the province of Canterbury, for granting to the king a sum of money to exempt them from the penalties of their conviction on this indictment, that the first movement was made towards a revolt against the see of Rome, by the titles given to Henry of 'the one protector of the English church, its only and supreme lord, and, as far as might be by the law of Christ, its supreme head.' Shortly after, the convocation declared the king's marriage with Catherine to be contrary to the law of God. The same year Henry went the length of openly countenancing Protestantism abroad by remitting a subsidy to the confederacy of the Elector of Brandenburg and other German princes, called the League of Smalcald. In August, 1532, Cranmer was appointed to the archbishopric of Canterbury. In the beginning of the year 1533 Henry was privately married to Anne Boleyn; and on the 23rd of May following archbishop Cranmer pronounced the former marriage with Catherine void. In the meantime the parliament had passed an act forbidding all appeals to the see of Rome. Pope Clement VII. met this by annulling the sentence of Cranmer in the matter of the marriage; on which the separation from Rome became complete. Acts were passed by the parliament the next year declaring that the clergy should in future be assembled in convocation only by the king's writ, that no constitutions enacted by them should be of force without the king's assent, and that no first-fruits, or Peter's pence, or money for dispensations, should be any longer paid to the pope. [ANNATES.] The clergy of the province of York themselves in convocation declared that the pope had no more power in England than any other bishop. A new and most efficient supporter of the Reformation now also becomes conspicuous on the scene, Thomas Cromwell (afterwards lord Cromwell and earl of Essex), who was this year made first secretary of state, and then master of the rolls. [CROMWELL, THOMAS.] In the next session, the parliament, which re-assembled in the end of this same year, passed acts declaring the king's highness to be supreme head of the church of England, and to have authority to redress all errors, heresies, and abuses in the church; and ordering first-fruits and tenths of all spiritual benefices to be paid to the king. After this various persons were executed for refusing to acknowledge the king's supremacy; among others, two illustrious victims, the learned Fisher, bishop of Rochester, and the admirable Sir Thomas More. [FISHER, JOHN; MORE, THOMAS.] In 1535 began the dissolution of the monasteries, under the zealous superintendance of Cromwell, constituted for that purpose visitor-general of these establishments. Latimer and other friends of Cranmer and the Reformation were now also promoted to bishoprics; so that not only in matters of discipline and polity, but even of doctrine, the church might be said to have separated itself from Rome. One of the last acts of the parliament under which all these great innovations had been made was to petition the king that a new translation of the Scriptures might be made by authority and set up in churches. It was dissolved on the 18th of July, 1536, after having sat for the then unprecedented period of six years.

Events now set in a new current. The month of May of this year witnessed the trial and execution of Queen Anne—in less than six months after the death of her predecessor, Catherine of Aragon—and the marriage of the brutal king, the very next morning, to Jane Seymour, the new beauty, his passion for whom must be regarded as the true motive that had impelled him to the deed of blood. Queen Jane dying on the 14th of October, 1537, a few days after giving birth to a son, was succeeded by Anne, sister of the duke of Cleves, whom Henry married in January, 1540, and put away in six months after—the subservient parliament, and the not less subservient convocation of the clergy, on his mere request, pronouncing the marriage to be null, and the former body making it high treason 'by word or deed to accept, take, judge, or believe the said marriage to be good.'

Meanwhile the ecclesiastical changes continued to proceed at as rapid a rate as ever. In 1536 Cromwell was constituted a sort of lord-lieutenant over the church, by the title of vicar-general, which was held to invest him with all the king's authority over the spiritualty. The dissolution of the monasteries in this and the following year, as carried forward under the direction of this energetic minister, produced a succession of popular insurrections in different parts of the kingdom, which were not put down without great destruction of life, both in the field and afterwards by the executioner. In 1538 all incumbents were ordered to set up in their churches copies of the newly-published English translation of the Bible, and to teach the people the Creed, the Lord's Prayer, and the Ten Commandments, in English; the famous image of our Lady at Walsingham,

* See vol. vii., p. 467, where the duke is by a misprint called Edward Stanley.

and other similar objects of the popular veneration, were also under Cromwell's order removed from their shrines and burnt. In 1539 the parliament, after enacting (by tho 31 Henry VIII., c. 8) that the proclamation of the king in council should henceforth have the same authority as a statute, passed the famous act (the 31 Henry VIII., c. 14) known by the name of the Six Articles, or the Bloody Statute, by which burning or hanging was made the punishment of all who should deny that the bread and wine of the sacrament was the natural body and blood of the Saviour—or that communion in both kinds was not necessary to salvation—or that priests may not marry—or that vows of chastity ought to be observed—or that the mass was agreeable to God's law—or that auricular confession is expedient and necessary. This statute, the cause of numerous executions, proceeded from a new influence which had now gained an ascendancy over the fickle king, that of Gardiner, bishop of Winchester, the able leader of the party in church and state opposed to Cranmer and Cromwell. [GARDINER, STEPHEN.] This new favourite was not long in effecting the ruin of the rival that was most in his way; Cromwell, who had just been created earl of Essex, and made lord chamberlain of England, was in the beginning of June, 1540, committed to the Tower on a charge of treason, and beheaded in a few weeks after.

On the 8th of August this year Henry married his fifth wife, the Lady Catherine Howard, whom he beheaded, 13th February, 1542. During this interval he also rid himself by the axe of the executioner of a noble lady whom he had attainted and consigned to a prison two years before on a charge of treason, Margaret, countess dowager of Salisbury, the daughter of tho late duke of Clarence, and the last of the York Plantagenets. Her real crime was that she was the mother of cardinal Pole, who had offended the tyraut, and who was himself beyond his reach.

In the latter part of the year 1542 war was declared by Henry against Scotland, with a revival of the old claim to the sovereignty of that kingdom. An incursion made by the duke of Norfolk into Scotland, in October, was followed the next month by the advance of a Scottish army into England; but this force was completely defeated and dispersed at Solway Moss, a disaster which is believed to have killed King James, who died a few weeks after, leaving his crown to a daughter, the unfortunate Mary Stuart, then only an infant seven days old. The failure of the efforts of the English king to obtain possession of the government and of the young queen, owing to the successful resistance of cardinal Beaton and the Catholic party, led to a renewal of hostilities in the spring of 1544, when Scotland was invaded by a great army under the earl of Hertford, which penetrated as far as Edinburgh, and burned that capital with many other towns and villages. In the preceding year also Henry had concluded a new alliance with the emperor against the French king; and in July, 1544, he passed over with an army to France, with which he succeeded in taking the town of Boulogne. On this however tho emperor made a separate peace with Francis; and on the 7th of June, 1546, Henry also signed a treaty with that king, in which he agreed to restore Boulogne and its dependencies in consideration of a payment of two millions of crowns.

He had some years before found a sixth wife, Catherine Parr, the widow of the Lord Latimer, whom he married 10th July, 1543. As the infirmities of age and disease grew upon him, the suspiciousness and impetuosity of his temper acquired additional violence, and the closing years of his reign were as deeply stained with blood as any that had preceded them. One of his last butcheries was that of the amiable and accomplished Henry Howard, earl of Surrey, who, being convicted, after the usual process, of treason, was executed on the 19th (other accounts say the 21st) of January, 1547. Already Henry, says Holinshed, 'was lying in the agonies of death.' Surrey's father, the duke of Norfolk, was also to have suffered on the 28th; but was saved by the death of the king at two o'clock on the morning of that day.

The children of Henry VIII. were: 1. and 2. by Catherine of Aragon, two sons who died in infancy; 3. Mary, afterwards queen of England; 4. by Anne Boleyn, Elizabeth, afterwards queen; 5. a son still-born, 29th February, 1535; 6. by Jane Seymour, Edward, by whom he was succeeded on the throne.

The most important changes made in the law during this reign were those affecting ecclesiastical affairs, of which the principal have been already noticed. Along with these may be mentioned the statute defining the degrees within which marriage should be lawful (25 Henry VIII., c. 22), which, in regard to that point, is still the law of the land. The law of real property was also materially altered by the statute of Uses (27 Henry VIII., c. 10), and by various statutes permitting the devise, which was not before allowed, except by the custom of particular places, of real estates by will. [RECOVERIES, COMMON; FINES; USES; WILL.] To this reign is also to be assigned the origin of the Bankrupt Laws. [BANKRUPT.] Wales was first incorporated with England, and the laws and liberties of the latter country granted to the inhabitants of the former, in the 27th year of Henry VIII.; and Ireland, which before was styled only a lordship, was in 1542 erected into a kingdom.

HENRY (Kings of Germany). [GERMANY, *History*.]

HENRY IV. of Germany. [GREGORY VII.]

HENRY (Kings of Spain and Portugal). [SPAIN; PORTUGAL.]

HENRY OF HUNTINGDON, an antient English historian, the son of Nicholas, a married priest (see Tanner, *De Script.*, from Cave), was born about the end of the eleventh century; and, according to Warton (*Hist Engl. Poet.*, diss. ii., p. 125), was educated under Alcuinc of Anjou, a canon of Lincoln cathedral. Aldwin and Reginald, both Normans and abbots of Ramsey, were his patrons. He was made archdeacon of Huntingdon (whence he took his name), by Robert Bloet, bishop of Lincoln, some time before 1123. In his youth he discovered a taste for poetry, but in more advanced years applied himself to the study of history; and at the request of another friend and patron, Alexander, bishop of Lincoln, composed a general history of England, from the earliest accounts to the death of Stephen, A.D. 1154, in eight books, published by Sir Henry Savile among the 'Scriptores post Bedam,' fol., London, 1596, and Francof., 1601. The early part of this history was a compilation from older writers; the sequel, from what he had heard and seen. Wharton, in his 'Anglia Sacra,' vol. ii., p. 694, has published a letter of Henry of Huntingdon to his friend Walter, who was also abbot of Ramsey, 'De Mundi Contemptu,' which contains many curious anecdotes of tho kings, nobles, prelates, and other great men who were his contemporaries. Warton (*Hist. Engl. Poet.*, ut supr.) says, in the Bodleian Library there is a manuscript Latin poem by Henry of Huntingdon on the death of King Stephen and the arrival of Henry II. in England, which is by no means contemptible. The exact time of his death is not known.

HENRY, MATTHEW, an eminent nonconformist divine, was born at Broad Oak, a farm-house in the township of Iscoyd in Flintshire, October 18, A.D. 1662. His father, Philip Henry, who was highly esteemed for his talents and piety, was one of the 2000 clergymen who left the church of England in 1662, in consequence of their refusal to comply with the regulations of tho 'Act of Uniformity.' Matthew Henry received the principal part of his education under Mr. Doolittle of London. In 1685 he commenced the study of the law in Gray's Inn; but he soon relinquished this profession; and after being ordained in 1687, settled at Chester in the same year as minister of a Dissenting congregation. In 1712 he left Chester, and became the minister of another congregation at Hackney. He died on the 22nd of June, 1714, of apoplexy, while he was travelling from Chester to London.

The work by which Matthew Henry is principally known is his 'Exposition of the Old and New Testament,' which originally appeared in 5 vols. fol.; and has since been frequently reprinted. This work has been greatly admired by many persons, on account of the piety of the author and the lively style in which it is written; and perhaps it is the best Commentary on the Bible for the use of those persona who are more anxious to obtain a devout sentiment from a text than to understand the real meaning of the passage. Matthew Henry did not live to complete the 'Exposition.' The remarks on the latter books of the New Testament, from *Romans* to *Revelations*, were written by the ministers whose names are printed in the 'Exposition.' Matthew Henry was also the author of many other works; of which the principal are, 'Inquiry into the Nature of Schism;' 'Life of Philip Henry;' 'Scripture Catechism;' 'Communicants' Companion;' 'Discourses against Vice and Profaneness;' 'Method of Prayer;' and numerous Sermons on separate subjects. These works have been little read of late years; but Mr. Williams, who is well acquainted with them, remarks (*Preface to the Miscellaneous Works of Henry*, p. iii.), 'that it will be found on examination that the same commanding excellences, which have rendered Mr. Henry so celebrated as an expositor, distinguished him as a preacher, and have imparted to his sermons and treatises and tracts a charm not less fascinating than that which pervades the Commentary. There is throughout the same soundness of diction, the same facility of illustration, and the same unvarying attention to usefulness.' The miscellaneous works were republished in 8vo., Lond. 1830.

The life of Matthew Henry has been written by Tong, 8vo., 1716; but a fuller and more accurate account of his life and writings is given by Williams in his *Memoirs of the Life, Character, and Writings of the Rev. M. Henry*, prefixed to the edition of the *Exposition*, published in 3 vols. 8vo., Lond. 1828.

HENRY, ROBERT, D.D., was the son of a farmer in the parish of St. Ninians, Stirlingshire, where he was born in 1718. Having completed the usual course of education for the Scottish church at the university of Edinburgh, he was licensed as a preacher in 1746, being then master of the burgh or grammar school of Annan, in Dumfriesshire. In 1748 he was elected minister of a Presbyterian congregation at Carlisle, with which he remained till August, 1760, when he removed to a similar situation in the town of Berwick-upon-Tweed. It is supposed to have been about this time that he conceived the project of his 'History of Great Britain, written on a new plan,' on which his literary reputation rests. The same year that he established himself in Berwick he married a Miss Balderston, whose sister afterwards married Gilbert Laurie, Esq., lord provost of Edinburgh; and this connexion eventually led, in 1768, to Mr. Henry's removal to that city. His first appointment was as minister of the church of the New Grey Friars, which he retained till 1776, and then exchanged for the easier charge of one of the ministers of the Old Church, in which he continued till his death. His access to the libraries at Edinburgh encouraged him to proceed with the design of his History, which want of the necessary books had before almost induced him to relinquish. The first volume, in 4to., appeared in 1771, the second in 1774, the third in 1777, the fourth in 1781, and the fifth, bringing down the narrative to the accession of Henry VII., in 1785. The author, upon whom the degree of D.D. had been conferred by the university of Edinburgh in 1770, died in 1790; but before his death he had completed the greater part of another volume of his History, extending to the accession of Edward VI., which was published in 1793 under the superintendence of Malcolm Laing, Esq., who supplied the chapters that were wanting, and added an Appendix. A continuation of the work, but on a less extended scale, to the accession of James I., was published in one volume 4to., and in two volumes 8vo., in 1796, by James Pettit Andrews, Esq., who is also the author of a 'History of Great Britain connected with the Chronology of Europe,' coming down to the accession of Edward VI., and compiled in great part from Dr. Henry's work (though there are also many other sources used, especially for the foreign history), which appeared in two volumes 4to. in 1794 and 1795. Dr. Henry's History has, since its completion, been repeatedly reprinted in twelve volumes 8vo. The author had published the successive quarto volumes on his own account; but when the first octavo edition was proposed in 1786, he sold the property of the work to a publishing house for 1000*l.*, besides which the profits it had already yielded him amounted to 2300*l.* In 1781, on the unsolicited application of Lord Mansfield, a pension of 100*l.* a year was granted to Dr. Henry by the king.

These facts are extracted from a biographical memoir of some length which appeared with the posthumous volume of the History, and in which may be also found a diffuse account of Dr. Henry as a private member of society, in which character he appears to much advantage. His only other publication was a Sermon preached before the (Scottish) Society for propagating Christian Knowledge, in 1773. The early volumes of his History were assailed with unusual virulence as they successively appeared by Dr. Gilbert Stuart, well known as the author of various able and learned historical works. An interesting account may be found in Mr. D'Israeli's 'Calamities of Authors' of the persecution, as he represents it, of Dr. Henry, by Stuart, first in the Edinburgh Magazine and Review, and afterwards in the English Review, which he set up in London. Stuart was a man of bad temper and little principle, and he was probably actuated in this affair by feelings of personal animosity to Dr. Henry or some of his friends; but he was a person of genuine learning and original research, as well as of great acuteness, and in many of his objections to the History there was much force and justice. Henry's cause, on the other hand, was taken up by his friends, and there is printed in the Memoir of his Life a very encomiastic character of his work (so far as it had proceeded), which is said to be 'by one of the most eminent historians of the present age, whose history of the same period justly possesses the highest reputation,' and 'who died before the publication of the third volume,'—words which we suppose describe Mr. Hume. The work had certainly considerable merit as the first attempt to write a History of England upon so extended a plan, combining the history of society and the general civilization of the country with that of public events; and the author has collected a great mass of very curious matter, a large portion of which is not to be found in any of our common histories; but it has no pretensions to be considered as executed either classically or critically. It abounds in statements derived from sources of no authority, and in other negligences and inaccuracies, partly arising from the character of the author's mind and acquirements, partly the consequence of his provincial situation and want of acquaintance with or access to the best sources of information. In almost every one of the departments into which it is divided it is now far behind the state to which historical and archæological knowledge has advanced.

HENRY, WILLIAM, was the son of Mr. Thomas Henry, of Manchester, who was a zealous cultivator of chemical science. Dr. Henry was born on the 12th of December, 1775. His earliest instructor was the Rev. Ralph Harrison, who, on the establishment of an academy in Manchester, which has since been removed to York, was chosen to fill the chair of classical literature. Immediately after leaving the academy he became an inmate in the house of Dr. Percival, whose character as an able and enlightened physician is well known. Here he remained for some years, and in 1795 he studied at Edinburgh, where the chair of chemistry was occupied by the venerable Dr. Black. After remaining there only one year however, he was obliged, from prudential motives, to quit the university. On visiting Edinburgh again in 1807 he received the diploma of Doctor in Medicine; and although he subsequently and successfully practised as a physician in Manchester, he was compelled to retire from it on account of the state of his health, which from an accident in early life had always been delicate.

Though the period between his two academical residences was passed in the engrossing occupations of his profession, and the superintendence of a chemical business established by his father, he nevertheless both zealously and successfully attended to the science of chemistry, and from that period until 1836, the year in which he died, he contributed a great number of important papers to the Royal Society, the Philosophical Society of Manchester, and to various philosophical journals. In 1797 he communicated to the Royal Society an experimental memoir, the design of which was to re-establish, in opposition to the conclusions drawn by Dr. Austin, and sanctioned by the approval of Dr. Beddoes and other eminent chemists, the title of carbon to be ranked among elementary bodies, although his proofs indeed contained a fallacy, which in a subsequent paper he himself corrected. In 1800 he published in the 'Philosophical Transactions' researches on muriatic acid gas. These experiments were undertaken in the hopes of detaching the imaginary element, which, in accordance with the prevailing theory, was supposed with oxygen to constitute the acid in question. It was not till many years afterwards that the true nature of this acid was ascertained by Davy, and to the new doctrine Dr. Henry was an early convert.

In 1803 Dr. Henry made known to the Royal Society his elaborate experiments on the quantity of gases absorbed by water at different temperatures, and he arrived at the simple law, 'that water takes up of gas condensed by one, two, or more additional atmospheres, a quantity which ordinarily compressed would be equal to twice, thrice, &c., the volume absorbed under the common pressure of the atmosphere.' In 1808 he published in the same work a form of apparatus adapted to the combustion of larger quantities of gas than could be fired in eudiometric tubes. In the same year he was elected a Fellow of the Royal Society, and in the year following he received, by the award of the president and council, Sir Godfrey Copley's donation, as a mark of their approbation of his valuable communications to the Society. He published various other papers, both in the 'Manchester Memoirs' and in the 'Philosophical Transactions.' His latest communication to the Royal Society was a paper in 1824, in which he succeeded in overcoming the only difficulty he had not before conquered, that of ascertaining by chemical means the exact proportions which the gases left after the action of chlorine on oil and coal gas bear to each other. This he effected by availing himself of the property which had been recently discovered by Döbereiner in finely-divided platina, of determining gaseous combination.

Alluding to his analysis of coal-gas, other compounds of carbon and hydrogen, and various other subjects, it has been truly remarked by his friend and townsman Mr. John Davies, that his papers 'present a fine specimen of inductive research. His investigations on the combinations of gases by volume, the absorption of different gases by water, the application of Döbereiner's spongy platina to gaseous analysis, and a great number of other interesting subjects, have exhibited great philosophical acumen and unequalled precision in manipulating. Never was there a more careful, a more impartial, a more accurate experimenter. It may be mentioned, as an instructive illustration, that on one occasion, when a young friend was assisting him in his operations, the former proceeded, before the termination of an experiment, to calculate the result. "Stop," said the doctor emphatically; "don't try what the result should be, or there will be danger of *coaxing the experiment* so as to make it correspond with the estimate."'

Dr. Henry was the author of a most valuable and useful work, entitled 'Elements of Experimental Chemistry,' which has reached the eleventh edition.

'As a literary character,' it is most truly stated by the gentleman above named, 'Dr. Henry deserves a much higher reputation than he has in this respect yet obtained. His characters of Priestley, of Davy, and of Wollaston, are some of the finest specimens of that species of composition in the English language. The discrimination which they manifest, and elegance and accuracy of the style in which they are written, will render them models of the highest value to those who may be required to exercise their powers upon such topics.'

With respect to the personal character of Dr. Henry, it is said of it, with great justice (as the writer of this memoir can testify), by his son Dr. C. Henry (*Biographical Memoir of the late Dr. Henry*), that in the general intercourse of society he was distinguished by a polished courtesy, by an intuitive propriety, and by a considerate forethought and respect for the feelings and opinions of others; qualities issuing out of the same highly-toned sensibility that guided his tastes in letters, and that softened and elevated his whole moral frame and bearing. His comprehensive range of thought and knowledge, his proneness to general speculation in contradistinction to detail, his ready command of the refinements of language, and the liveliness of his feelings and imagination, rendered him a most instructive and engaging companion. To the young, and more especially to such as gave evidence of a taste for liberal studies, his manner was peculiarly kind and encouraging. He was most anxious to promote, as far as was in his power, their progress in knowledge.'

His frame, originally delicate, worn out by illness and distracted by loss of sleep, at last gave way, and he died on the 2nd of September, 1836, in his 61st year.

HENSLOVIA'CEÆ, a very small and little known natural order of Exogens, supposed to be related either to Stilaginaceæ or Combretaceæ. Its fruit is unknown, and there is no possibility of forming a fixed opinion upon the subject until more species and genera shall have been discovered. Only three or four species, all natives of the hot and damp parts of Europe, have yet been seen. They are all trees, with opposite entire exstipulate leaves, and minute racemose, apetalous flowers, with as many anthers sessile in the sinus of the calyx as there are lobes of that organ; a two-celled, many-seeded ovary, and a single style.

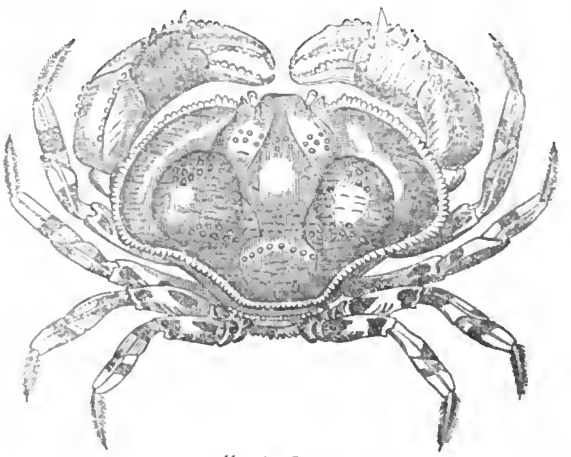
Henslovia pubescens.
1, A flower magnified; 2, a vertical section of the ovary.

HEPA'TICÆ, a name formerly applied to a class of cryptogamic plants, part of which are popularly called liverworts. It is now subdivided into several natural orders. [JUNGERMANNIACEÆ; MARCHANTIACEÆ.]

HEPATI'TIS. [LIVER.]

HE'PATUS, Latreille's name for a genus of brachyurous crustaceans, placed by M. Milne Edwards under the tribe of *Calappians*, and, in the opinion of the latter, establishing the passage between the *Cancerians*, which they approach in their general form; the *Calappæ*, which they resemble in the disposition of their *Chelæ* (*manus*); and the *Leucosians*, from which they differ but little with reference to the method of the organization of the mouth. The *Carapace* is large, convex, regularly arched anteriorly, strongly narrowed posteriorly; the *hepatic regions* are very large, and the branchial regions very small. The *front* is narrow, straight, rather projecting, and placed a good deal above the level of the lateral border of the carapace, which prolongs itself under the orbits to reach the sides of the buccal frame. The *orbits* are small, circular, and placed on the same level with the front. The *internal antennæ* are somewhat apart, and are bent back very obliquely under the front. The *external antennæ* occupy the internal angle of the orbits, which they separate from the antennary pits; their basilary joint is narrow, but rather long; the second is, on the contrary, small, and their terminal stem is nearly rudimentary. The *buccal frame*, which is very narrow forwards, and nearly regularly triangular, prolongs itself beyond the level of the lower border of the orbits, and is entirely occupied by the *external jaw-feet*, the third joint of which is triangular and terminated internally by a straight edge, under which are concealed the remaining joints. The *sternal plastron* is oval, and presents nothing remarkable. The *anterior feet* are strong, without being large, and are capable of a close and exact application against the lower surface of the body, where they are entirely concealed: the *hand* is surmounted by a crest, and the *claws* are rather inclined downwards and inwards. The remaining feet are of moderate length, and the abdomen is divided into seven joints in both sexes.

Geographical Distribution of the genus.—The only species known, viz. *Hepatus fasciatus* (*Calappa angustata* of Fabricius; *Cancer princeps* of Herbst; and *Calappa angustata* of Bosc), and *Hepatus Chiliensis*, are inhabitants of the coasts of America: the first having been found in the north and at the Antilles; the second on the coast of Valparaiso. (M. Edwards.)



Hepatus fasciatus.

HEPHÆ'STION, a grammarian of Alexandria, lived about the middle of the second century of the Christian era. He is said to have instructed the emperor Verus. (Julius Capitolinus, c. 2.) He wrote a treatise on Greek metres (Ἐγχειρίδιον περὶ Μέτρων), which was printed for the first time at Florence in 1526. This work has also been edited by Turnchus, 4to., Paris, 1553; by Pauw, 4to., Utrecht, 1726; but the best edition is by Gaisford, 8vo., Oxford, 1810, with the 'Chrestomathia' of Proclus, reprinted at Leipzig, 1832.

HEPHÆSTION. [ALEXANDER III.]

HEPIA'LIDÆ, a family of Lepidopterous insects of the section *Lepidoptera Nocturna* of Latreille. The moths belonging to this family are distinguished by the want of tongue, the wings being deflexed, long and narrow, and the thorax devoid of crest. Their larvæ live in the interior of vegetables, on which they feed, or in some instances they live in the ground, and feed upon the roots of plants; they are fleshy, naked, and have six thoracic, eight abdominal, and two anal feet. The pupæ have the segments of the body denticulated.

The principal genera contained in this family are *Hepialus*, *Cossus*, *Stygia*, and *Zeuzera*.

In the genus *Hepialus* (Fabricius) the antennæ are much shorter than the thorax, the wings are long and narrow, the posterior pair nearly equal to the anterior. The larvæ live in the ground and upon the roots of plants.

Hepialus Humuli, an insect commonly known by the name of ghost-moth, will afford an example of this genus. This moth measures from one and a half to two inches in width when the wings are expanded, and a large female is sometimes three inches in width. The male is of an immaculate silvery white colour above, and brown beneath. When on the wing, which is usually in the evening about twilight, it is seen with tolerable distinctness if below the eye, on account of its white colour; but upon a slight change in its position, when the darker colour of the underside of the wings is opposed to the eye, it suddenly disappears; hence probably arises the name which has been applied to it.

Mr. Stephens, in his 'British Entomology,' however accounts for the name in another manner; he says it is 'very common in grassy places in the middle of June, and not unfrequently met with in church-yards, whence its name of ghost-moth.' The female ghost-moth is very dissimilar in colour to the male; indeed such is the case in all the species of Hepialus. The anterior wings are of a buff yellow colour above, with spots of a deeper hue; the under wings are palish brown, having a faint pink tint.

Five or six other species of this genus inhabit this country, for descriptions of which see Stephens, *Illustrations of British Entomology—Haustellata*, vol. ii.

HEPTAGON, a figure of seven sides. For the regular heptagon, see REGULAR FIGURES.

HEPTARCHY. [ENGLAND.]

HERACLE'A. [CALABRIA.]

HERACLI'DÆ, the descendants of Hercules. According to tradition, after the death of Hercules his children took refuge in Attica, in order to escape the persecution of Eurystheus. They were hospitably received by Theseus, and with the assistance of the Athenians defeated Eurystheus. After the battle the Heraclidæ are said to have obtained possession of the whole of Peloponnesus; but they had not remained in the country long before a pestilence again drove them back to Attica. They attempted soon afterwards to march again into Peloponnesus, but were met at the Isthmus by an army consisting of Arcadians, Ionians, and Achæans. In a single battle with Echemus, king of Tegea, Hyllus, the eldest son of Hercules, was slain, and the Heraclidæ promised not to invade Peloponnesus for a hundred years from that time. (Herod., ix. 26; Pausan., i. 41.) They did not however observe their engagement, for both Cleodæus, son of Hyllus, and his grandson Aristomachus, renewed the attempt, but without success. The Heraclidæ retreated to Doris, where they obtained a considerable army to assist them in the recovery of their dominions. With the aid of an Ætolian chief named Oxylus, they crossed from Naupactus to the southern side of the Corinthian gulf eighty years after the Trojan war. (Thucyd., i. 12.) A battle took place between the Dorians under the command of the sons of Aristomachus and the Peloponnesians under that of Tisamenus, the grandson of Agamemnon, in which the latter were defeated, and all Peloponnesus, except Arcadia and Achæa, fell into the hands of the Heraclidæ. Elis was assigned to Oxylus, and the rest of the Peloponnesus was divided between the three sons of Aristomachus; Temenus obtained possession of Argos, Cresphontes of Messenia, and Aristodemus, or his sons Eurysthenes and Procles (for according to the general tradition Aristodemus did not live to enter Peloponnesus) of Lacedæmon. The land of the conquered country was divided among the Dorians, and the old inhabitants were obliged to emigrate, or were reduced to an inferior caste. (Pausan., ii. 18; iii. 1; iv. 3.)

Such is the traditional account of that important event in Grecian history, usually called 'the return of the Heraclidæ,' by which the Dorians obtained possession of the greater part of the Peloponnesus. It is asserted by the universal tradition of antiquity that the Dorians were led to this conquest by Achæan chiefs; but this fact has been doubted by many modern writers, who have considered it improbable that the Dorians should have been commanded by foreign chiefs. It has been supposed that the Heraclidæ were the hereditary princes of the Doric race, who were descended from a Dorian Hercules; and that the story of the Heraclidæ being descended from the Argive Hercules, who performed the commands of Eurystheus, was not invented till after the conquest of the Peloponnesus. (Müller's *Dorians*, vol. i., p. 57, Eng. Transl.) Though the general tradition assigned the complete conquest of Peloponnesus to the sons of Aristomachus, it appears probable from other traditions that the greater part of the Peloponnesus was not reduced by the Dorians till long afterwards. (Thirlwall's *Hist. of Greece*, vol. i., pp. 262—273.)

HERACLI'TUS of Ephesus, surnamed the Naturalist (φυσικός), belongs to the dynamical school of the Ionian philosophy. He is said to have been born about B.C. 500, and, according to Aristotle, died in the sixtieth year of his age. The title he assumed of '*self-taught*' refutes at once the claims of the various masters whom he is said to have had, and the distinguished position that he held in political life attests the wealth and lustre of his descent. The gloomy haughtiness and melancholy of his temperament led him to despise all human pursuits, and he expressed unqualified contempt as well for the political sagacity of his fellow-citizens as for the speculations of all other philosophers, as having merē learning and not wisdom for their object. Of his work 'On Nature' (περὶ φύσεως), the difficulty of which obtained for him the surname of 'the obscure' (σκοτεινός), many fragments are still extant, and exhibit a broken and concise style, hinting rather than explaining his opinions, which are often conveyed in mythical and half-oracular images. On this account he well compares himself to the Sibyl, 'who,' he says, 'speaking with inspired mouth, smileless, inornate, and unperfumed, pierces though centuries by the power of the god.'

According to Heraclitus, the end of wisdom is to discover the ground and principle of all things. This principle, which is an eternal everliving unity, and pervades and is in all phenomena, he called *fire*. By this term Heraclitus understood, not the elemental fire or flame, which he held to be the excess of fire, but a warm and dry vapour; which therefore, as air, is not distinct from the soul or vital energy, and which, as guiding and directing the mundane development, is endued with wisdom and intelligence. This supreme and perfect force of life is obviously without limit to its activity; consequently nothing that it forms can remain fixed; all is constantly in a process of formation. This he has thus figuratively expressed: 'No one has ever been twice on the same stream.' Nay, the passenger himself is without identity: 'On the same stream we do and we do not embark; for we are and we are not.'

The vitality of the rational fire has in it a tendency to contraries, whereby it is made to pass from gratification to want, and from want to gratification, and in fixed periods it alternates between a swifter and a slower flux. Now these opposite tendencies meet together in determinate order, and by the inequality or equality of the forces occasion the phenomena of life and death. The quietude of death however is a mere semblance which exists only for the senses of man. For man in his folly forms a truth of his own, whereas it is only the universal reason that is really cognisant of the truth. Lastly, the rational principle which governs the whole moral and physical world is also the law of the individual; whatever therefore is, is the wisest and the best; and 'it is not for man's welfare that his wishes should be fulfilled; sickness makes health pleasant, as hunger does gratification, and labour rest.'

The physical doctrines of Heraclitus formed no inconsiderable portion of the eclectical system of the later Stoics, and in times still more recent there is much in the theories of Schelling and Hegel that presents a striking though general resemblance thereto.

The fragments of Heraclitus have been collected from Plutarch, Stobæus, Clemens of Alexandria, and Sextus Empiricus, and explained by Schleiermacher in Wolf and Buttman's 'Museum der Alterthumswissenschaft,' vol. i. See also Brandis's 'Handbuch der Geschichte der Griechisch-Röm. Philos.,' Berlin, 1835; and Ritter's 'History of Antient Philosophy,' Oxford, 1837.

HERA'CLIUS, the son of the patrician Heraclius who was governor of Africa under the emperor Phocas, assisted in dethroning the latter A.D. 610, and was proclaimed emperor in his place. He applied himself to reform the discipline of the army; he renewed the truce with the Longobards of Italy, and turned his arms against the Avari who had invaded Thrace, and had advanced to the gates of Constantinople. Those barbarians soon after retired across the Danube loaded with their spoils. The Persians meantime invaded Syria, devastated Jerusalem, and made an irruption into Egypt, in consequence of which the usual supplies of corn which that country used to send to Constantinople were stopped, and the capital was afflicted by a severe famine. Another Persian army had advanced through Asia Minor to Chalcedon, but Heraclius induced the commander to withdraw, and sent ambassadors to treat of peace with Khosru, the Persian king, who spurned his offers, and summoned Heraclius and his subjects to abjure Christ and pay worship to the sun. Heraclius, roused by this insult, collected an army, and marched against the Persians, whom he defeated in a succession of brilliant campaigns, and pursued them as far as the Tigris, A.D. 622—27. The first year of the expedition of Heraclius against the Persians was the same in which Mohammed openly assumed the character of prophet and legislator, after his flight to Medina. Khosru was at last dethroned by his son Siroes, who concluded peace with Heraclius. The latter years of the reign of this emperor were passed amidst theological controversies. Heraclius supported the doctrine of the Monothelites, who taught that the human nature in Jesus Christ was entirely passive under the will of his divine nature. [EUTYCHIANS.] Pope John IV. assembled a council at Rome A.D. 640, which condemned the Monothelites. Meantime the Arabians, after the death of Mohammed, and under the caliphate of Abu Bekr, invaded Syria, Palestine, and Mesopotamia, and under the following caliphate of Omar they conquered Egypt and Cyrenaica. Heraclius was unable to oppose the torrent of Arabian courage and fanaticism; he sunk into inactivity and sloth, and died of the dropsy in February, 1641, after a reign of thirty years. From that epoch the decided though gradual decline of the Eastern empire may be dated. Heraclius was succeeded by Heraclius Constantine, his son by his first wife Eudocia, who in the fourth month of his reign was poisoned by his step-mother Martina, who had her own son Heracleonas proclaimed in his stead. An insurrection however soon after broke out at Constantinople against the new emperor, who was mutilated and banished together with his mother, and Constans II., son of Heraclius Constantine, was raised to the imperial throne. (Theophanes and other Byzantine historians; Gibbon.)

Coin of Heraclius.

British Museum. Actual Size. Gold. Weight, 69 grains.

HERALD, an officer whose duty, during the middle ages, was to carry challenges or peaceful messages from one sovereign or nobleman to another, to proclaim peace or war, to lay out the lists in jousts or tournaments, to be the witness of all combats whether general or particular, and to record in writing the names of those who behaved most valiantly, to number the dead after battle, and specially to supervise all matters connected with the bearing of coat-armour, the marshalling of processions, and other state ceremonies. His functions were something like those of the Greek *kerux* (κῆρυξ), and the Roman *Fecialis*; but the origin of the name is much disputed, and the actual date of the institution uncertain. The word *Heraldus* occurs in the imperial constitutions of Frederick Barbarossa, A.D. 1152, about the same time to which the origin of heraldry is with most reason assigned. The earliest mention of a herald in England is in a pell-roll of the 12th Edward III.; but there is little doubt that the office existed as early at least as the dawn of hereditary coat-armour. The English heralds were first incorporated by Richard III. [HERALDS' COLLEGE.] There are three orders or grades of heralds, namely, kings of or at arms, heralds, and pursuivants. They were antiently created with much ceremony, and the mode is curiously detailed by Gerard Legh apud Upton. 'It is necessary,' says he, 'that all estates should have couriers as their messengers for the expedition of their business, whose office it is to pass and repass on foot, being clad in their prince's colours "parted upright;" that is to say, half of one colour and half of another, with the arms of their sovereigns painted on the boxes in which they carried their dispatches, and which were fixed to their girdle on the left side. It was not permitted to them to bear the arms of their lord in any other manner.' 'They were knights,' he adds, 'in their offices, but not nobles, and were called knights-caligate of arms, because they wore "startuppes" (a sort of boot or gaiter) "to the middle leg." When they had conducted themselves properly in this situation for seven years, they were made chevaliers of arms, and rode on horseback to deliver their sovereign's messages, clad in one colour, their garments being only guarded or trimmed with the colour of their sovereign, and bearing their boxes aforesaid, with the arms painted on them, on the left shoulder, "and not elsewhere."' From these runners and riders the three orders of heralds were supplied, the chevalier of arms, having served another seven years, being created a pursuivant in the following manner:—The herald of the province, to whom he was to be pursuivant, wearing his coat of arms, took the candidate by his left hand, holding in his right a cup of silver, filled with wine and water, and leading him to his sovereign, in the presence of many witnesses duly summoned for this purpose, inquired by what name the pursuivant was to be created; and upon the sovereign's answer proclaimed his style accordingly, pouring some of the wine and water upon his bare head. He then invested him with the tabard, or herald's coat, emblazoned with the arms of the sovereign, but so that the sleeves hung upon his breast and back, and the front and hind parts of the tabard over his arms, in which curious fashion he was to wear it till he became a herald. Strutt has given a representation of the pursuivant so attired from the Harleian MS. 2278, without being aware of the distinction. The oath of office was then administered to him, and lastly the sovereign presented him with the silver cup aforesaid. Having once been made pursuivant, he might be created a herald, 'even the next day,' which was done by the principal herald or king of arms leading him in like manner before the sovereign, but bearing a gilt instead of a silver cup, and turning the tabard so that the sleeves hung in their proper place over the arms. A collar of SS was then put about his neck, one S being argent, or silver, the other sable, or black, alternately, and when he was named, the prince himself poured the wine and water on his head, and after the oath was administered gave him the cup as before; whereupon the herald cried, 'A largess.' The kings of arms were created and solemnly crowned by the sovereigns themselves, and distinguished from the heralds by richer tabards, the embroidery being on velvet instead of satin, gilt collars of SS, and coronets composed of a plain circle of gold surmounted by sixteen strawberry leaves, eight of which are higher than the rest.

Modern heralds of all classes are now made and appointed by the earl marshal, and their functions and privileges are much abridged and disregarded. The present number in England is fourteen, viz.: four kings of arms—Garter, Clarencieux, Norroy, and Bath; the second and third being provincial kings, Clarencieux having power over all parts of England south of the Trent, and Norroy over all parts north of it. Six heralds—Somerset, Chester, Windsor, Richmond, Lancaster, and York; and four pursuivants—Rouge Dragon, Portcullis, Blue Mantle, and Rouge Croix. In Scotland there is one king at arms, named Lyon; and in Ireland one, named Ulster. To these regular officers are sometimes added, by command of the king to the earl marshal, a herald or pursuivant extraordinary. Such were the heralds Arundel, Norfolk, and Mowbray; and on the occasion of the funeral of the late King William IV., Mr. Albert Woods, son of Sir W. Woods, Clarencieux king of arms, was created Fitzalan pursuivant extraordinary.

HERALDS' COLLEGE, or COLLEGE OF ARMS, a corporation founded by Richard III. in the first year of his reign by a charter dated the 2nd of March, 1483, in which he gives to the principal officers of the corporation a house called Colde Arbor, in the parish of All Hallows the Less, London. In the first year of the reign of Henry VII. this house was seized into the king's hands under the Act of Resumption as the personal property of John Writhe, then garter king at arms; and during the reign of that king and of his successor Henry VIII. the heralds made several unsuccessful attempts by petition to obtain a restoration of it, or the grant of some other building for their general use. King Edward VI., in the third year of his reign, by a charter dated June 4th, confirmed to them all their antient privileges; and Philip and Mary, by charter of the 18th of July, 1554, re-incorporated them, and granted to them Derby House, then occupying the site of the present college on St. Benet's Hill, near St. Paul's Church-yard. The old building was destroyed in the great fire of London, but all the books, papers, &c., were fortunately saved, and removed to the palace in Westminster, where the heralds held their chapters, &c., until the college was rebuilt. The corporation consists of the three kings at arms—Garter, Clarencieux, and Norroy (Bath not being a member); six heralds, and four pursuivants. [HERALD.] The arms of the college are—argent, a cross gules between four doves rising azure. Crest, on a ducal coronet, Or, a dove rising azure. Supporters, two lions rampant gardant argent, ducally gorged Or. There is a heralds' college in Scotland, composed of Lyon king at arms, six heralds, and six pursuivants.

HERALDRY, the art of arranging and explaining in proper terms all that appertains to the bearing of coats of arms, badges, and other hereditary or assumed marks of honour; also the science of marshalling processions and conducting the ceremonies of coronations, instalments, creations of peers, funerals, marriages, and all other public solemnities.

The origin of heraldry, in the first and most commonly understood sense, has been attributed, by the general consent of all rational writers on the subject, to the necessity for distinguishing by some outward sign, amidst the confusion of battle, the principal leaders during the expeditions for the recovery of the Holy Land. But nothing is absolutely known concerning it beyond the fact that the middle of the 12th century is the earliest period to which the bearing of heraldic devices, properly so called, can be traced; and the commencement of the 13th, the time about which they became hereditary.

The earliest roll of arms of which we have any notice is of the reign of Henry III.; and the reign of Edward I. presents us with the earliest heraldic document extant. The famous roll of Caerlaveroch, a poem in old Norman French, rehearses the names and armorial ensigns of all the barons, knights, &c., who attended Edward I. at the siege of Caerlaveroch castle, A.D. 1300. [BANNER, p. 408.] Heraldry is therein first presented to us as a science. The principal rules and terms of the art were then in existence, and from about that time the latter are continually found in the fabliaux and romances of France and England.

The oldest writer on heraldry whose work has descended to us is Nicholas Upton, whose treatise 'De Militari Officio' was composed in the reign of Henry V., and translated in that of his successor by Juliana Barnes [BERNERS], in the work known as the 'Boke of St. Albans.' As Upton quotes no earlier authorities, his definitions and explanations can only be looked upon as assertions made nearly three hundred years after the origin of the practice, and consequently to be believed, or not, according to the discretion of the reader. In the reign of Richard III. the English heralds were incorporated and the College of Arms founded, and in the following century a swarm of writers arose both in France and England, each contradicting the other, and wasting a world of learning and research in the most absurd and idle controversies.

On the decline of chivalry the study of heraldry became gradually neglected, and the art, which had formed for centuries a portion of the education of princes, and occupied the attention of some of the most learned men in Europe, was abandoned to the coach-painter and the undertaker, while kings of arms and pursuivants were looked upon as mere appendages of state pageantry, their office ridiculed, and their authority defied.

That the pedantic nonsense of such writers as Morgan, Ferne, Mackenzie, &c., contributed to these results, there can be little doubt. A taste for the critical study of antiquities generally is now however reviving throughout Europe, and the use of heraldry as a key to history and biography is daily becoming more and more acknowledged.

The rules of heraldry as now practised at the College of Arms are, as we have before remarked, comparatively modern, and vary in some points from those observed in France and Germany.

According to the received authorities there are ten classes of arms, viz.:—

1. Arms of *Dominion*, being those which sovereigns bear as annexed to the territories they govern.

2. Of *Pretension*, those borne by sovereigns who are not in possession of the dominions to which such arms belong, but who claim or pretend to have a right to such possession, as for instance the kings of England from Edward III. to George III. quartered the arms of France.

3. Arms of *Community*, being those of bishoprics, cities, universities, academies, and other bodies corporate.

4. Of *Assumption*, such as are assumed by a man of his proper right without the grant of his sovereign, or of a king at arms. As for instance when a man of any degree whatsoever has taken prisoner in lawful war any gentleman, nobleman, or prince, he may bear the arms of that prisoner, and transmit them to his heirs for ever.

5. Arms of *Patronage*, such as governors of provinces, lords of manors, patrons of benefices, &c., add to their family arms, as a token of their superiority, rights, and jurisdiction.

6. Arms of *Succession*, borne by those who inherit certain estates, manors, &c., either by will, entail, or donation.

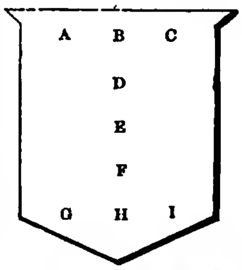
7. Arms of *Alliance*, such as the issue of heiresses take up to show their maternal descent.

8. Arms of *Adoption*, borne by a stranger in blood, with the special permission of the sovereign, applied for in order to fulfil the will of the testator who may bequeath certain monies or estates on condition of the party's assuming his name and arms.

9. Arms of *Concession*, augmentations granted by the sovereign of part of his own ensigns or regalia to such persons as he pleases to honour therewith.

10. Arms *Paternal* and *Hereditary*, such as are transmitted from the first possessor to his son, grandson, great-grandson, &c.; thereby forming complete and perfect nobility. The son being a gentleman of second coat-armour the grandson a gentleman of blood, and the great-grandson a gentleman of ancestry.

These several sorts of arms are displayed on shields, or escutcheons, and on banners, the ground of either being called the field, and the figures borne upon it the ordinaries and charges.



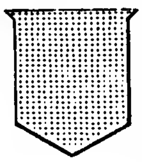
The shield, or escutcheon, contains certain points or locations, viz. A, B, C, the chief A being tho dexter or right-hand chief, B the precise middle chief, and C the sinister or left-hand chief. D is the honour point; E tho fess point, being the exact middle of the shield; F the nombril or navel point; G, H, I, the dexter, middle, and sinister base points.

The colours of the escutcheon, or of its ordinaries and charges, are five:—

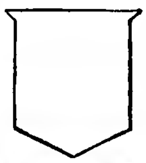
Red	(the heraldic name of which is)	Gules
Blue	"	Azure
Black	"	Sable
Green	"	Vert
Purple	"	Purpure.

To which must added, or rather prefixed, *yellow* and *white*, which being ordinarily represented by gold and silver, are called *metals*, and named by heralds, after tho French, *Or* and *Argent*.

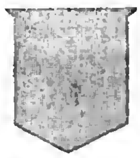
There are also two other colours recognised by heralds, but rarely seen in English coats of arms, viz. orange, called *Tenne*, and a dark blood-red inclining to purple, called *Sanguine*, or *Murrey*, from mulberry. These colours and metals have been since the sixteenth century expressed in engravings by lines and points or dots, the ingenious idea of which is attributed to an Italian named Petrasancta. Thus *Or*, or *gold*, is known by the escutcheon being filled with small points or dots.



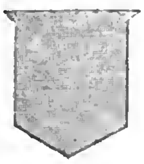
Argent, or *silver*, by the shield being left perfectly plain.



Gules, or *red*, by perpendicular lines from the top to the bottom of the escutcheon.

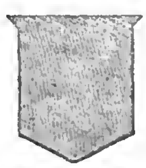


Azure, or *blue*, by horizontal lines.

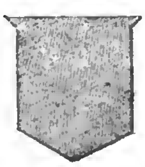


Sable, or *black*, by the two former crossing each other.

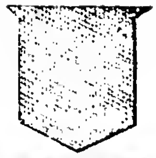
Vert, or *green*, by diagonal lines from right to left.



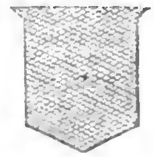
Purpure, or *purple*, by similar lines from left to right.



Tenne, or *orange*, by perpendicular lines crossing lines from right to left.



Sanguine, or *murrey*, by transverse lines from each side of the shield.

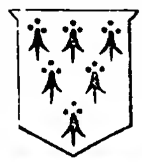


The metals and colours above mentioned are also distinguished by some heralds by the names of planets and precious stones; and there are besides, according to Sir John Ferne (*Glory of Generosity*), twelve other fantastical sorts of blazoning (by which word is meant, describing in proper heraldic terms, the bearings, &c., of a shield or banner); but as all these are now obsolete, we shall only allude to the fact without encumbering our columns by rehearsing them.

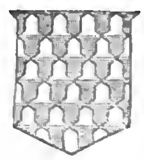
There are nine roundlets, or balls, also used in heraldry, the names of which are sufficient to denote their colour, without particularizing the same, viz.:—

Bezants .	Or	Hurts .	Azure	Pellets .	Sable
Plates .	Argent	Pommes	Vert	Oranges	Tenne
Torteaux	Gules	Golpes .	Purple	Guzes .	Sanguine.

To metals and colours must be added Furs, which, according to some heralds, are of ten different sorts. Those most commonly met with are however comprised under the names of Ermine and Vair, the rest being variations of colour and disposition. The first is represented in heraldry thus, the field being *white*, or *argent*, the spots and tails *black*, or *sable*.



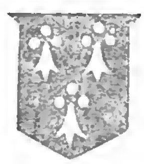
The second is represented by figures like little cups or bells reversed and ranged in lines, thus. The colours being, of the field *Argent*, of the cups *Azure*, or vice versâ; but where the matter is doubtful, the metal to possess the field by pre-eminence.



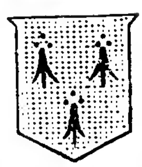
N.B. If the same figures are found in other colours, they are no longer to be blazoned or described as *Vair*; but '*Vairy, Or*, and *Gules*,' or whatever else it may be.

The principal variations above mentioned are:—

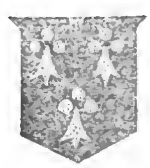
1. *Ermines*, the field of which is *Sable*, and the spots and tails *Argent*.



2. *Erminois*, the field *Or*, the spots and tails *Sable*.

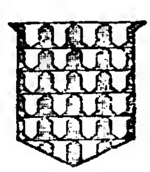


3. Pean, the field *Sable*, the spots and tails *Or*.

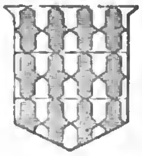


4. *Erminites*, the same as Ermine, with the addition of a *red* hair on each side the *black* tails.

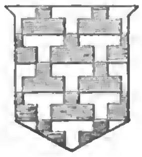
5. *Vair en point* is when the point of a cup or bell is opposite to the baso of another.



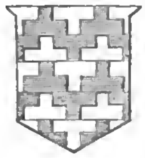
6. *Counter Vair*, when bells of the same colour are placed base to base and point to point.



7. *Potent* is classed as a fur, but the word signifies a crutch or a gibbet (Potence, Fr.) It is represented thus—



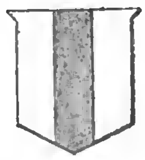
8. *Potent-counter-potent*, sometimes called *Vairy cuppy*, is when the crutches are counter placed; thus—



The principal charges or figures expressed on the shield are called the *Ordinaries;* they are nine in number, and styled *honourable.* They consist of the *Chief*, the *Pale*, the *Bend*, the *Bend Sinister*, the *Fess*, the *Bar*, the *Chevron*, the *Cross*, and the *Saltier*.

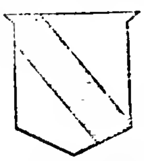
The *Chief* is the upper third of the escutcheon, determined by a horizontal line; thus—

The *Pale* is the middle third of the field when divided perpendicularly.



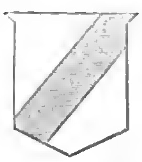
This ordinary has two diminutives; the *Pallet* being half the width of the *Pale*, and the *Endorse* half that of the *Pallet*.

The *Bend* is formed by two diagonal lines drawn from the right or dexter chief to the left or sinister base; thus—

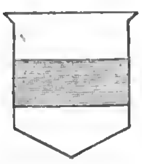


The *Bend* has four diminutives; the *Bendlet*, the *Garter*, the *Cost*, and the *Ribbon*.

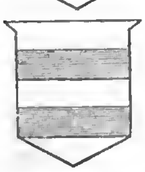
The *Bend Sinister* passes from the left to the right of the shield, and has two diminutives, the *Scarp* and the *Baton*.



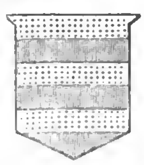
The *Fess* occupies the middle third of the shield divided horizontally.



The *Bar* is similarly formed, but occupies only a fifth of the shield, and is never borne single.



When the number exceeds five, it is blazoned Barry of so many pieces, expressing the number and colour, as Barry of Six, Or, and Gules.



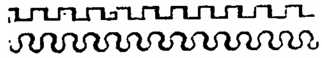
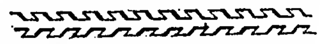
The *Bar* has two diminutives; the *Barrulet*, half the width of the *Bar;* and the *Closet*, half that of the *Barrulet*.

The Chevron is a figure formed like the rafters which support the roof of a house, and is therefore sometimes called *a Spar*, and in German *Sparren*. It has two diminutives, the *Chevronel* and the *Couple-close*.

The Cross, as an ordinary, is drawn thus. All other sorts of crosses should, in our opinion, come under the head of common charges, as they must be specially described.

The Saltier is *the figure generally* known in England as St. Andrew's Cross, and is indeed always so called by the German heralds, and frequently by the Scotch.

Eight of these nine honourable ordinaries give their names to the various single lines used in dividing the field of the escutcheon, where more than one metal or colour is required, such escutcheon being described as *parted per pale*, when divided perpendicularly; *per fess*, when divided horizontally; *per cross*, when in four squares; *per saltier*, when in four triangles; *per bend*, when diagonally, from right to left; *per bend sinister*, when in the contrary direction; and *per chevron*, when in the shape of that figure. The Chief being itself formed by a single line, they do not say *parted per chief;* but when the partition-line is not straight or even, its peculiarity must be specified in every instance: and of crooked lines there are eight recognised by English heralds, namely:—

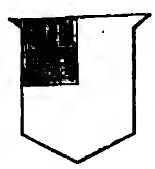
1. Engrailed . . 
2. Invected . . . 
3. Wavy . . .
4. Embattled . . 
5. Nebuly . . . 
6. Raguly . . . 
7. Indented . .
8. Dancette, limited to three indentations . 

It is therefore necessary to say 'a Chief engrailed,' or 'a Cross invected,' or 'Parted per fess, indented,' and so forth.

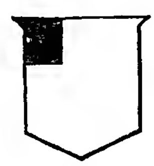
In addition to the nine honourable ordinaries are to be mentioned the subordinate ordinaries, the Gyron, the Quarter, the Canton, the Fret, the Pile, the Orle, the Tressure, the Flanches, the Flasques, the Voiders, and, according to some authorities, the Lozenge, the Fusil, the Mascle, and the Rustre.

The Gyron is formed thus: and when the shield is divided per cross and per saltier into eight similar divisions, it is called Gyronny.

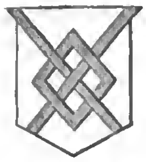
The Quarter is, as its name imports, the fourth part of the shield, and is always placed in chief.



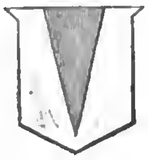
The Canton is a square figure like the quarter, but smaller, occupying only a third part of the chief itself.



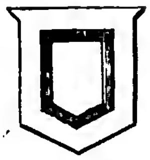
The Fret is formed thus: when composed of more pieces similarly interlaced, the field is said to be *fretty*.



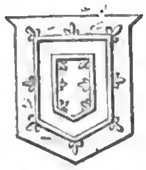
The Pile is formed like a wedge, thus: it is sometimes borne *in bend*, but must then be so described.



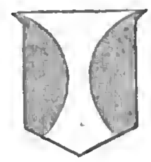
The Orle is a sort of border or frame within the shield.



The Tressure is commonly supposed to be half the breadth of the Orle, and is generally borne double, and what is called flowry and counter-flowry, as in the royal achievement of Scotland.

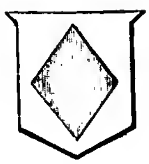


The Flanches are formed by two curved lines nearly meeting in the centre, thus:

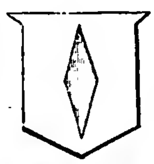


The Flasques may be called the diminutives of the Flanches, and the Voiders the diminutives of the Flasques, as the only difference is in the quantity of the shield which they occupy.

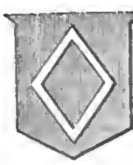
The Lozenge is of the shape of the Diamond in a playing-card. A shield so divided by diagonal lines as to form several of such figures is called Lozengy.



The Fusil, called also a Spindle, is longer and narrower than the Lozenge. A shield so divided by lines as to form several of such figures is called Fusily; and if parted per pale and per bend, would be either Lozengy-bendy, or Fusily-bendy, according to the width of the space between the lines.



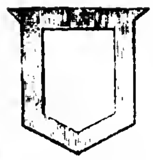
The Mascle is of the same form as the lozenge; but hollowed out, or, in heraldic term, *Voided*, so as to form a mere frame of that shape.



The Rustre is a similar figure, but pierced or voided round, instead of square, thus:

To these some heralds add the Inescutcheon, which is a small shield placed in the centre or top point of the escutcheon; but this, except when borne by an heiress as an escutcheon of pretence, may, in our opinion, be ranked amongst the common charges, as may also the lozenge, the fusil, the mascle, and the rustre.

We have next to speak of *differences*, so called from their being particular marks borne to distinguish persons of the same family from one another. While heraldry was arbitary, the son frequently assumed arms perfectly different from those of his father; but in the time of Edward I. we find two marks generally considered as family differences or signs of cadency,—the *Border* and the *Label*.



The Border is, as its name denotes, a guard or edging to the shield, and by the French heralds is accounted an ordinary. The border should always be in width one-fifth of the breadth of the shield itself, and stops when it encounters a chief, a quarter, or a canton, but passes over all other ordinaries. If the interior line is not plain or even, it must be described as *engrailed, invected*, &c. When divided into four equal parts, it is called a *border quarterly*. When divided into small squares of different colours, it is called a border *gobonated*, or *gobony*, or *compony*. When into *two* rows of squares, it is called a *border counter-compony*. When into *three* rows of squares, it is called *checky*.

The Label, or File, as it is sometimes called, is a sort of filet from which depend generally three or five lambeaux, or points, thus,—

It is sometimes however said to have been borne as a common charge, and is to be found only with one point and with as many as nine: other authorities consider it always as a *difference*. The label of three points is now always used as the difference of the heir or eldest son of the first house.

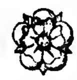
For the second son the difference is a crescent 

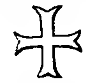
For the third, a mullet, or star of fine points 

For the fourth, a martlet . . . 

For the fifth, an annulet . . . 

For the sixth, a fleur-de-lys . . 

For the seventh, a rose . . . . 

For the eighth, a cross moline . . . 

For the ninth, a double quaterfoil . . 

These are called the differences of the first house; and by the six first, the six sons of Thomas Beauchamp, earl of Warwick (temp. Edward III.) are distinguished in a window of St. Mary's Church at Warwick.

The children of the second house are distinguished by the first son bearing a crescent charged with a label: the second, a crescent charged with a crescent; the third, a crescent charged with a martlet, and so on.

The junior branches of the royal family are however distinguished by the label only, the Prince of Wales bearing it simply argent, and the rest differenced by various charges, a practice as antient as the reign of Richard II.

In the general term *charges* we comprise all descriptions of figures borne in coat-armour, whether things animate or inanimate, real or imaginary, everything in short contained in or placed upon the shield; but those we have above-mentioned are to be distinguished from the *common charges*, by which expression are understood all other.

Many of these, such as crosses and crosslets in all their variety, escalop shells, bezants (the golden coins of Byzantium, or Constantinople), Saracens' heads, &c., were assumed during the Crusades, or after the return of the Crusaders, by themselves or their families, in commemoration of those expeditions. Others, such as beasts, birds, fishes, reptiles, trees, flowers, the sun, moon, stars, &c., were borne either as types of the peculiar dispositions or qualities, or as denoting by some similarity of sound in the pronunciation the names of the bearers. Such have been called with us *canting* or *punning* arms, and by the French *armes parlantes*. It has been the fashion with modern heralds to decry this species of bearing; to account it of rare occurrence in antient heraldry, and less honourable where it did occur: but recent investigations prove it to have been one of the most frequent as well as most antient descriptions of charges, and as worthy of respect as any other. It has indeed been suggested that the bearing frequently gave rise to the surname itself. This is however a mere conjecture; but the grants of arms which have been handed down to us prove incontestably that when sovereigns desired to express their approbation of noble or useful deeds by such distinctions, the name of the person to be honoured was frequently expressed by the charge, instead of the act he had performed, which would never have been the case had it been considered in those days as an inferior bearing. An acquaintance also with the language of the nation and time in which the arms were first granted or assumed, as also of its pronunciation, is of the greatest importance to this question, and such researches may yet shed much light upon the origin and history of heraldry. The Cornish family of Godolphin bear a white eagle; but those who are unacquainted with the antient Cornish language would be far from guessing that a white eagle was so called in it. A third species of allusive bearings is that which designates the place or office of the individual; and many charges appear in the arms of our nobility derived from ancestors who have held situations of high honour or great trust under our early monarchs; and lastly, a fourth portion have been assumed, as Camden has exemplified, in honour of the feudal lord, or most powerful neighbouring chief, or been conceded to the bearer by such nobleman as a mark of respect or affection.

The crest is the next object in point of antiquity to the shield. It was the ornament worn upon the helmet, and consequently the helmet itself was generally represented with it upon the seal of the knight or nobleman. The crest from Richard II.'s time was rarely worn, except upon the tilting helmet, and then upon a wreath which was generally a twisted roll of silk of two colours, being those of the family of the wearer. Beneath this wreath was frequently worn, as a sort of hood to the helmet, a piece of silk or velvet lined with ermine, which floated with jagged ends on the shoulders: these are by the French called *hachemens*, and by us *mantlings* or *lambrequins*. *Supporters* are of later origin, and are supposed to have taken their rise from the fanciful devices of the early seal-engravers, who filled up the space not occupied by the shield with all sorts of monsters or natural animals, by way of ornament. They did not become common till the close of the fourteenth century, and Henry VIII. was the first monarch who formally granted supporters to peers of the realm and knights of the garter and of the bath. No person under the rank of a knight of the bath has a right to supporters, unless by special grant of the sovereign.

Mottos had their origin probably in the war-cries of the different knights. There are several instances however of a motto being borne in addition to the *cri de guerre*.

The badge or device is frequently confounded with the crest; but it was altogether independent of the armorial bearings of the family, although in many instances it became hereditary. It is frequently, but very incorrectly, placed upon a wreath.

The arrangement and description of all the above insignia in proper heraldic order and terms are styled the *marshalling* and *blazoning* of arms.

We shall speak first of *blazoning*. The verb 'to blazon' is generally derived from the German *blasen*, to blow or sound a horn or trumpet, such being usually the practice before proclaiming the style or arms of any personage on his arrival in the camp, the lists, or the banqueting hall. The term however was soon applied to the proclamation itself, and finally used as synonymous with description generally: thus we find in the old book on hunting written by Jacques de Fouilloux, and presented to Charles IX. of France, the description of the hare entitled 'Le Blason du Lièvre.' To spread the fame or the disgrace of any person was also to blazon it. Favine, in his 'Théâtre d'Honneur,' says, 'Les habitans disent pour blasonner leur ville;' and in the Chronicle of Louis I., duke of Bourbon, the knights of the order of the crown are commanded not to suffer any person to defame (blazonner et medire) the ladies.

The principal rules of blazoning are as follows:—

1. In blazoning a coat the herald begins with the field, noticing the lines, if any, by which it is divided, the difference of those lines, and then the colours, next the charges, beginning with the *immediate* charge, that is, the one which lieth nearest the field, such as any ordinary, and nearest the centre of the field if a common charge, and lastly, the more remote or inferior charges.

Thus the accompanying coat would be blazoned: *Party per pale, indented, azure and gules; on a fess argent, a crescent of the first between two mullets sable.*

2. All tautology is to be strictly avoided, and the repetition particularly of such words as *of*, or, and *with*, is considered a great fault. In the above blazon, 'a crescent of the *first*' is said, in order to avoid the repetition of the word *azure;* so, if it were gules, we should say 'a crescent of *the second*.' For the same reason, when the field is undivided, and the charges, though of more than one description, of only one colour or metal, it would be blazoned in this way: 'Argent, a chevron between three mullets sable,' by which the chevron is understood to be sable as well as the mullets.

3. It is accounted by English heralds false heraldry to put metal upon metal, or colour upon colour; but instances of such blazoning frequently occur in foreign arms, particularly in those of German families. The objection is notwithstanding a sound one, as the charges should be rendered as distinct as possible, which can only be done by adhering to the English rule.

4. When a charge is represented of its *natural* colour, it is to be blazoned *proper*.

5. In blazoning animals, the teeth and claws, or talons, of the ravenous beasts are called their arms; and when they are to be represented of a different colour or metal from that of their bodies, they must be blazoned as '*armed*, Or,' or 'Gules,' as the case may be. If the tongue is shown the beast is said to be langued of such or such a colour, as 'a Lion, argent, *armed* and *langued*, azure.' More docile animals, the stag and deer, for instance, are said to be 'attired,' and not 'armed.' Beasts of prey are, according to their attitude, blazoned, *Rampant*, *Rampant-guardant*, *Rampant-regardant*, *statant*, *passant*, *salient*, *sejant*, *couchant*, *dormant*, *naissant*, *issuant*, *combattant*, *endorsed*, *erased*, &c. Stags are said to be *trippant*, *at gaze*, &c.

Birds of prey are also blazoned as 'armed' of such a colour, but such as have no talons are described as 'beaked and membered' *The Cock* is said to be *armed*, *crested*, and *jelloped*, the latter term referring to the wattles, or gills.

Birds, according to their attitudes, are blazoned *Volant*, *Displayed*, *Preying*, &c.

Fish, when placed horizontally, are termed '*naiant*; when perpendicularly, '*hauriant;*' when *bent* (as the dolphin is generally represented), '*embowed;*' if face to face, '*respecting each other;*' if back to back, '*endorsed*.'

The sun must be blazoned according to his condition, full, or in his eclipse. The moon, defined as crescent, *in*crescent, or *de*crescent: the first being, when represented with the horns upwards; the second, when the horns point to the dexter or right side of the shield; and the third, when to the left or sinister side. If downwards, it is called a *crescent reversed*.

The human figure is blazoned either *vested* or *naked*. Parts of the human figure, if cut off, are said to be *coupé;* if ragged or torn off, *erased*. Heads are also blazoned *wreathed* or *banded*, as the case may be.

Flowers are blazoned *jessant*, *slipped*, *seeded*, &c.

When the field of an escutcheon is covered with flowers of the same colour or metal, or any other pattern with flowers, or scroll work intermixed, it is said to be *diapered;* but when it is filled with flowers, crosses, or any other device of another colour or metal, repeated, as the French say, *sans nombre*, it is then blazoned as *semée*. An animal so covered with flowers or crosses should be blazoned as *powdered*. When the field, charge, or supporter is covered with *goutes*, or *drops*, it is called *gutty;* and if of gold or yellow, *gutty d'or;* of argent, *gutty d'eau;* of gules, *gutty de sang;* of azure, *gutty de larmes;* of vert, *gutty de vert;* and of sable, *gutty de poix*. When a bend, fess, or any other ordinary passes over an animal, it is said to be *debruised*. When the charge is divided by any of the partition lines, and the colours of the field are reversed upon it, it is said to be *counterchanged*.

By *marshalling* of arms we understand the orderly disposition of sundry coats, belonging to distinct families, in their proper places within one shield, by impaling or quartering;

and the joining of ensigns of honour and dominion with the paternal arms of the bearer, &c.

When a man marries he impales his wife's paternal arms, by placing them upright on the left side of his own in the same escutcheon, such impalement being also called *arms en baron et femme.* If that wife should be or become an heiress, the husband may bear her arms on an escutcheon of pretence over his own; Legh says however that this should not be done till he has begotten an heir of that heiress. In Scotland the husband frequently quarters the arms of his wife with his own when she is an heiress. In England this is only done by the children of such a marriage. If the mother be no heiress, the children cannot quarter her coat.

Another mode of impalement was by taking only half of each coat, and joining them in one escutcheon. This was called *dimidiation;* but the practice has long fallen into disuse.

The complete escutcheon of a family should never, according to some authorities, consist of more than six or eight quarterings; others admit of sixteen; and the Germans marshal sometimes twenty and thirty coats in one shield.

The best mode of marshalling so many is to begin by placing the arms of the first heiress who married into the family next to the paternal coat, and next to them the several coats which that heiress brought in; then the arms of the second heiress, followed by those which she brought in, and so on in rotation. When the royal arms are brought in by any match, it is usual however to give that match the second quarter next to the paternal coat, and some say it should even take precedence of that.

The arms of a widow are composed of her husband's and her father's impaled within a lozenge.

Those of a maid are her father's only, borne in a lozenge also, without any difference, except she be of the royal family, in which case a distinction is expressly furnished by the heralds for the individual coat by the command of the sovereign.

If the widow be an heiress, she may wear her paternal coat in an escutcheon of pretence over that of her husband, the latter however being in a lozenge, and her daughter, while unmarried, may quarter her mother's arms with her father's in a lozenge; but if the mother be no heiress, then, says Legh, the daughter has no further right to the arms of her mother's family, except to set them up pale-ways in her house to show her descent.

If the husband be a knight of the garter, or of any other order, the arms of the wife must not be impaled, but placed in a separate shield.

Such are the principal rules and terms of the science of heraldry: for further detail we must refer our readers to the works of Edmonson, Nisbett, Berry, &c., cautioning them, at the same time, against the Scylla and Charybdis of the heraldic inquirer, the absurd and misdirected enthusiasm of the champions of the art, and the undeserved contempt of its depreciators. By the latter it has been stigmatized as 'the science of fools with long memories.' It should rather be designated as a science which, properly directed, would make fools wise. It is, we repeat, a key to history which may yet unlock stores of information; at present its most learned professors have studied the art itself more than the use which may be made of it. They have wasted their time and their learning upon idle controversies, and still more idle speculations. A mysterious signification has been given to nearly every charge and tincture known in armoury, and a different one by nearly every writer upon the subject. The names of the ordinaries and colours have been derived from every sort of object and through every known language, without one fact having been elucidated on which we can depend. Even the word *blazon*, the only one we have ventured to hint the origin of, has been hotly claimed as Arabic by some disputants, and we will certainly not extend this article one line by an attempt to disprove it.

HERAT. [Khorassan.]

HE'RAULT, a department in France, on the coast of the Mediterranean, which derives its name from the river Hérault. The department approximates in form to a parallelogram, having its greatest extension N.E. and S.W.: it is bounded on the N.E. by the department of Gard; on the S.E. by the Mediterranean; on the S.W. by the department of Aude; and on the N.W. by the departments of Tarn, Aveyron, and Gard. The greatest length from north-east to south-west is nearly 80 miles. Its greatest breadth at right angles to the length 44 miles. The area of the department is estimated at 2417 square miles; the population in 1836 was 357,846, being about 148 to a square mile, somewhat below the average density of the population of France. The area rather exceeds that of the two English counties of Chester and Salop, but it has less than two-thirds of their population. Montpellier, the capital of the department, is in 43° 36′ N. lat. and in 3° 52′ or 3° 53′ E. long.: 366 miles from Paris in a straight line south by east.

The coast of the Mediterranean is low, and is lined by étangs, or pools; the chief of these are the Etang de Vendres, near the mouth of the Aude; and the Etangs de Thau and Mauguio, which, with the intermediate waters, form one long pool, extending 35 to 40 miles from the mouth of the Hérault to that of the Vidourle.

The north-western side of the department is occupied by the Espinouse mountains, part of the chain of the Cévennes, and their branches: nearly one-third of the department is of a mountainous or hilly character. Towards the Mediterranean the surface becomes more level. Many streams flow from the mountains to the sea. The Vidourle rather belongs to the department of Gard, in which it rises; but in the lower part of its course it separates the departments of Gard and Hérault. The Salazon and the Les, with its feeder, the Mosson (which receives the Caulazon), are small streams, none of them so much as 25 miles long. The Hérault is larger: it is generally considered to rise near Villeraugue in the department of Gard, but the head of its feeder, the Trevezet, which should be regarded as its true source, rises more to the west, near the border of the departments of Gard and Aveyron. It flows about 27 miles first eastward, then southward, before entering the department of Hérault, through which it flows about 53 miles in a direction nearly south by west into the Mediterranean, near Agde: its whole course is about 80 miles, for 7 or 8 of which, viz. from the town of Bessan, it is navigable. Its feeders are the Vis (chiefly belonging to the department of Gard), the Lergue, and the Boyne, on the right bank, and the Landou on the left. The Livron flows 25 miles from the lower slopes of the Cévennes into the sea. The Orb rises on the north-western boundary of the department, and flows about 65 miles in a very winding channel to the Mediterranean: it is navigable for about 3 miles. Its tributaries are the Bauson, the Vialas, the Jean or Jeau, and the Bernasobres, all on the right bank. The Aude forms for a short distance the south-western boundary of the department, and the Ceysse and the Brian, which belong to the system of the Aude, with the Agout and the Larn, which belong to the system of the Garonne, water the western part.

The navigable canals of the department are numerous, and some of considerable extent. The Canal du Midi, or Canal du Languedoc, enters the department on the southwest, and runs nearly 40 miles to its termination in the Mediterranean, near the town of Cette. The Canal des Etangs extends about 17 miles along the line of the coast-waters from the nearest part of the Etang de Mauguio to the town of Cette. The canal which skirts the Etang de Mauguio is about 6 or 7 miles long; and that of Lunel, from the town of Lunel to the Etang de Mauguio, about 8 miles. The Canal de Graves (or the navigation of the Les) with that of the Grau du Les is about 7 miles. That portion of the Canal Radelle (extending from Aigues Mortes to the Etang de Mauguio) which belongs to this department, is about 4 miles long: the canals of Robine de Vic and Peyrade are under 2 miles each. A canal has been projected from Montpellier to the Canal des Etangs: its length is estimated at about 5 miles. The whole length of the canal navigation of the department is about 87 miles.

There are seven 'routes royales,' or government roads, with an aggregate length of 232 miles; but of these about 55 miles were (at the commencement of 1837) out of repair, and above 36 miles unfinished. The principal government road is that from Paris into Spain by Perpignan; it enters the department between La Cavalerie, in the department of Aveyron, and Lodève; and passes by Lodève, Clermont de Lodève, Pézénas, and Béziers to Narbonne in the department of Aude: the other roads lead in various directions from Montpellier and Béziers. There are seventeen 'routes départmentales,' with an aggregate length of 300 miles; but not much more than half this extent is in repair. The 'chemins vicinaux,' or bye-roads and paths, have an aggregate length of more than 3000 miles. There is a railroad from Montpellier to Frontignan and Cette, 17 miles long, which is much used for passengers.

The greater part of the department is occupied by the strata between the chalk and the new or saliferous red sandstone. About the upper waters of the Orb are found the formations which intervene between these and the primitive rocks; and in the western extremity of the department, amid the Cévennes, the primitive rocks occur. The mineral wealth of the department is not great: it consists chiefly of coal, some iron, copper, and lead, some varieties of marble much valued for ornamental purposes, and a species of lignite which is used, under the name of 'fossil ashes,' for manure. There are mineral waters at Montpellier, Balaruc, and other places. There are some important salt-pans along the coast. The climate of the department is mild in winter; in summer it is frequently very hot, but on the whole healthy.

More than a third part of the surface of the department is waste, about one-fourth is arable, one-sixth is devoted to the cultivation of the vine, an eighth is woodland (the forests are chiefly of oaks, cork-trees and pines), and the remainder is devoted to various culture, or is occupied by the étangs, rivers, ponds, and other waters. The quantity of grass-land is very small. Wheat is the grain chiefly cultivated, then rye and oats; of barley and pulse, maize, and maslin or mixed corn, the quantity is unimportant: nor are potatoes much grown. The quantity of grain raised is not beyond what is required for home consumption; the produce of the vineyards, both wine and brandy, the dried fruits, perfumes, liqueurs, and wood, furnish the chief articles of export. The olive, fig, and mulberry are cultivated, and some plants used for dyeing are produced. Horned cattle are not numerous, but sheep are; and also mules. The manufactures of the department are considerable; they consist chiefly of cloth, especially for clothing the troops, and other woollen fabrics, cotton yarn and cotton goods, and silk hose: above 17,000 workmen are engaged in these various branches. The fishery on the coast is busily carried on, especially that of sardines.

The department is subdivided into four arrondissements, of which Montpellier, Béziers, Lodève, and St. Pons, are respectively the chief towns: the area and population of the department are thus distributed:—

Arrondissement.	Area.	Population.
Montpellier	780 sq. miles.	123,656
Béziers	696 „	128,149
Lodève	474 „	57,730
St. Pons	467 „	48,311
	2417	357,846

The chief towns of each arrondissement are as follows:—

In the arrondissement of Montpellier are Montpellier near the Lez, population in 1836, 35,506 [MONTPELLIER]; Cette on the Mediterranean, pop. in 1831, 10,638 [CETTE]; Lunel la Ville, so called to distinguish it from Vieux Lunel, near the Vidourle, pop. 6050 for the town, or 6260 for the whole commune; Mèze on the Etang de Thau, pop. 4258 for the town, or 4400 for the whole commune; Ganges on the Hérault, pop. 4173 for the town, 4193 for the whole commune; Marsillargues or Massillargues on the Vidourle, pop. 3233 for the town, 3292 for the whole commune; Aniane, near the Hérault, pop. 2408 for the town, 2480 for the whole commune; Poussan, near the Etang de Thau, pop. 1850 for the town, 1916 for the whole commune; Pignan, near Montpellier, pop. 1877 for the town, 1889 for the whole commune; Frontignan, on the line of the étangs near Cette, pop. 1656 for the town, 1877 for the whole commune; and St. Bauzille do Putois on the Hérault, pop. 1622: beside the smaller towns of Lansargues, Mauguio, Boisseron, Castries, Les Matelles, Celleneuve, Miravaux, and Villeneuve, near Montpellier.

Lunel and Frontignan are well known for the wines produced in their neighbourhood; the former is a place of considerable trade: brandy is sent to the north of France; and at the weekly market much corn is sold for the supply of the mountainous parts of the department. Ganges, a town of considerable business, preserves the remains of an old castle; and at Aniane are the remains of the first monastery built by St. Benedict.

In the arrondissement of Béziers, are Béziers on the Orb, population in 1836, 16,233 [BEZIERS]; Bedarrieux on the Orb, pop. 5781 for the town, 5998 for the whole commune [BEDARRIEUX]; Pézénas on the Hérault, pop. 7481 for the town, 7847 for the whole commune; Agde on the Hérault, near the Mediterranean, pop. 7965 for the town, 8202 for the whole commune; Marseillan on the Etang de Thau, pop. 3625 for the town, 3687 for the whole commune; Montagnac, near the Hérault, pop. 3260 for the town, 3440 for the whole commune; Florensac, near Marseillan, pop. 3512; Bessan on the Hérault, where the navigation begins, pop. 2210 for the town, 2228 for the whole commune; Serignan on the Orb, pop. 1997; Villeneuve, near Béziers, pop. 1966 for the town, 1996 for the whole commune; Servian, a few miles north-east of Béziers, pop. 1918 for the town, 2174 for the whole commune; and Vias, near Agde, pop. 1684 for the town, 1761 for the whole commune: besides the smaller towns of St. Gervais, Nissan, Capestan, Mauroilhan, and Quarante.

Pézénas is on the road from Paris to Narbonne, and into Spain through Moulins, Clermont, Mende, and Lodève, not far from the right bank of the river Hérault. Pézénas was known to the Romans by the name Piscenæ. Pliny notices the excellence of the woollen cloths made there. Pézénas was in the middle ages a chatellanie, which was successively held by the houses of Montmorency and Conti, the latter a younger branch of the house of Bourbon Condé. The town is neatly built, and is adorned with two fountains, a good quay, and handsome promenades. There are manufactures of woollens, which are in good repute, linens, cotton handkerchiefs, leather, soap, verdigris, silk-stockings, and hats. Wool-washing, for which the waters of the Pein are considered to be well adapted, and distilling, are carried on. The wines of the neighbourhood are considered excellent. Trade is carried on in the manufactured articles above mentioned, and in wine, brandy, almonds, olive-oil, dried fruits and capers, alum and copperas. There is a good market on Saturday, and three yearly fairs. There are a theatre and a college founded by Henri IV. Near this town is an old castle, built by Constable Montmorency.

Agde is a town of great antiquity. It is thought to have been a colony of the Greeks of Massilia: it bore the Greek name Agatha. A bishopric was established here, probably in the fifth century, which continued to the time of the Revolution; the bishop was a suffragan of the archbishop of Narbonne: there was also a celebrated abbey, which had at one period 300 monks. In the middle ages Agde was the capital of a county. The harbour is accessible to small vessels, of which 120 belong to the port: the chief trade is carried on coastwise. There are considerable salt-pans near the town.

In the arrondissement of Lodève, are Lodève on the Lergue, a feeder of the Hérault, population in 1836, 11,208 [LODEVE]; Clermont de Lodève, near the Lergue, pop. 5905 for the town, 6199 for the whole commune [CLERMONT]; Gignac, near the Hérault, pop. 2594 for the town, 2779 for the whole commune; St. André, between Gignac and Clermont de Lodève, pop. 2131; and Montpeyroux, near Gignac, pop. 1675 for the town, 1713 for the whole commune: besides the smaller towns of Joncels and Ceilhes.

In the arrondissement of St. Pons, are St. Pons on the Jean or Jeau, population in 1836, 6995; La Salvetat on the Agout, pop. 3986 for the whole commune; and St. Chinian, between St. Pons and Béziers, pop. 2375 for the town, or 3270 for the whole commune: besides the smaller towns of Orlargues and Olonzac.

St. Pons is situated in a valley amid the Cevennes, on a road leading across the mountains from Béziors to Castres and Alby. The town, which is pleasant, probably derives its origin from a religious house of the Benedictine order founded in the tenth century by Pons, count of Toulouse, who transported hither the relics of St. Pons, his patron Saint, martyred at Nice. In A.D. 1317 Pope John XXII. elevated the abbot of this house to episcopal rank, and detached thirty-nine parishes from the diocese of Narbonne to form a new diocese for him. The bishopric was abolished at the Revolution. Woollen cloth, hosiery, leather, and cotton-yarn are manufactured. Marble is quarried in the neighbourhood.

The population of the towns, except the chief towns of arrondissements, is taken from the census of 1831.

The department of Hérault constitutes the diocese of Montpellier, the bishop of which is a suffragan of the archbishop of Avignon. It is in the jurisdiction of the cour royale, or high court of justice, of Montpellier, and in the circuit of the university of the same city. It is included in the ninth military division, the head-quarters of which are at Montpellier. It sends six members to the Chamber of Deputies. There are four Protestant consistorial churches.

The proportion of those who could read and write among the young men enrolled in the military census of 1828-29 was forty-five in every hundred, being above the average of France.

The department is composed of the former dioceses of Montpellier, Lodève, and Béziors, part of the diocese of Narbonne, and part of the diocese of St. Pons, if not all: these were all in Languedoc.

HERBELOT, BARTHE'LEMI D', was born at Paris, on the 14th of December, 1625. He commenced the study of the Oriental languages in early life, and acquired an accurate knowledge of the Arabic, Hebrew, Syriac, Persian, and Turkish languages. During his residence in Italy, whither he went with the hope of obtaining instruction from natives of the East, he enjoyed the friendship and patronage of the Cardinals Barberini and Grimaldi; and on his return to France he received a pension from Fouquet of 1500 livres, which he afterwards lost on the disgrace of that minister. He was subsequently appointed Oriental secretary and interpreter to the king. During a second visit which he made to Italy he was received in the most distinguished manner by Ferdinand II., grand-duke of Tuscany, who presented him with a great number of valuable Oriental MSS., and wished to retain him at his court. But D'Herbelot was prevailed upon by the solicitations of the minister Colbert to return to Paris, where he was appointed professor of Syriac on the death of Auvergne. He also received a pension from the king. He died 8th of December, 1695.

The work by which D'Herbelot is known to posterity is entitled 'Bibliothèque Orientale, ou Dictionnaire Universel, contenant généralement tout ce qui regarde la connoissance des peuples de l'Orient,' fol., Paris, 1697. This work, which he commenced in Italy, and upon which he employed the labour of many years, was published after his death by Galand. The 'Bibliothèque Orientale' was founded upon the Arabic dictionary of Haji Khalfa, and has been deservedly considered by scholars as a most extraordinary work for the time in which it appeared. D'Herbelot also drew his materials from numerous other works in Arabic, Persian, and Turkish, which are enumerated by Galand in his preface to the 'Bibliothèque.' On many subjects connected with Oriental history and antiquities the 'Bibliothèque Orientale' supplies the only information which is available at the present day to a person unacquainted with the Oriental languages. But its statements must be received with great caution; for while the learned author appears to have had a most extensive knowledge on all subjects connected with the East, he certainly did not pay sufficient attention to accuracy. It should however be recollected that he did not live to complete the work, and that his plan embraced too great a number of subjects to allow any one individual to do justice to them all.

The 'Bibliothèque Orientale' was reprinted at Maestricht, fol., 1776, and also at the Hague, 4 vols. 4to., 1777—1799. The latter edition contains many valuable additions by Schultens and Reiske, and also a supplement by Visdelou and Galand. An abridgement of the original work was published at Paris, 6 vols. 8vo., 1782, by Désessarts. A German translation of the 'Bibliothèque Orientale' was published at Halle, by Schulz, 4 vols. 8vo., 1785—90.

D'Herbelot also wrote several other works, which have never been published. Amongst these Galand mentions a Turkish and Persian Dictionary, in three volumes folio.

HERBERT, EDWARD, LORD HERBERT OF CHERBURY, a profound and original thinker, but of a temperament somewhat fanciful and eccentric, was born in the year 1581, at Montgomery, in the principality of Wales. After going through the usual course of studies at Oxford, where he was a member of University College, Herbert visited London in 1600, and shortly afterwards proceeded to the Continent with the design of seeing foreign parts, but was induced by an inherent love of enterprise and danger to join the English auxiliaries then serving in the Netherlands, where he soon distinguished himself by his reckless daring and intrepidity. Having returned to England, he was upon the accession of James I. created a knight of the bath, and was distinguished at the court of that pedantic monarch by his gallantry and his learning. In 1816 Sir Edward was sent ambassador to France: in this situation the bold independence with which he answered a haughty remark of the Connétable De Luynes brought upon him the displeasure of the French monarch, at whose request he was recalled. The conduct of Herbert met however with the approbation of James, who, upon the death of De Luynes, sent him in a similar capacity to Paris, where he published his first work, entitled 'Tractatus de Veritate, prout distinguitur à Revelatione, à Verisimili, à Possibili, et à Falso,' 4to., Paris, 1624. The year following he returned to England, and was created a baron of the kingdom of Ireland. From this date Lord Herbert does not appear to have held any public office, and his time was divided between the gaieties of the court and the pursuits of literature. In 1631 he was elevated to an English peerage, and two years after published an enlarged edition of the 'Tractatus,' of which another appeared in 1645, accompanied with the treatise 'De Religione Gentilium, Errorumque apud eos Caussis.' Upon the outbreak of the political troubles under Charles I., Lord Herbert at first took the side of the parliament, which however he subsequently abandoned at a great sacrifice of personal interests and fortune. He died in the year 1648. After his death two posthumous works were published, the 'Expeditio Buckinghami Ducis in Ream Insulam,' and the 'Life and Reign of King Henry VIII.,' with a dedication to the first Charles. It is by the latter work that Lord Herbert is best known to posterity. His Memoirs, which are the earliest instance of autobiography in our language, remained in manuscript until they were printed, in 1764, by Horace Walpole, at his private press at Strawberry Hill.

Herbert of Cherbury was the contemporary of Hobbes of Malmesbury, to whose principles of philosophising he was directly opposed, notwithstanding the striking coincidence of many of the results at which they respectively arrived. He maintained the theory of innate ideas, and made a certain instinct of the reason (rationalis instinctus) to be the primary source of all human knowledge. Accordingly he did not, with Aristotle and the Stoics, compare the mind to a pure tablet (γραμματεῖον ἐν ᾧ μηθὲν ὑπάρχει ἐντελεχείᾳ γεγραμμένον), or to the tabula rasa of the schoolmen, but to a closed volume which opens itself at the solicitation of outward nature acting upon the senses. Thus acted upon the mind produces out of itself certain general or universal principles (communes notiones), by reference to which all debateable questions in theology and philosophy may be determined, since upon these principles at least all men are unanimous. Consistently with these views, he does not, with Hobbes, make religion to be founded on revelation or historical tradition, but upon an immediate consciousness of God and of divine things. The religion of reason therefore, resting on such grounds, is, he rightly argues, the criterion of every positive religion which claims a foundation in revelation. No man can appeal to revelation as an immediate evidence of the reasonableness of his faith, except those to whom that revelation has been directly given; for all others, the fact of revelation is a matter of mere tradition or testimony. Even the recipient of a revelation may himself be easily deceived, since he possesses no means of convincing himself of the reality or authenticity of his admitted revelation.

Herbert made his own religion of reason to rest upon the following grounds:—There is a God whom man ought to honour and reverence: a life of holiness is the most acceptable worship that can be offered him: sinners must repent them of their sins, and strive to become better; and after death every one must expect the rewards or penalties befitting the acts of this life.

Lord Herbert is one of the numerous instances on record of the little influence which speculative opinions exercise upon the conduct of life. Maintaining that no revelation is credible which is imparted to a portion only of mankind, he nevertheless claims the belief of his hearers when he tells them that his doubts as to the publication of his work were removed by a direct manifestation of the divine will. Notwithstanding the little favour which has been shown to his works, which is partly indeed attributable to the obscurity both of his style and diction, but chiefly to the predominant inclination for the empirical philosophy of Bacon and Hobbes, the skill and sagacity with which he has pursued his researches on a purely rational method are alone sufficient, even had we not a Glanvil and a few others to boast of, to refute the objection which has been urged against us of a total absence in the national mind of all pure and reflex reasoning. The doctrine that outward objects are but the occasions of educing all general knowledge is the foundation of the fame of Kant; and there is much also in the writings of Jacobi which reminds the reader of the principles and method of the philosopher of Cherbury.

The view of Lord Herbert on innate ideas is opposed generally by Locke ('On the Human Understanding,' b. i., c. 2), and some special points are called into question by Gassendi, in his 'Epistolæ ad Librum Ed. Herberti Angli,' in the third volume of his works.

HERBERT, GEORGE, born April 3, 1593, was the fifth brother of Lord Herbert of Cherbury. He was educated at Westminster, and elected thence to Trinity College, Cambridge, about the year 1608. In 1615 he became Fellow of the college, and in 1619 was elected to the office of public orator, a post in those times of considerably more importance than at present. While at Cambridge he made the acquaintance of Lord Bacon, but the pleasures of the court and some hopes of preferment led him to spend much of his time away from that seat of learning. His expectations however failing on the death of James I., he turned his attention to divinity, of which he had before been a laborious student, and took holy orders. He was made prebendary of Leighton Bromswold, or Layton Ecclesia, in 1626. He married in 1630, and in the same year accepted the rectory of Bemerton; but the effects of a quotidian ague, which had attacked him the year before, soon made themselves again apparent, and he died in 1632. His poetical works are well and deservedly known. They belong to the same school with those of Donne, Quarles, and Herrick, and remind us forcibly of certain poems which have lately appeared at Oxford under the title of 'The Christian Year,' and the same analogy may be traced between that school of divines to whom these poems are owing and our author; there is the same zeal and energy in pastoral duties, the same love of paradox in language, the same reverence for antiquity and for the ceremonies of the church.

Herbert's chief prose work is 'The Priest to the Temple,' a sequel to his work called 'The Temple; Sacred Poems and Private Ejaculations.' It lays down rules, and very good rules for the life which a country clergyman ought to lead. He also wrote a translation of Cornaro on Temperance, and some Latin poems.

(Izaak Walton's *Life of Herbert*; Chalmers' *Biog. Dict.*)

HERBERT, SIR THOMAS, was born at York about 1606, and entered Jesus College, Oxford, in 1621, whence he removed to Trinity College, Cambridge. In 1626 he went abroad in the suite of Sir Dodmore Cotton, ambassador from Charles I. to the Shah of Persia, through the interest and at the expense of his kinsman William Herbert, earl of Pembroke, a man of cultivated and elegant talents, and a generous encourager of learning. He sailed to Surat, thence to Ormus, traversed Persia northwards to the Caspian Sea, and returned by Ispahan and Bagdad, down the Tigris; thon proceeded to the coast of India, near Surat; visited (or at least described) the straits of Malacca, Java, Pegu, the Molucca islands, &c; and returned to England after four years' absence. In 1634 he published his 'Some Yeares Travels into Africa and Asia the Great,' &c. (revised and enlarged by the author in 1638), which is an accurate and trustworthy work, and the best account of Persia anterior to that of Chardin. It contains a great many curious facts which the reader will hardly find anywhere else. The work was translated into Dutch by Van Vliet, and re-translated into French by Wicquefort. The English edition is ornamented with a great many cuts. [CHARDIN, SIR JOHN.] Herbert espoused the cause of the parliament, and in 1647 was one of the commissioners appointed to receive the king from the Scots at Newcastle. In that capacity he attended the king to Holdenly Castle, and was selected by him, on the dismissal of his former attendants, to be about his person. Though, being a Presbyterian, he was opposed in religion, as well as politics, to the opinions of Charles, still the respectful propriety of his behaviour won the regard of the royal prisoner, towards whom Herbert in his turn appears to have conceived a strong veneration and affection. He attended him to the last; and after the Restoration his faithful service was rewarded by Charles II. with the title of baronet. In 1678 he published 'Threnodia Carolina,' an historical account of the two last years of the life of King Charles I., by Sir Thomas Herbert and others, reprinted by Nicol in 1813. He died at York in 1682. (*Athenæ Oxonienses*, where there is an original account of the last days and burial of Charles I., communicated to Wood by Herbert himself.)

HE'RBSTIUM. [THALASSINA.]

HERCULA'NEUM, or *Herculanum* (Cic. *ad Att.* 7, iii.), a very antient Italian city, situated on the coast of Campania, near Naples. It is said to have been of Pelasgian origin, but its history is obscure, and it seems never to have attained any importance. In the time of Titus, A.D. 79, it was overwhelmed by that memorable eruption of Vesuvius which also ruined Pompeii. [VESUVIUS.] It appears to have been buried under showers of ashes, subsequently overflowed by streams of lava, and is stated to be 70 feet below the present surface of the ground. It was re-discovered by the sinking of a well in 1713, when several antiquities were found. This led to further investigation; and after several years, in which little was done, the Neapolitan government undertook the work of excavation. The theatre, a chalcidicum, and two temples, are the chief buildings explored: the private houses are chiefly small, and of one story, like those of Pompeii. The whole excavation is said to have been about 600 yards long by 300; but it being impossible to remove the incumbent soil, in consequence of its thickness, as fast as one part was thoroughly searched, it was filled up with rubbish from another. A small part of the theatre is all that is now accessible. The chief advantage as yet derived from Herculaneum is the magnificent collection, not only of statues and paintings, and vases, but of domestic implements of every use and description, deposited in the Royal Museum at Portici. These are figured and described in the magnificent work, 'L'Antichita d'Ercolano,' Nap., 1757, 10 vols. fol. The collection has been abundantly increased from Pompeii.

Great expectations were raised by the discovery of a large number of manuscripts, written on rolls of papyrus. The attempts to unroll them hitherto have had but imperfect success; and those of which the subjects have been ascertained are of little interest. There seems to be very little hope of recovering any of the lost treasures of antiquity in this quarter. The work entitled 'Herculanensium Voluminum quæ supersunt,' Naples, 3 vols., 1788, 1809, 1827, contains, we believe, all that has yet been deciphered. The University of Oxford published, in 1824-5, two volumes, 8vo., of fragments lithographed from fac-similes (apographa) presented to them by George IV.; these have been also published in the Neapolitan work. The bulk of those which have been examined contain the works of Greek philosophers and sophists, and treat of natural and moral philosophy, medicine, criticism, the arts, &c. The papyri have uniformly been found in a state resembling charcoal, dry, and crumbling, the laminæ, for the most part, strongly adhering to each other. There is an elaborate account of the several methods which have been tried to unroll them in the last edition of the 'Encycl. Britann.,' art. 'Herculaneum.'

HE'RCULES (in Greek, Heracles), a celebrated hero of Greek mythology, the offspring of Zeus by Alcmena, daughter of Electryon, a son of Perseus, and king of Mycenæ. His reputed father was Amphitryon (son of Alcæus, another of the children of Perseus), who having accidentally killed his father-in-law Electryon, was compelled to leave Mycenæ, and take refuge in Thebes. Here Hercules was born and educated, and here his early feats of strength and valour were done; such as slaying the lion of Cithæron, delivering Thebes from the tribute to Erginus, king of Orchomenos, and taking in marriage the daughter of Creon.

Being fated to serve Eurystheus, king of Mycenæ, he performed what are called his labours, in obedience to the commands of his master. They are so well known that we need only enumerate them:—the first was, to bring the skin of the Nemean lion; the second, to destroy the Hydra; the third, to catch the hind of Artemis; the fourth, to bring to Eurystheus the Erymanthian boar alive; the fifth, to cleanse the stables of Augeas; the sixth, to drive away the water-fowl of lake Stymphalis; the seventh, to fetch the Cretan bull; the eighth, to bring to Mycenæ the mares of Diomedes; the ninth, to obtain the girdle of Hippolyta, queen of the Amazons; the tenth, to bring the oxen of Geryon from the island of Erythia; the eleventh, to bring the apples of the Hesperides; the twelfth, to conduct Cerberus from the under world. Many other exploits did he perform, such as the taking of Troy, which are all related by the mythologists, Apollodorus, and others. But we have already gone into somewhat unnecessary detail, as our object will rather be to point out the classes to which these traditions belong, than to give our readers information with which they can supply themselves elsewhere.

There are then three distinct kinds of tradition relating to Hercules; the first consisting of stories drawn from some Eastern or other religion, and applied to the Theban hero. Such are his wanderings round the coasts of Greece, which exhibit in a mythical form the establishment of the worship of a wandering god of the Phœnicians. Such also is his voluntary death on Mount Œta; and, according to Müller (*Dorians*, i. 444), his murdering his children. Another, and the second class of traditions, are those which represent him performing labours such as would naturally be those of a young community. (Pausan., viii. 14.) A third class exhibits him in the light of a conqueror and destroyer of tyrants, and here the awkwardness of ascribing the deeds of the Peloponnesian hero to the Theban Hercules is most striking; for while on the one hand he is serving Eurystheus as a slave, on the other he appears as one who forms alliances and disposes of kingdoms.

The legends of Hercules perhaps afford a better instance than those of any other hero or god, except Apollo, of the various sources from which mythical accounts spring.

Hercules is represented as a half-naked man, with broad shoulders and brawny limbs, resting on a club, and covered round his loins with the skin of the Nemean lion. He appears however to have originally borne a spear and buckler, or a bow and sword, the later representation having been substituted about the time of Stesichorus.

(Müller's *Dorians*, and the authors whom he quotes; Thirlwall's *History of Greece*; Müller's *Prolegomena*; Buttmann's *Mythologus*, i. xi.)

HERCULES, one of the old constellations, called ἐνγονασιν by Aratus, Hyginus, and Ptolemy, and described by the first as 'a figure like that of a man in sorrow' while the second offers various fabular significations from the stories of Hercules, Orpheus, Cetheus, Theseus, Thamyris, Ixion, Prometheus, &c. The club, lion's skin, and character of Hercules, are not so old as Aratus, who describes this figure as stretching his hands to different quarters, and makes an allusion to the neighbouring dragon, which shows that he was not painting a hero.

Character. (Not in Bayer.)	No. in Catalogue of		Magnitude.	Character. (Not in Bayer.)	No. in Catalogue of		Magnitude.
	Flamsteed, (Piazzi,) [Bradley.]	Astron. Society.			Flamsteed, (Piazzi,) [Bradley.]	Astron. Society.	
	3	1828	6		73	1996	6
r	5	1830	6	ρ	75	1999	4
υ	6	1839	5	λ	76	2009	4½
κ	7	1847	5		78	2013	6½
	9	1858	6		79	2026	6
(T)	10	1856	5		84	2038	7
	17	1867	6	ι	85	2035	4
γ	20	1875	3	μ	86	2046	4
r	22	1876	4		87	2048	6
	25	1887	5		89	2053	6
β	27	1896	3	θ	91	2058	4
n	28	1898	6	ξ	92	2060	4
h	29	1899	4	(E)	93	2068	5
g	30	1897	5	ν	94	2065	5
	33	1904	6	(B)	95	2077	4
σ	35	1905	4	(Q)	96	2080	5
ζ	40	1909	3		97	2081	5
i	43	1914	5½		98	2087	5
η	44	1913	3	(P)	101	2095	5
l	45	1916	5	(C)	102	2094	4½
k	47	1922	5	ο	103	2091	4
	49	1927	6	A	104	2100	4½
	50	1925	5	(G)	105	2107	5
(X)	51	1930	5		106	2112	5½
	52	1926	5½	*t*	107	2116	6
	53	1935	5	(F)	109	2121	4
	54	1938	5	(K)	110	2168	4½
ε	58	1948	3	(M)	111	2173	4
d	59	1952	6	(N)	112	2182	5
	60	1957	5½	(O)	113	2186	5
α	64	1970	3		(3)	1963	6
δ	65	1976	4	(H)	(100)	2134	6
ω	66	1980	6		(109)	2003	6
π	67	1978	3½		(116)	2146	6
u	68	1982	5		(132)	2153	6
e	69	1987	4½		[2308]	2117	5½
	70	1989	4½				

The constellation is situated between Draco, Bootes, Lyra, and Ophiuchus; but as there is no star in it larger than of the third magnitude, there is nothing very remarkable about it. The principal stars α and β lie between the bright stars in the head of Ophiuchus and in Corona Borealis.

HERCULES, PILLARS OF. [GIBRALTAR, STRAITS.]

HERDER, JOHANN GOTTFRIED Von, was born in 1744, at Morungen in East Prussia, where his father kept a little girls'-school. The only books he was allowed to read were a Bible and Hymn-book, though he secretly turned his attention to other works. A preacher named Trescho engaged him as a writer, and as he observed in him germs of talent, he allowed him to remain with his sons, while he gave them instruction in Latin and Greek. A complaint in the eyes, with which he was afflicted, was the means of his becoming acquainted with a Russian surgeon, who was so pleased with him, that he offered to take him to Königsberg and thence to Petersburg, designing to instruct him in surgery gratis. Herder accepted the offer, but at Königsberg fainted away at the first dissection which he attended, and thereupon resolved to study theology. He fortunately gained the acquaintance of persons who appreciated him, and procured him a place as instructor in the Frederick's College at Königsberg. With the most indefatigable industry he studied philosophy, natural science, history, and languages, and in 1764 became assistant at the cathedral school at Riga, to which office that also of preacher was attached. Though his sermons were greatly admired, he soon left the situation, as he desired to study the world at large. He accordingly went to France, and was there chosen by the Prince of Holstein-Oldenburg as his travelling companion. He would have gone from France to Italy had he not been arrested by the complaint in his eyes at Strasburg, where he first became acquainted with Göthe. In 1775 he became theological professor at Göttingen, where he was enabled to pursue his favourite studies under the benign influence of the Duke of Saxe-Weimar and his wife He died in 1803.

The writings of Herder fill about sixty volumes, and are on the greatest variety of subjects. As a theologian he has gained celebrity by his 'Spirit of Hebrew Poetry;' as a philosopher, he is known as the author of the 'Philosophy of the History of Man,' a work which has been translated into English. He was not so much a metaphysician as an observer. He strove to discover a point of union where science, religion, history, poetry, and art should meet; and in order to take one comprehensive view of all the tendencies of man, he made himself acquainted with the literature of a variety of countries, Oriental as well as European, antient as well as modern. His collection of popular ballads of all nations has a high reputation; and a poem by him called the 'Cid' has been declared by the Spaniards themselves to be truly Spanish. The great influence which he exercised on German literature, by introducing his countrymen to the knowledge of an infinite variety of subjects, was undoubtedly great; and his name is never mentioned among them but in terms of high respect and admiration.

HERDERITE, a mineral which occurs in crystals embedded in fluor at Ehrenfriedersdorf in Saxony. Primary form a right rhombic prism; cleavage parallel to the lateral planes, and in the long diagonal of the prism; fracture small, conchoidal; hardness 5; colour greyish and yellowish-white; streak white; lustre vitreo-resinous; nearly transparent; specific gravity 2·985.

HEREFORD, an antient city, and parliamentary and municipal borough, situated upon the left bank of the Wye, about 115 miles in a direct line west-north-west of London. The name is probably derived from the British Hên-fford, signifying the 'old road.' The city or liberties (these words are used indiscriminately) extend far beyond the mass of the town, and their boundaries are perfectly well ascertained. The liberties comprise the parish of All Saints; part of the parish of St. John the Baptist; part of the parish of St. Martin; part of the parish of St. Nicholas; part of the parish of St. Owen; part of the parish of St. Peter;

the township of Huntington in the parish of Holmer; another part of the parish of Holmer; part of the township of Tupsley in the parish of Hampton Bishop; and small portions of the parishes of Bullingham and Breinton. The city contains 2320 statute acres, and a population of 10,280. The borough council consists of the mayor, six aldermen, and eighteen councillors. The following courts are or may be held within its limits:—the Quarter-Sessions; the Petty Sessions; the Mayor's Court; View of Frankpledge; and Court of Pie Poudre. The income of the corporation arises from real property, tolls, and fees: in 1832 it amounted to 1176*l.*

History and Antiquities.—In early times this city was important as a garrison to restrain the Welsh. The principal events of its history are its pillage by the Welsh in 1055; its capture by King Stephen in 1141; the execution of Owen Tudor, who was beheaded here in 1461; the surrender of the city during the rebellion, in 1643, to the parliamentary troops, headed by Sir Wm. Waller; and the siege of Hereford by the Scotch under Lord Leven.

A house of Grey Friars stood at the southern extremity of the city: a house formerly belonging to the Black Friars, the picturesque arms of which have been engraved in the book of Mr. Grose and other antiquaries, may be seen in the suburb of Widemarsh St.; and adjoining it was a chapel and building belonging to the Knights Hospitallers of Jerusalem. There was also a Benedictine cell, belonging to the abbey of St. Peter, at Gloucester. The castle consisted of two wards of different dimensions, having a keep within the smaller: the Wye formed its defence on the south side; on other points it was defended by moats. It was taken possession of by Sir William Waller in 1643, and was garrisoned till 1652; but at that time the parliamentary commissioners returned it as 'ruinous,' and its materials worth no more than 85*l.*

Hereford is situated in a broad, fertile, and well-cultivated valley, and at sufficient elevation above the river Wye to be free from fogs and damp. It has always been esteemed a healthy town. The principal streets are broad and straight, and have all been macadamized. The private houses, with few exceptions, are built of red brick, and the public buildings of stone. The shire-hall was built after a plan of Sir Robert Smirke, and is remarkable for the unassuming beauty of its exterior, as well as the good general arrangement of the interior. Besides the courts and rooms necessary for the transaction of assize and magisterial business, it contains a large room, which is used at elections and other public meetings, and occasionally as an assembly-room. The town-hall, a large wood and plaster building supported by oaken pillars, stands in the High Town, and the fruit and vegetable market is held underneath and around it: additional markets have also been built between this site and the guildhall, a brick building in a remote situation. The Union workhouse, first inhabited in 1838, stands just beyond the north-east limits of the city. In the county gaols, which are in the same neighbourhood, the silent system is in force, the regulations rigid, and the superintence of the visiting magistrates is vigilant and discreet. One of the gateways of the ancient walls has been fitted up as a city prison. There are several hospitals or almshouses. A large infirmary, supported by contributions and benefactions, stands south-east of the city, near the Castle-green. The principal churches are those of All Saints, St. Peter, St. Nicholas, and St. John. All Saints Church faces Broad-street on the north; the steeple is tall and well-proportioned, but its external architecture is generally uninteresting. A parapet of brickwork on the south side, which has been added to the original stone wall, greatly disfigures the elevation. The vicarage of St. Martin's and All Saints, which is in the gift of the dean and canons of Windsor, is returned of the annual value of 380*l.* St. Peter's Church, founded by Walter de Lacy in 1085, is a plain building, with a spire. The annual value of the vicarage, as returned in 1835, is 366*l.* The rectory of St. Nicholas is valued at 188*l.* a year.

The church dedicated to St. Owen, and destroyed during the civil wars, was consolidated with St. Peter's in the reign of Charles II.: that of St. John the Baptist has probably been at all times an appendage to the cathedral. The latter is a vicarage, of which the dean and chapter are patrons.

Hereford Cathedral stands upon the south side of the city, not very far from the Wye. It is probable that this situation was occupied in very early times by a church of considerable importance. Polydore Virgil mentions that there was a large church (templum magnificum) at Hereford, in the reign of Offa, king of Mercia. Ethelbert, who was murdered at the instigation of Offa [Herefordshire], was buried in this cathedral, and gifts were offered at his shrine, where it was asserted that miraculous appearances had been shown. Milfrid, the governor of the province in the time of Egbert, was attracted to the spot, and he determined to erect in honour of St. Ethelbert a new church, which is referred to as 'lapidea structura,' a distinction which makes it probable that the former was a wooden building. The date of the building is fixed at 825. We are ignorant what were the causes of the rapid decay of this edifice; the whole however, says Grose, was rebuilt by Bishop Athelstan about the year 1030. This cathedral was entirely demolished in 1055. No renewal was attempted until the latter years of William the Conqueror's reign, when Bishop Lozing and others commenced the present building in the Saxon style. In 1786 the western portion of the cathedral fell, and alterations were subsequently made, the spire was removed, and a new western end added by Wyatt: either from want of funds or want of taste the architect has sadly marred the beauty of the original structure. The cathedral contains many monuments of great antiquity, some of which are highly ornamented. For a minute description of this cathedral, see Duncomb's 'Hist. of Herefordshire,' and Britton's 'Cathedrals.'

In the chapter-room there is a curious map of the world, probably one of the oldest original maps in existence; a copy of it was made, a few years ago, for the London Geographical Society. At the east end of the church is the library, which contains many valuable books and manuscripts. The 'college' is a quadrangle, which contains the residences of the vicars of the cathedral. At the west end there formerly stood two chapels, the one above the other, and a cloister communicating with the bishop's palace. The elevation of these chapels, destroyed long since, may be seen in Gough's edition of Camden. Part of the cloister which remains has lately been rendered more visible by the removal of a school-house which obscured it. Triennial music-meetings have for many years been held in the cathedral, in rotation with those of Gloucester and Worcester.

The members of the cathedral are the bishop; the dean, who holds a canonry, and is appointed by the crown; two archdeacons; one golden prebendary, whose office appears to have been that of confessor to the bishop; five other residentiary canons (including the dean); also a lecturer; these are all chosen from the prebendaries by the chapter, the bishop having the casting vote. Besides other dignitaries, there are twenty-eight prebendaries appointed by the bishop, and twelve vicars choral nominated by the dean and chapter. The vicars have rooms allotted to them in the 'college,' a gloomy building at the east end of the cathedral, which was built for their accommodation in the time of Edward IV.

In addition to the churches belonging to the establishment, there are places of worship for the principal denominations of dissenters. A Roman Catholic chapel of considerable dimensions is now (1838) erecting in Broad Street.

No manufacture or important wholesale trade is carried on here, unless it is the manufacture of gloves, of which a considerable quantity are made. The establishment of an iron-foundry has been consequent upon the reduction of the price of coal caused by the Abergavenny railroad. Before this project was completed, coal was sold here at from 30*s.* to 40*s.* a ton; the price now varies from 17*s.* to 22*s.* Gas-works have also been established, so that the streets and shops are well lighted. A literary and scientific society holds its meetings periodically, papers are read, and a collection for a museum is in progress; this useful institution is well attended, and if sufficient funds can be raised, it is intended to build a museum, library, and suitable apartments. A bill is now (1838) before parliament for enabling the citizens to dispose of certain lands belonging to them, and for the curtailing to two days St. Ethelbert's fair, which has heretofore been held on nine days in May. The principal fairs here are held on the first Tuesday after February 2, for cattle, &c.; the Wednesday in Easter week, for cattle; May 19—28, for diversions; July 1, October 20, horned cattle, cheese, &c. The February and October fairs are the most largely frequented; the latter is one of the most considerable cattle fairs in England. The market-days are Wednesday and Saturday; the 'Great Market' is on the Wednesday after St. Andrew's day.

HEREFORDSHIRE, an inland county, situated in that part of the west of England which is bordered by South Wales. The counties of Worcester and Gloucester form its boundaries on the east; Shropshire, with a portion of Worcestershire, on the north; Radnorshire, Brecknockshire, and a part of Monmouthshire, on the west; Monmouthshire and Gloucestershire on the south.

There are four detached portions of this county; the first belonging to Wolphy hundred, situated about 9 miles east-north-east of Ludlow; the second, also belonging to Wolphy, lies south of the river Teme, about 2 miles west of Tenbury; both these are separated by Shropshire from the main body of the county: the third, a portion of Huntington hundred, which is surrounded by Radnorshire, is about 3 miles west of Presteign; the fourth, a part of Ewyas Lacy, is on the borders of Brecknockshire and Monmouthshire, immediately west of Llanthony and the Hatterel range of the Black Mountain.

Its greatest length from the north side of Mocktree Hill to the southern portion of the Lord's Wood is about 40 miles. Its greatest breadth from the western side of the parish of Brilley, adjoining Clyro Hill, to the foot of the Malvern Hills, in the east of the parish of Cradley, is 34 miles. Its area is 860 square miles, or 550,400 acres. In 1831 the gross population amounted to 111,211 persons; and the average number of inhabitants to each square mile was 122. This distribution of population, compared with that of the neighbouring counties, gives the following results as to the average number of persons to a square mile:—Gloucester, 307; Hereford, 129; Monmouth, 198; Shropshire, 165; Brecknock, 63; Radnor, 58.

In extent of surface Herefordshire is exceeded by 24 English and Welsh counties, in amount of population by 44 counties in England and one in Wales. Hereford, the county town, is 132 miles distant from London by way of Wycombe, Oxford, Cheltenham, Tewkesbury, and Ledbury. A more direct line from Cheltenham to Ledbury, avoiding Tewkesbury and crossing the Severn at the Haw Bridge, saves three miles, and is frequently travelled by private carriages, but avoided by the public coaches on account of the absence of towns. The mail line is from Cheltenham through Tewkesbury; that of the coaches from Cheltenham through Gloucester and Ross.

Surface, &c.—The surface of this county is generally hilly, but the valleys occasionally expand into open plains. The Hatterel range of the Black Mountain, which forms its border on the west-south-west, is the highest land within its limits. Parallel to this range the chain which commences with the Vagar Hill and terminates in Mynydd Ferddin forms an important feature in the country: there is likewise a third and lower line of hills extending in the same direction from Middlewood to Wormbridge. In the south-west the Saddlebow and Garway are conspicuous; and in the south the hills near Walford and Penyard, with the long chain extending from the Lea northward towards Woolhope and Stoke Edith. The Malvern Hills, and the range stretching northward from Stamford Bishop to Wolferlow, comprising Bromyard Downs, are the principal heights upon the eastern boundary. On the north are the hills of Downton and Leintwardine, together with the range running in a south-west direction from Ludlow towards Kington, and continuing towards Huntington and Brilley Mountain. Near the centre of the county, Dinmore, Westhope, and Badnage Hills, with the line on which the circle of firs called Lady Lift stands conspicuous, form the most prominent features.

Rivers.—No large rivers have their source in these hills; the principal streams which water Herefordshire rise in the higher counties of South Wales. They are, the Wye, the Lugg, the Teme, the Arrow, the Fromie, the Leddon, the Dover, and the Munnow.

The *Wye*, which rises in Cardiganshire, enters Herefordshire on its western side, and running at first in a northerly direction, becomes for a short distance its boundary from Radnorshire: near Clifford the bearings of its course are changed, and the river flows east-south-east with many windings through a broad and fertile valley until it reaches the city of Hereford. Between that city and the town of Ross its general course is south, but its windings are numerous: two loops which surround King's Capel and Foy are from their length of great inconvenience to the inhabitants of that neighbourhood. From Ross the Wye runs a general south and then a south-west course, and again forming the boundary of Herefordshire for a few miles, finally leaves it near the Leys. It is imperfectly navigable throughout the whole of this county. when the depth of water has been moderately increased by rains, barges are worked up as far as the borders of Brecknockshire, but the numerous shoals and rapids, the frequent and sudden bends, form great impediments to their course. The immediate vicinity of mountains, and the very large surface of country which it drains, cause sudden and frequently destructive floods. After northerly or westerly rains the water sometimes rises eight or even ten feet in the course of 24 hours. For picturesque beauty this river is justly celebrated. In the upper part of its course through Herefordshire, there is a want of that boldness which characterizes the features of the country through which it afterwards flows, nevertheless there are some very striking prospects in the neighbourhood of its banks. This will be acknowledged by those who are acquainted with the following places—the Rhyd Spence Hill, Myrbidge Hill, Brobury Scar, and Lynda. To the majority of tourists these localities are unknown, not because they are not beautiful, but on account of the still greater beauty and accessibility of the scenery below Ross, the views of Goderich, the neighbourhood of the New Weir, and the vicinity of the Wye below Monmouth. The number of bridges by which this river is crossed is inconveniently small: fords indeed are frequent, but they are rough, and often rendered impracticable by floods. Trout, greyling, laspring, and salmon, are taken; since the destruction of a weir in the lower part of the river the number of salmon has increased, and it appears probable that it would receive further additions, but for the killing of the fish when they are not in season. From a deficiency in the protecting laws relating to this river, persons are permitted to destroy the old fish, whilst in the summer months, when the fish are in the best season, they are legally prohibited from taking them. Nearly the whole of the county of Hereford lies within the basin of the Wye.

The *Lugg*, rising in Radnorshire, enters Herefordshire near the Combe, flows in an easterly direction to Leominster, and after passing that town takes a more southerly course through Lugwardine, a village about three miles from Hereford, to Mordiford, near which place it falls into the Wye. Barges are sometimes navigated for the short space between Mordiford and Lugwardine Bridge. The river is not broad, and its banks are generally steep. Trout are plentiful, but salmon are rarely taken in this stream.

The *Teme*, which likewise rises in Radnorshire, enters Herefordshire near Brampton Bryan, and flowing under the beautiful woods and castle at Downton crosses the border into Shropshire. At Ludlow it again enters Herefordshire, which it finally quits near Burford, and falls into the Severn a few miles from Worcester. It is abundantly stocked with excellent trout and greyling.

The *Arrow* rises in the Radnorshire hills to the west of Kington, and passing through that town takes an easterly direction, until it falls into the Lugg, not far below Leominster. In this little stream there is excellent sport for fishermen.

The *Fromie* rises near Wolfrelow in the hundred of Broxash and falls into the Lugg at Hampton Bishop: the stream is small, but liable to be greatly swollen by floods.

The *Leddon*, also a small stream, rises in Radlow hundred above Bosbury, passes through Ledbury and becomes tributary to the Severn.

The *Doyer* rises above Dorstone, drains the fertile valley called the Golden Valley, and falls into the Munnow near Pontrilas.

The *Munnow* rises in the Hatterel Hills, and after receiving several tributary brooks falls into the Wye near Monmouth. Trout abound in all these streams, but are seldom of very great weight.

Canals.—In addition to the navigation of the Wye two canals have been formed through portions of this county for the conveyance of coal and other heavy goods. At the end of the last century acts of parliament were obtained for making a canal from Hereford to the Severn near Gloucester, also from Stourport in Worcestershire to the town of Kington. Want of funds has prevented the completion of both these schemes; the Gloucester canal has been brought no farther than Ledbury. The canal projected from Stourport to Kington has never reached either terminus, but a portion of the intermediate space from Leominster through Tenhury to the neighbourhood of the Abberley Hills has been completed. In both these canals the supply of water is deficient.

Roads.—The principal turnpike roads are, from Hereford to Ross, 14 miles; Hereford to Ledbury, 15; Hereford to Hay, 20; Hereford to Kington, 19; Hereford to Abergavenny, 24; Hereford to Monmouth, 20; Hereford to Leominster, 13; Hereford to Ludlow, 24; Hereford to Bromyard, 14.

Not many years ago the roads in this county were proverbially had; now their surfaco is generally good, and on the chief lines the ascents have heen rendered easier, either hy diversions or cutting. The Cheltenham and Aberystwith mail traverses the county from Ledbury through Hereford to Kington; the Gloucester and Caermarthen mail passes through Ross; and the Worcester mail to Kington travels hy way of Bromyard and Leominster. A mail which lately ran from Bristol to Liverpool through Monmouth, Hereford, Leominster, and Ludlow, has lately been discontinued between Liverpool and Hereford, passengers and letters from Bristol heing more expeditiously carried hy way of Birmingham and the Grand Junction Railway. The parish roads are often inexcusahly neglected. No railway has yet heon constructed in this county on which steam-power is applied. The present amount of traffic and travelling renders such speculations unsafe. Tram-roads for the conveyance of corn, coal, &c. have been constructed from Abergavenny to Hereford, and from Brecknock through Hay and Eardisley to Kington and the neighbouring lime-rocks and stone-quarries on the borders of Radnorshire. The henefits derived from hoth these roads have been very great; the supply of coal in Hereford has been rendered certain and its prico lowered from ahout 30 to 18 shillings a ton; an easy transport is also afforded for corn to the Monmouthshire iron-works, whence iron is received in return. The Brecknock railroad has also lowered the price of coal in the district through which it passes, and tended greatly to the improvement of the turnpike roads hy conveying to a tract deficient in roadstono an excellent material from Stanner Rock, a trap formation, at the foot of which the railroad has heen carried.

Climate.—The climate of Herefordshire varies greatly, according to the elevation and exposure. The neighbourhood of Ross and Ledhury, as well as the central portion of the county, enjoys a far superior climate to such portions of the north and west as are in the vicinity of Wales. The air is healthy, and the population long-lived. It is said that Serjeant Hoskins entertained James the First in his progress here with a morrice-dance hy ten old men and women, whose united ages exceeded 1000 years. (Gough's Camden.)

Geology.—To the casual observer the whole of Horefordshire appears to consist geologically of old red sandstone, a formation of great thickness, which has heen suhdivided in the following manner:—1, red conglomerate and sandstone without organic remains; 2, cornstone and argillaceous marls, containing crustacea of undescribed genera, as in the northern and central parts of the county; 3, flaggy highly micaceous tilestone, containing a small number of fossils, as seen in the neighbourhood of Downton Castle.

This trough of sandstone is neither frequently broken through by igneous rocks, nor materially lifted or curved hy their action. On the eastern side, the mean direction of the strata, as determined hy the outline of the trap and sienitic ridges of Abherley and Malvern, is from north to south. But there are many aherrations from that direction, and innumerahle local disturhances, curvatures, and faults. In the neighhourhood of Eastnor Park, three of the grauwacke formations have the north-easterly and south-westerly strike so persistent in Salop and Wales, but this is merely local, heing only maintained in a length of 2½ miles, for the Ledhury ridge, which terminates this group, is seen to strike due south at its apex near Clencher's Mill. The discrepancy is still greater hetween the strike of the major axis of the Woolhope Valley, extending to Flaxley in Gloucestershire (a distance of ahout 18 miles), and that of Shucknell Hill, which, although only two miles distant from the northern end of the Woolhope Valley, and composed of the same rocks, has a direction from south-west to north-east, and at right angles to the former, which runs from north-west to the south-east. The strike of the strata of Shucknell Hill is parallel to the line of bearing of the adjoining trap rocks of Bartestree. On the western houndary the prevailing strike of the deposits is from north-east to south-west; hut there are minor axes of elevation, subordinate to the great line of elevatory movement, which are for the most part marked hy eruptive ridges of trap rock, which tilt the strata upon their flanks hoth to the north-west and to the south-east. Limestone has been raised to the surface in many places; for instance, the valley of elevation at Aymestry, where pentamerus limestone is seen, and at Ledhury and the foot of the Malvern range, where transition limestone appears.

The valley of elevation at Woolhope is supposed to be the most symmetrical in Great Britain; the two superior formations of the grauwacke series are incurvated round a central dome-shaped mass, composed of the shelly sandstones of the third formation, from which the strata dip away on all sides at angles varying from 15° to 70°. The harder strata of each formation having resisted destruction, whilst the shales have been worn away, the former constitute the highor encircling ridges, the latter deep trenches of intervallation. The outer zone contains all the fossils characteristic of the Ludlow rocks, and passes beneath the old red sandstone; the inner zono, those of tho coralline formations of Wenlock and Dudley, and both these are wrapped round a nucleus of the third formation. The outer zone is unhroken hy any transverse gorge throughout two-thirds of its circumference, hut at Mordiford it is violently dislocated, and the result has been a chasm, hy which and by two minor fissures the valley is entirely drained. The whole of the valley is stated to be one of clean denudation, being entirely free from any fragments even of the old red sandstone, though the inferior and denuded strata must have been raised up through that formation. (*Geol. Trans.*, vol. ii., p. 15.) Mr. Murchison, from whose paper, as reported in the 'Proceedings of the Geological Society,' these observations have been extracted, has in the press a detailed account of the geology of this and the neighbouring counties.

Soil and Agriculture.—The soil of this county consists principally of a deep heavy red loam, which varies in its degree of tenacity: in some districts there is a suhstratum of clay; in others gravel approaches nearer to the surface. The wholo is extremoly favourahlo to the growth of trees, especially the apple and the oak. In the neighhourhood of the towns the land here, as in most other counties, is cultivated chiefly either as meadow or pasture; in the rural parishes the quantity of land in tillage is greater, hut scarcely equal to that of grass land, and the management of the land depends upon the olimate and nature of the soil. The high lands, for the most part, are occupied hy oak coppices, which are numerous and extensive; these are felled at periods of from sixteen to twenty years, and fetch a price of from 18*l.* to 26*l.* an acre, the bark included. In the valleys and less exposed elevations, crops are raised in the following succession:—wheat, turnips, harley, clover, wheat, and peas or vetches. It is to the wheat crop that the farmer pays his chief attention: the two last weeks in Octoher or tho first in Novemher are reckoned to he the best sowing time; in few counties is the seed more skilfully or neatly put into the ground. The cultivation of turnips is neither so carefully practised nor so well understood; indeed the greater part of the soil is not well suited to this crop; nevertheless it would less frequently fail if the management was more attentive and skilful; the seed is in general sown too late.

Hop-yards are common in the middle and eastern portions of the county, the hundreds of Broxash, Radlow, and Grimsworth. The hines here are planted in rows and the land ploughed, a method different from that which is practised in Kent, where they are planted on mounds and the soil cultivated with the spade.

Orchards are numerous, and not confined to any particular distriot. The lahour of picking a quantity of apples and converting them into 110 gallons of cider may be estimated at from four to seven shillings; these form a *hogshead* of cider, which is sold at from 3*d.* to 2*s.* a gallon, according to the quality and ahundance of the crop; in ordinary years, the price varies from 4*d.* to 1*s.* 2*d.* a gallon. An orchard of full-grown trees in good condition will sometimes produce as many as 12 hogsheads an acre. Under the article Cider an account of its manufacture and treatmont may he found.

The highest wages paid to agricultural labourers are nine shillings a week; in the northern and western parts of the county eight and seven, and in winter as little as six shillings a week are given; the addition of cider is allowed by all farmers in the summer, and by a large portion during the winter; the labourer prefers receiving a portion of his earnings in 'drink' to being paid wholly in money. The wives and families suffer from the practice, but are not generally averse to it: they think the cider a luxury due to the man for his exertion, and are ignorant of the injury they sustain. From two to four quarts of cider is the usual daily allowance; in harvest time the quantity is unlimited, and food added to it, but the money wages are not raised; some labourers at this season will drink ten or even twelve quarts of cider in a day.

The prevalent breed of cattle is that for which this county is justly celebrated; their colour is red with white or mottled faces, and frequently white along the back and about the legs. Good milkers are occasionally found among the cows, and it is possible that a race might be reared from this stock that would be useful for the pail, but dairy farming is never practised here, and the milk of the cows, which are kept only for the purpose of breeding, is given to the calves. It was formerly the custom to work the oxen at three and four years old, and to feed and send them to market at five, but their inefficiency as beasts of draught, the quantity of fodder consumed by the older oxen, and the slow return of capital, have caused a complete change of system: the oxen are no longer worked, but are commonly fed when they are two years old, and sent to market before they are three: their early maturity and the readiness with which they fatten make them suited for this system of farming. Graziers from the south and the middle of England drive a large number of this popular stock from the Hereford Candlemas and October fairs. The Hereford ox feeds more readily than the Devon (see 'Cattle,' 'Library of Useful Knowledge,' p. 32): and in proportion to the quantity of food consumed lays on a greater weight of flesh than a Durham ox: the result of a trial upon this latter point may be seen in 'Cattle,' p. 34. That the flesh of the Herefords is of a finer quality than the Durhams, is proved by the superior price per stone which it obtains in Smithfield market.

The usual breed of sheep is a cross between the Leicester and the Ryeland, which is found to succeed better than the pure Leicester or Southdown; the pure Ryeland are extinct. Welsh mutton may be procured in most of the country towns. Agricultural horses of average quality are bred in considerable number. The northern part of the county bordering upon Radnorshire and Shropshire produces many useful riding and coach horses, which have lately (1838) been much sought after by London and other dealers: they are highly bred, compact and active; an inferior race, fine in the bone, long in the joints, and generally with bad action, is found throughout the rest of the district. Pigs are chiefly procured from Wales, from whence a large supply of eggs and excellent poultry is sent to the market in Kington, and sold to dealers who forward them to Cheltenham, Gloucester, and other large towns.

Political Divisions.—Herefordshire is divided into the eleven following hundreds:—Broxash, Grimsworth, Greytree, Ewyas Lacy, Huntington, Radlow, Stretford, Webtree, Wormilow, Wigmore, and Wolphy. These contain 221 parishes, and seven market-towns. 1. The town of Bromyard, situated in the north-east of the county, is in the hundred of Broxash, the market-day is Monday, the distance from Worcester 14 miles, from London 126; 2. Hereford has been previously described; 3. Ross stands beautifully on the banks of the Wye, 14 miles below Hereford, in the hundred of Greytree, the distance from Gloucester is 17 miles, from London 120; the market-day is Thursday; 4. Ledbury is in the hundred of Radlow, 15 miles from Hereford, 15 from Gloucester, and 16 from Worcester; the town has lately been improved by the removal of some houses which impeded the thoroughfare of the principal street; the market-day is Tuesday; 5. Leominster, upon the river Lug, is situated in Wolphy hundred, 13 miles from Hereford, 26 from Worcester, and 128 from London. It is a borough and corporate town, returning two members to parliament. The church is handsome and the market-place old, but in an inconvenient situation; the market-day is Friday. Several considerable cattle-fairs are held, and an agricultural society has lately been established here. The following statement respecting this borough is extracted from the population returns.—

Leominster.

	Stat. Acres.	Inhab. Houses.	Males.	Females.	Gross Population.
Borough and Parish	1150	886	1996	2304	4390
Broadwood } Townships	8140	64	175	172	347
and Ivington } Townships		117	306	296	802

6. Kington stands upon the Arrow in the hundred of Huntington, 19 miles north-west of Heroford, 40 miles from Worcester, and 152 from London. The market, which is largely supplied with poultry and eggs, supplied from South Wales, is held on Wednesday; 7. Weobly, in Stretford hundred, is situated 13 miles from Hereford. The town has declined, and no weekly market is held. Many of the houses are extremely picturesque, and the church has considerable beauty. It was formerly a borough in the power of the marquis of Bath, and returned two members to parliament; no charter of incorporation is known, neither does the borough appear to have been governed by any municipal officer.

The principal villages are Eardisland, Eardisloy, Pembridge, Shobdon, Wigmore, Leintwardine, Orleton, Brimfield, Cradley, Mordiford, Abbey Dore, Madley, Letton, and Lynhales. The principal benefices are—

	Patron.	Net annual value without deducting for Curate.
Bromyard, 1st portion	Bishop of Hereford,	£535
Cradley	do.	937
Kington (with chapels)	do.	666
Ross	do.	1284
Whitbourne	do.	533
Lugwardine	Dean and Chapter	929
Woolhope	do.	644
Upton Bishop	do.	708
Shobdon	Lord Bateman	764
Kingsland	Wm. Evans	800

The churches of Kilpeck and Moccas are accounted the oldest in the county; the most distinguished for architectural beauty are at Ledbury, Leominster, Weobley, Dilwyn, Pembridge, Madley, Burghill, Abbey-Dore, and Kilpeck. The principal gentlemen's residences are, Eastnor Castle, a modern building of great size, and of considerable beauty, situated near Ledbury; Hom Lacy, which belonged to the late duke of Norfolk, now the property of Sir Edwin Stanhope; Hampton-Court, which was sold by the present earl of Essex to Mr. Arkwright, who is making extensive alterations under the direction of Mr. Hanbury Tracy; Stoke Edith, Berrington, Shobdon, Croft Castle, Moccas, Garnons, Foxley, Garnstone, Downton Castle, Kentchurch, Goodrich Court, Harewood, and Whitfield. Kinnersley Castle, situated in the parish of the same name, is one of the oldest inhabited houses that we are acquainted with; it is asserted that it was built before the Conquest. Alterynis near Rowlston, on the borders of Monmouthshire, was formerly the residence of the family of Cecils, from which Lord Burghley descended. There is at Brinsop a curious fortified house, now occupied as a farm-house.

In Herefordshire industry is occupied, with little exception, in agriculture and retail trade. The manufacture of gloves employs a considerable number of women in the central and western parts of the county; some coarse hats are also made. No coal or productive ore has been discovered here, and not a single steam-engine is at work. Limestone is burnt at Woolhope, Ledbury, Aymestry, &c.

Ecclesiastical and Legal Divisions.—With the exception of the parishes of Ewyas Harold, Walterston, Dewlas, Michaelchurch Escle, St. Margaret's, Rowlston, Llansillo, and Clodock, which are in the diocese of St. David's, the whole county is comprised in the diocese of Hereford. The diocese is in the ecclesiastical province of Canterbury. Herefordshire is included in the Oxford circuit; the assizes and quarter-sessions are held at Hereford. Three members are returned to parliament for the county, two for the city, and two for the borough of Leominster. Ledbury, Ross, and Bromyard antiently sent members to parliament, but were excused at the request of the burgesses themselves on account of the expense then attached to those who exercised the privilege of electors. The polling-places for the county are Hereford, Ross, Ledbury, Bromyard, Kington, Leominster, and Peterchurch.

Poor Law Unions have been formed, and workhouses been altered or newly erected at Hereford, Bromyard, Abbey Dore, Ross, Ledbury, Leominster, Kington, and Weobly; parishes belonging to this county have been included in the following unions, of which the centres are in other counties:—Abergavenny, Hay, Knighton, Ludlow, Monmouth, Newent, Presteign, and Tenhury.

History and Antiquities.—The greater part, if not the whole, of Herefordshire, was comprised in the territory of the Silures, and was conquered by the Roman general Julius Frontinus, about A.D. 73. A line of Roman and British entrenchments may be traced from the Malvern Hills to Whitbourn, Thornhury, Croft, Brandon (near Leintwardine), and Coxwall Knoll (near Brampton Brian). There are also traces of a camp on the east of Leintwardine, near Downton. Difference of opinion exists as to the exact localities of Magna and Ariconium, two Roman towns, which were probably comprehended within the present limits of this county; one of them douhtless was at Kenchester. The Roman road called Watling Street entered the county near Brandon, passed through Wigmore to Kenchester, and thence by way of Kingston and Dore to Abergavenny in Monmoutbshire. A second Roman road traversed a small portion of the south of this county near Ross; a third entered it from Worcester, and passing Frome-hill, Stretton Grandison, Luggbridge, Holmer, and Stretton Sugwas, reached Kenchester. Entrenchments exist, or are recorded to have existed, near the courses of each of these three roads. During the Heptarchy, Herefordshire belonged to Mercia, and in 680 a synod was held at Hereford. This city was the principal town of Mercia in the time of Offa, whose palace was situated at Sutton, about three miles north-east of the city. The murder of Ethelbert, king of the East Angles, whilst at the court of Offa, as a suitor to his daughter, enriched the town and increased its importance by the attraction of a number of pilgrims to his shrine, where miraculous appearances were supposed to occur. During the pilgrimage of Offa to Rome, whither he went to expiate his crime, he consented to subject his kingdom to the payment of Peter's pence.

The Danes, who bad previously ohtained a temporary possession of the kingdom of Mercia, regained it about A.D. 819, and appointed Cenolph king. Cenolph was defeated by Alured, king of the West Saxons, whose successor Egbert united the seven principalities into one monarchy. In 912 the Danes made an irruption upon the hanks of the Wye, which they had navigated from the Severn, and seized the bishop of St. David's, then resident in Archenfield. King Edward paid 40*l.* for the ransom of the bishop. The position of Herefordshire relative to Wales subjected it to continual inroads from the Welsh. A considerable part of the county was included in the 'Marches,' a term used to express no definite portion of country, hut the frontier in dispute between the Welsh and the English, varying from time to time according to their respective successes. In the time of Edward the Confessor such an invasion is recorded; Gruffyth, a Welsh prince, aided hy Algar, a banished earl of Chester, defeated Ranulph, earl of Hereford, witbin two miles of this city. Seven of the canons were killed in the engagement; the town and cathedral were fired, the walls were levelled, and the marauders retired to Wales loaded with the spoils of their richer neighbours (1055). Edward sent Harold to subdue the Welsh, and Hereford was invested and fortified; in the end a treaty was concluded. The violation of this treaty hy the Welsh induced Harold, after he became king, to march a second time upon their territory; after reducing them to great extremities he made an ordinance that if any Briton was found on the English side of Offa's dyke (an artificial boundary which in part of its great length has been traced through the county of Hereford), his right hand should be cut off hy the king's officers. In spite of these and other severe exactions, attacks continued to be made upon the persons and property of the Marchers. Edric, son of the earl of Mercia, made an assault upon Hereford, but the garrison repulsed bim, and in revenge laid waste his lands. In a second expedition Edric was more successful; with two Welsh princes for allies he ravaged the county as far as the bridge of the city, and returned with 'a marvellous great spoil.'

The survey contained in Domesday book was commenced thirteen years after this period, and completed in six years. Mr. Duncomb's 'History of Herefordshire' (vol. i., 60-65), contains a list of the hundreds and other divisions into which this county was at that time divided, together with the modern names of such districts, as far as they can be ascertained. The antient proprietors are also enumerated. Two of these proprietors, the earl of Hereford and Lord Mortimer, in the first year of William Rufus, joined Odo, bishop of Baieux, in an insurrection, and laid waste parts of the counties of Gloucester and Worcester. The oppressions of the Normans and the loss of liberties and privileges gave the English subjects just cause of complaint. The king raised an army and besieged the insurgents, who had retired to Pevensey. The result was that Odo consented to leave the county, and the king promised to redress the grievances which were complained of. The king granted many lands in Wales to knights and others of the English and Norman nobility, and to the Mortimers and Lacys amongst thom, on the tenure of knight's service. In consequence of the grants, and for their security, many castles were soon afterwards erected. Upon the borders hostilities commenced between the new possessors and the Welsh. With a similar intention of repressing the incursions of the Welsh, a colony of Flemings, driven from their own country by an irruption of the sea, were established in Pembrokeshire by Henry I. Notwithstanding these precautions hostile inroads upon the Marches still occasionally took place, but no event occurred which immediately affected this county, until the crown of England was in dispute between Stephen and Maud, the daughter of Henry I. Geoffrey de Talebot and Robert earl of Gloucester then declared in favour of the empress. Talebot retired to Hereford, hut soon quitted it, and the castle of Weobly, which had heen garrisoned against Stephen, was totally demolished. Stephen afterwards invested the city of Hereford, but the result of the siege is not known.

The demolition of castles enforced by Henry II., in order to limit the power of his barons, had no very beneficial effect on the security of Herefordshire: in some instances a temporary resistance was made to the king's command. These garrisons being destroyed, the Welsh, who had for a long time lived in comparative tranquillity, recommenced their depredations, which were not quelled until an English army had been marched against them. In the reign of Henry III., the whole of England was disturbed through the insubordination of the harons, but the insecurity of the Marches was increased by the neighbourhood of the troops of the Welsh Prince Llewelyn, who had been reinforced by several powerful allies; the lands of the Mortimers were ravaged and many other outrages committed. During the trouhled times of Edward II., Herefordshire was the scene of many executions. The king, who had been captured in Caermarthenshire, was carried to Ledbury on his way to Berkeley Castle; his adherents Hugh de Spenser, Baldoe, and Reding, were executed at Hereford. In the following reign Lord Mortimer with many other of the principal barons and knights of this county accompanied the king in his invasion of France, and John Chaundos Humphrey, earl of Hereford, Sir Richard Pembruge, and Sir Guy de Bryan, received as a reward for their military services the newly instituted order of the Garter.

No particular event occurred by which this county was locally affected, until the rebellion of Owen Glendwr threw the Marches into confusion, and renewed the feeling of insecurity and alarm which the Welsh had so frequently excited. [GLENDWR.]

During the wars of York and Lancaster this county did not escape the general commotion; a battle was fought at Mortimer's Cross in the parish of Kingsland, between the earl of March and the army under the carls of Pembroke and Ormond (1461); the latter, though defeated, effected their escape, but Owen Tudor, husband of Catherine of France, was taken prisoner and afterwards beheaded at Hereford. At the termination of these civil wars, there was again a period of tranquillity. In the 27th year of Henry VIII., 1535, by the act for the incorporation of England and Wales, Herefordshire acquired, or rather recovered, a considerable extent of territory; Wigmore, Stapleton, and Lohameis on the north side of the county, were appointed to constitute the hundred of Wigmore. On the west Ewyas Lacy was formed into the hundred of that name. Huntington, Clifford, Winforton, Eardisley, and Whitney, composed the hundred of Huntington, and Ewyas Harold was united with that of Webtree. Mr. Duncomb mentions that at this timo there wero twenty-one monastic institutions in this county, which were situated at Aconhury, Barton, Clifford, Craswell, Dewlas, Dore, Ewyas, Flanesford, Hereford (4), Kilpeck, Ledbury, Leominster, Lymehrook, Monkland, Shobdon, Titley, Wigmore, and Wormesley. The statement of Tanner is sligbtly at variance with that of Mr. Duncomh: in his 'Notitia Monastica,' an account of these religious houses may be referred to. After the death of Henry VIII., no event of immediate local importance occurred in the district that we are treating of until the period of the civil wars; at this time, notwithstanding the great complaints that the tax of ship-money had raised in this inland county, the greater number of the principal families engaged on the part of the king; on the side of the parliament wero those of Harley, Birch, Hereford, Westfaling, Hardwicke, &c. The city of Hereford was garrisoned for the king, but was surrendered without resistance to the parliamentary army under Sir William Waller. It was soon evacuated and again garrisoned in the royal cause under the command of Lord Scudamore, by whom it was resolutely defended. After the battle of Naseby the king marched to the relief of Hereford, and the Scotch army raised the siege. In the course of the year 1646, tho city was taken by surprise, and the whole county was reduced by detachments in the interest of the parliament, under the command of Sir William Waller and Colonel Birch. Colonel Birch was appointed governor, and his regiment increased to 1200 men. During the period of his concealment, Charles II. more than once passed through different portions of this county. The castle, which was greatly out of repair, was soon afterwards sold by order of the parliament. The keep has since been levelled, and no part of the walls remains: the site of those which cnclosed the larger court is now converted into a public walk.

The following is an alphabetical list of the castles which have existed in this county; in some instances the ruins are still visible, in others the demolition has been complete:—Brampton Bryan, Bredwardine, Clifford, Dorstone, Eardisley, Ewias Harold, Goodrich, Hereford, Huntington, Kilpeck, Longtown, Lynhales, Pembridge, Penyard, Snowdell, Stapleton, Tretire, Urish Hay, Welsh Newton, Weobley, Wigmore, Wilton.

The only druidical remains is a pile of stones called Arthur's Stone, situated in the parish of Dorstone. About a mile north of Hereford, on the Hay road, a monument commemorates tbe removal of the markets to this spot during the prevalence of an infectious disorder which raged in the city. Dr. Charlton, bishop of Hereford, is said to have erected the White Cross in 1347.

There existed in the antient territory of Archenfield, which was probably co-extensive with the present rural deanery of the same name, many privileges, usages, and customs, which would form interesting subjects for antiquarian research. The custom of Gavelkind long continued in force there.

Many persons of celebrity were born in this county: we may enumerate, among them, Roger Mortimer, earl of March; Robert Devereux, earl of Essex; Hakluyt; Garrick; and John Kyrle, the Man of Ross.

Statistics.

Population.—Herefordshire may be considered as entirely an agricultural county. In 1811 it ranked tbe second on the list of agricultural counties, in 1821 the third, and in 1831 the fourth. No manufacture worth notice exists in the county. Of 29,342 males twenty years of age and upwards living in the county in 1831 only 63 were employed in manufactures, about 40 of whom were engaged in making hats and gloves in Leominster; and 16,397 were occupied in agricultural pursuits.

The population of Herefordshire at each of the four enumerations made in the present century was—

	Males.	Females.	Total.	Increase per cent.
1801	43,955	45,236	89,191	..
1811	46,404	47,669	94,073	5·47
1821	51,552	51,691	103,243	9·74
1831	55,838	55,373	111,211	7·49

showing an increase between the first and last periods of 22,020, or not quite 25 per cent., which is 32 per cent. below the whole rate of increase throughout England.

The following table contains a summary of the population, &c., of every hundred, as taken in 1831:—

Summary of the County of Hereford.

Hundreds, Cities, or Boroughs.	Houses.				Occupations.			Persons.			
	Inhabited.	Families.	Building.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.	Males, twenty years of age.
Broxash, Hundred	2,315	2,522	10	88	1,702	467	353	6,066	5,715	11,781	3,173
Ewyas-Lacy	672	711	3	61	523	114	74	1,762	1,673	3,435	856
Greytree	2,374	2,508	13	97	1,302	700	506	5,833	5,853	11,686	3,093
Grimsworth	1,430	1,532	5	47	982	331	219	3,526	3,434	6,960	1,938
Huntington	1,170	1,276	11	56	621	395	260	2,913	3,058	5,971	1,611
Radlow	2,540	2,732	20	86	1,451	648	633	6,565	6,554	13,119	3,462
Stretford	1,706	1,808	4	76	1,286	348	174	4,226	4,302	8,528	2,268
Webtree	1,779	1,908	18	58	1,312	412	184	4,641	4,418	9,059	2,422
Wigmore	1,101	1,180	10	27	801	241	138	2,904	2,819	5,723	1,566
Wolphy	2,644	2,867	24	99	1,499	811	557	6,585	6,664	13,249	3,532
Wormelow	2,107	2,243	22	76	1,339	431	473	5,583	5,310	10,893	2,819
Hereford, City	2,069	2,278	19	98	70	1,207	1,001	4,709	5,573	10,282	2,602
Militia under Training								525		525	
Totals	21,907	23,565	159	869	12,888	6,105	4,572	55,838	55,373	111,211	29,342

County Expenses, Crime, &c.—The sums expended for the relief of the poor at the four dates of—

		£.		s.	d.	
1801	were	46,471,	being	10	5	for each inhabitant.
1811	„	82,981	„	17	7	„
1821	„	62,728	„	12	1	„
1831	„	62,622	„	11	3	„

The sum expended for tho same purpose for the year ending March, 1837, was 39,218*l.*; and assuming that the population had increased at the same rate of progression as in the ten preceding years, the above sum gives an average of 6*s.* 8*d.* for each inhabitant. These averages are above those for the whole of England and Wales.

The sum raised in Herefordshire for poor-rate, county-rate, and other local purposes, in the year ending the 25th of March, 1833, was 70,287*l.* 16*s.*, and was levied upon the various descriptions of property as follows:—

On land	£62,572	6
Dwelling-houses	7,068	11
Mill, factories, &c.	434	9
Manorial profits, navigation, &c.	212	10

The amount expended was—

For the relief of the poor	£ 60,233	6
In suits of law, removal of paupers, &c.	1,776	5
For other purposes	9,061	6
	71,070	17

In the returns made up for subsequent years, the descriptions of property assessed are not specified. In the years 1834, 1835, 1836, and 1837, there were raised 67,266*l.*

17s., 59,596*l.* 6*s.*, 52,121*l.* 16*s.*, and 48,650*l.* respectively; and the expenditure for each year was as follows:—

	1834. £.	s.	1835. £.	s.	1836. £.	s.	1837. £.
For the relief of the poor .	56,683	0	48,033	0	42,195	7	39,218
In suits of law, removals, &c.	2,244	16	1,224	8	1,701	11	1,073
Payment towards the county-rate . . .	9,354	16	5,436	10	3,539	8	4,248
For all other purposes			5,490	10	5,358	4	3,148
Total money expended	£68,282	12	60,174	8	52,794	10	47,687

The saving effected on the whole sum expended in 1837, as compared with the expenditure of 1834, was therefore 30 per cent.; and the saving effected on the sum expended for the relief of the poor was in 1837 nearly 31 per cent., as compared with that expended in 1834.

The number of turnpike trusts in Herefordshire, as ascertained in 1835, is 14; the number of miles of road under their charge is 553; the annual income in 1835, arising from the tolls and parish composition, was 30,663*l.* 1*s.* 7*d.*; and the annual expenditure, 25,305*l.* 14*s.* 8*d.*

The county expenditure in 1834, exclusive of that for the relief of the poor, was 5,365*l.* 12*s.*, disbursed as follows:—

	£.	s.	d.
Bridges, building, and repairs, &c.	473	9	5
Gaols, houses of correction, &c., and maintaining prisoners, &c. .	1,858	14	6
Shire-halls and courts of justice, building, repairing, &c. . .	172	15	6
Prosecutions . .	1,363	9	5
Clerk of the peace . .	202	19	7
Conveyance of prisoners before trial	180	19	4
„ transports .	169	17	7
Constables, high and special .	62	18	0
Coroner . .	143	8	3
Miscellaneous . .	737	0	5

The number of persons charged with criminal offences in the three septennial periods ending with 1820, 1827, and 1834, were respectively 750, 735, and 1078; making an average of 107 annually in the first period, of 105 in the second period, and of 154 in the third period. The number of persons tried at quarter-sessions, in each of the years 1831, 1832, and 1833, in respect to which any costs were paid out of the county rates, were 78, 57, and 51 respectively. Among the persons charged with offences, there were committed for—

	1831.	1832.	1833.
Felonies . . .	75	55	46
Misdemeanors . .	3	2	5

The total number of committals in each of the same years was 80, 58, and 55 respectively.

	1831.	1832.	1833.
The number convicted was .	53	40	45
„ acquitted .	18	13	5
Discharged by proclamation .	9	5	5

In 1837, at the assizes and sessions, 186 persons were charged with crime in Herefordshire. Of these, 9 were charged with offences against the person, only 2 of whom for common assaults; 18 with offences against property committed with violence; 145 with offences against property, committed without violence; 4 for uttering counterfeit coin; 3 for poaching; and 7 for riot or breach of the peace. Of the whole number of offenders, 102 were convicted, 48 were acquitted, no bill was found against 34, and 2 were not prosecuted. Of those convicted, only 1 was sentenced to death, which sentence was commuted to transportation for life; 4 others were sentenced to transportation for life; 2 for 14 years, 2 for 10 years, 9 for 7 years, and 2 for other periods; 4 were imprisoned for 2 years, 19 for one year, and 54 for 6 months or under; and 5 were fined and discharged on sureties. Of the whole number of offenders, 155 were males, and 31 were females; 79 could neither read nor write; 81 could read and write imperfectly; 23 could read and write well; 1 had received a superior instruction, and the degree of instruction could not be ascertained of the remaining 2.

The number of persons qualified to vote for the county members of Herefordshire is 7175, being about 1 in 15 of the whole population, and about 1 in 4 of the male population twenty years of age and upwards, as taken in 1831. The expenses of the last election of county members to parliament were to the inhabitants of the county 207*l.* 8*s.* 8*d.*, and were paid out of the general county-rate.

There are 4 savings' banks in this county. The number of depositors and amount of deposits on the 20th of November in each of the following years were—

	1832.	1833.	1834.	1835.	1836.
Number of depositors	3,875	4,087	4,562	4,793	5,197
Amount of deposits	£117,127	£118,484	£129,104	£132,773	£145,242

The various sums placed in the savings' banks in 1835 and 1836 were distributed as under:—

	1835. Depositors.	Deposits.	1836. Depositors.	Deposits.
Not exceeding £20	2,755	£19,975	2,938	£21,527
„ 50	1,262	38,073	1,410	42,462
„ 100	528	36,648	570	40,169
„ 150	143	17,725	172	20,280
„ 200	70	11,308	80	13,630
Above 200	35	9,044	27	7,174
	4793	132,773	5,197	145,242

Education.—The following summary is taken from the Parliamentary Returns on Education, made in the session of 1835:—

	Schools.	Scholars.	Total.
Infant schools	7		
Number of infants at such schools; ages from 2 to 7 years:—			
Males		32	
Females . . .		46	
Sex not specified .		224	
			302
Daily schools	327		
Number of children at such schools; ages from 4 to 14 years:—			
Males . . .		2,848	
Females . . .		2,842	
Sex not specified .		2,823	
			8,513
Schools .	334		
Total of children under daily instruction			8,815
Sunday-schools	144		
Number of children at such schools; ages from 4 to 15 years:—			
Males		2,335	
Females . . .		2,727	
Sex not specified .		2,532	
			7,594

If we assume that the whole population has increased since 1831 in the same ratio as it did the 10 years preceding that date, and also that the population between the ages of 2 and 15 has preserved the same relative proportion to the whole population as it did when ascertained in 1821, then we obtain 37,905 as the approximate number of children between the ages of 2 and 15 in this county in 1834, when the educational inquiry was made. Thirteen Sunday schools are returned from places where no other school exists, and the children (437 in number) who are instructed therein cannot be supposed to attend any other school; at all other places Sunday-school children have opportunity of resorting to other schools also; but in what number or in what proportion duplicate entry of the same children is thus produced must remain uncertain. Thirty-nine schools (containing 1937 children) which are both daily and Sunday schools, are returned from various places, and duplicate entry is therefore known to have been thus far created. Allowing for a number of children having thus been entered twice as under instruction, it may perhaps be fairly estimated that little more than one-third of the children between the ages of 2 and 15 are receiving instruction in this county.

Maintenance of Schools.

Description of Schools.	By endowment. Schls.	Scholars.	By subscription. Schls.	Scholars.	By payments from scholars. Schls.	Scholars.	Subscrip. and payment from scholars. Schls.	Scholars.
Infant Schools	—	—	2	64	3	50	2	188
Daily Schools	72	2586	37	1,832	203	3,740	15	355
Sunday Schools	13	830	124	6,321	..	..	7	443
Total...	85	3416	163	8,217	206	3,790	24	986

The schools established by dissenters, included in the above statement, are—

	Schools.		Scholars.
Infant school . .	—	containing	—
Daily schools . .	5,	,,	218
Sunday-schools .	24,	,,	1,494

The schools established since 1818 are—

	Schools.		Scholars.
Infant and other daily schools	138,	containing	4,026
Sunday-schools	105,	,,	5,073

Twenty-three boarding-schools are included in the number of daily schools given above. No school in this county appears to be confined to the children of parents of the Established church, or of any other religious denomination, such exclusion being disclaimed in almost every instance, especially in schools established by Dissenters, with whom are here included Wesleyan Methodists.

Lending-libraries of books are attached to 14 schools in this county.

HERESY, HERETICS. The word 'heresy' (from *αἵρεσις, choice*) was originally used to express any opinion which a man adopted. Thus it was applied to the philosophic sects of Greece and Rome. (Cicero, *Paradox. Proëm.*) In the New Testament the term often simply denotes a religious party, without implying any censure. (*Acts*, v. 17; xv. 5; xxvi. 5; xxviii. 22.) Josephus calls the three great Jewish sects '*heresies*.' (*Antiq. Jud.*, xiii., c. 5, s. 9.) But it is also used in the New Testament as a term of reproach. Thus it was applied by the Jews to Christianity (*Acts*, xxiv. 5, 14), and by the Apostles to those who resisted their doctrines (1 *Cor.*, xi. 9; *Gal.*, v. 20; 2 *Pet.*, ii. 1; *Tit.*, iii. 10). The fathers applied the words *heresy* and *heretics* respectively to opinions which were different from what they considered the doctrine of the Apostles, and to those who held such opinions, though some of the fathers draw a distinction between *heresy*, as a wilful rejection of the doctrines of Scripture, and errors arising from ignorance or weak judgment. When the creed of the church began to be settled by ecclesiastical councils, all who refused to submit to their decisions were denounced as heretics. They were also called *heterodox*, while those who adhered to the opinions of the church were called *orthodox*, or *catholics*. Heretics were distinguished from unbelievers, inasmuch as they professed Christianity. Heresy must not be confounded with schism: the former relates to doctrine; the latter is any division on points of discipline. The number of heresies mentioned by early ecclesiastical writers is from 80 to 150; but Lardner (*Hist. of Heretics*, i. 5) has shown that many of these ought to be excluded from the list; nor have we any evidence that many of them had numerous followers.

Most of the heresies of the first two centuries related to the creation of the world, the origin of evil, the person of Christ, and the connection between Judaism and Christianity; and nearly all may be included under two great sects:—1. The Ebionites and Nazarenes, who, upon embracing Christianity, adhered to many Jewish opinions and ceremonies. 2. The Gnostics, who engrafted upon the Christian religion certain opinions of the Greek and Oriental philosophy. Some however regard the Ebionites as a sect of Gnostics.

Both these heresies are supposed to have commenced in the Apostolic age, and to be referred to in the writings of St. Paul and St. John. [EBIONITES; GNOSTICS.]

The Gnostics appear to have been very early divided among themselves concerning the respect which ought to be paid to the Mosaic law, and a new sect was formed by a Jewish Gnostic named Cerinthus. [CERINTHUS.] The Nicolaitans mentioned in the 'Apocalypse' (ii. 6, 15) are supposed to have been a sect of Gnostics, and some identify them with the Cerinthians. About A.D. 121, Valentinus, an Egyptian, engrafted some opinions of his own upon Gnosticism, and founded a new sect. His party was strongly opposed by Irenæus and Tertullian. Another sect which took its rise from the opinions of the Gnostics was that of Cerdo and the more celebrated Marcion, who began to propagate their tenets at Rome about A.D. 130. The principal feature of this heresy was the adoption of the Oriental belief in two supreme powers, the one good and the other evil. The principal followers of Marcion were Lucian, or Leucius, and Apelles. About A.D. 172, Bardesanes and Tatian gave rise to a new sect of Gnostics, which was chiefly distinguished by the practice of an austere discipline. These people were called, from their habits of abstinence, Encratites, Hydroparastates, and Apotactites. The Docetæ were a sect of Gnostics who sprung up very early. They held that the body of Christ was immaterial, and therefore did not suffer on the cross, but only appeared to die. Several minor sects of Gnostics are mentioned by antient writers, such as the Adamites, the Cainites, the Sethians, and the Ophians, an account of which is given in Lardner's 'History of Heretics.' He doubts the existence of such sects as the Adamites and Cainites. The sect of Eclectics, or New Platonists, was founded at Alexandria in the second century; but though its tenets were embraced by many Christians, it is rather to be regarded as a philosophical than a Christian sect. [ECLECTICS.]

We now come to the heresies which existed from a very early age respecting the divinity of Christ. This doctrine was denied by some of the Ebionites in the second century. [EBIONITES.] About the end of that century Praxeas founded a new sect. Denying the doctrine of the Trinity, he held that the divine nature was intimately united with the person of Christ, whom he considered to be a mere man, but born of a virgin. His followers were called Monarchists, from their rejecting the doctrine of the Trinity; and Patripassians, because they were supposed to believe that the Father suffered on the cross: this opinion however they seem to have disclaimed. In the opinions of Praxeas ecclesiastical historians trace the germ of the Sabellian heresy. His chief antagonist was Tertullian. His opinions were held, with some slight variations, by his contemporaries Artemon and Theodotus. Among the heresies of this age respecting the creation of the world was that of Hermogenes, who believed in the eternity of matter.

The Montanists, who arose in Phrygia about the year 170 (some say 150), are rather to be looked upon as fanatics than heretics. Their leader Montanus claimed the character of a prophet: he appears to have differed from the orthodox in no leading doctrine, but only in some points of discipline. His opinions owe their celebrity chiefly perhaps to the circumstance that they were embraced by Tertullian. [TERTULLIAN.] We find traces of this heresy down to the time of Augustin and Jerome. Some inconsiderable heresies arose in the second century on points connected with the rites and ceremonies of the church, such as the Artotyrites and others. [COMMUNION.]

In the third century Gnosticism still had adherents, though it was fast falling into disrepute. But a new heresy arose out of the Oriental philosophy, headed by Manes, who attempted to unite the doctrines of the Persian Magi with those of the Apostles. [MANICHÆANS.] The controversy on the Trinity and the person of Christ continued with increasing warmth. About the middle of the century the doctrines of Praxeas were revived, with slight variations, by Noëtus of Smyrna, Sabellius, an African bishop, and Beryllus, an Arabian. The last two were opposed by Dionysius of Alexandria and Origen. [SABELLIANS.] Another heresy relating to the same subject was established by Paul of Samosata, bishop of Antioch. A new sect of Ebionites, or Jewish Christians, appeared about the middle of the third century, but it lasted only for a short time. They were called Elcesaites, from their founder Elxai. The Novatians, followers of Novatian, a presbyter of Rome, are reckoned, perhaps erroneously, among the heretics of this century. They held no doctrine different from those of the Catholic church, but maintained a greater severity of discipline; and hence they were called Puritans (*καθαροί*). By some historians they are regarded as austere and turbulent fanatics, while others rank them as the earliest sect of reformers in church discipline.

In the fourth century the attention of the church was chiefly occupied with the Arian controversy [ARIANS; ARIUS.] Out of these disputes other heresies arose respecting the person of Christ, such as that of Apollinaris [APOLLINARIS], Marcellus, Photinus, and Macedonius. Near the end of this century we find a new sect of Gnostics in Spain, under the name of Priscillianists. The Donatists, who caused great commotions in the church during this century, are rather to be classed with schismatics than with heretics. [DONATISTS.] For an account of certain minor sects in the fourth century, see Epiphanius, *De Hæresiis*.

At the beginning of the fifth century the Pelagian controversy arose. [PELAGIANS.] The disputes concerning the Trinity and the person of Christ continued to give rise to new sects, the chief of which were the Nestorians and their opponents the Eutychians, or Monophysites. [EUTY-

CHIANS.] The controversies of these sects with the orthodox and each other continued nearly 200 years, producing various minor sects, such as the Monothelites [EUTYCHIANS], the Anthropomorphites (who maintained, from *Genesis*, i. 27, that God had a human shape), and others.

The rapid spread of the monastic system in this century was warmly resisted by Vigilantius, who thus incurred the enmity of Jerome, and has been ranked among the heretics.

In the sixth century the Monophysites continued to branch out into new sects, several of which arose on the question whether the body of Christ was corruptible or incorruptible. Other minor sects are mentioned by Mosheim. (*Ecc. Hist.*, vol. ii.) After this time most of the antient sects remained in existence in different parts of the Christian world with greater or less vigour. The only new sect which requires a distinct notice is that of the Paulicians, which was formed in Armenia and Cappadocia in the seventh century. After suffering severe persecutions they were dispersed over Europe, in various parts of which they formed settlements about the eleventh century. The origin of the Albigenses is traced to a body of Paulicians which settled in France. [ALBIGENSES.] The doctrines of the Paulicians have been identified by some with those of the Manichæans, while others regard them as reformers of the corruptions of the church. (Vaughan's *Life of Wycliffe*, Introd., c. ii.) The history of later sects merges in that of the Reformation.

(Epiphanius, *De Hæresiis*; Lardner's *History of Heretics*; Gibbon's *Roman Empire*; Mosheim's *Ecclesiastical History*; Neander's *Kirchengeschichte*.)

HERI'ADES, a genus of Hymenopterous insects of the section Mellifera (Latreille), and family Apidæ. Distinguishing characters:—body elongated, slender, almost cylindrical, that of the males with a small cavity beneath near the apex; mandibles triangular; maxillary palpi two-jointed.

The little bees belonging to this genus, we are informed by Latreille, make their nests in holes in old trees; we presume that, as in the genus Chælostoma, the holes are made by the bees themselves.

Heriades Campanularum, a species very common in various parts of England, is about a quarter of an inch in length, of a black colour, and sparingly covered with grayish hairs. This little bee is by far the smallest British species known of the family to which it belongs; it is common during the summer and autumnal months in the flowers of the various species of Campanulæ, and apparently is never found in the flowers of any other genus of plants. 'The males are often taken asleep in these flowers; their abdomen is then doubled, so that the tubercle with which its base is armed fits into the cavity near the anus.' (See Kirby's *Monographia Apum Angliæ*, vol. ii., p. 256-7. For detailed characters of the genus, see Latreille's *Genera Crustaceorum et Insectorum*, Paris, 1806, 1807.)

HERIOT is a feudal service consisting in a chattel rendered to the lord on the death of a tenant, and in some places upon alienation by a tenant. It is stated to have originated in a voluntary gift made by the dying tenant to his lord and chieftain of his horse and armour. (Glanvile.) This render became first usual, then compulsory; and at an early period we find the antient military gift sinking into the render of the best animal (at the election of the lord) possessed by the tenant, and sometimes a dead chattel, or a commutation in money. (Bracton; *Fleta*; *Coke-Littleton*.)

Heriots are either heriots-custom or heriots-service. Where a heriot is due from the dying tenant by reason of his filling the *character* or *relation of tenant* within a particular seigniory, honour, manor, or other district, in which it has been usual from time immemorial to make such renders upon death or alienation, it is called *heriot-custom*: *heriot-service* is a heriot due in respect of the *estate* of the tenant in the particular land held by him.

For heriot-custom the lord cannot distrain, because the duty arises out of the character or relation of tenant sustained by the party within the seigniory, &c., in which the custom is found to exist, and not, as in the case of heriot-service, in respect of the particular land holden. As the selection of the best animal is however with the lord, he may determine his choice by an actual seizure, upon which the property in the animal will vest in the lord by the mere act of seizing it.

But for heriot-service the lord may either seize or distrain. He may seize, because by this act of selection the property is vested in him; or he may distrain, because, the land being the debtor, the lord may, by the coercion of a distress upon that land, compel the succeeding tenant to deliver or procure the delivery of the heriot.

Where the heriot-service has been created since the time of legal memory, it is called a *heriot by reservation*, and sometimes a *suit-heriot*: if its origin go back beyond the limits of legal memory, it is called a *heriot by tenure*.

Heriot-custom formerly prevailed very extensively in freehold lands, but is now more commonly found in lands of customary tenure, whether copyholds,—the conventionary estates in Cornwall, held under the duke of Cornwall,—the customary estates called *customary freeholds* in the northern border counties,—or lands in antient demesne.

Heriot-service may be reserved in respect of a freehold, a leasehold, or a customary tenure; but as, since the statutes of Quia Emptores and Prerogativâ Regis, it is probable that no new sub-tenures in fee have been created, and as it has not been usual to reserve heriots upon gifts in tail, or upon the creation of freehold leases for lives, heriot-service in modern times is generally found in connection with long leasehold estates, where, in consequence of some restriction imposed upon the exercise of the leasing power, or in token of respect for antient usages, this species of render has been retained.

Heriots, whether heriots-service or heriots-custom, are multiplied whenever the land subject thereto becomes divided amongst different tenants holding distinct parts of such lands in severalty. Where therefore land is held subject to a heriot-service to be rendered at the death of a tenant, if the tenant alien part of the land a distinct heriot will be due upon the death of both the alienor and the alienee· and if such distinct heriots have in fact become due and have been rendered or compounded for during the alienation ,whereby the lord will have obtained actual seisin of the several heriots), the liability to pay such multiplied heriots will continue, even though all the land should afterwards be reunited, and vest again in the same person. Inattention to these rules has lately caused some strange and contradictory decisions in the courts of Westminster. (2 Nevile and Mann, 798.)

A distress for heriot-service must be taken upon the land in respect of the tenure, or upon the demise of which it is reserved; and where double or treble heriot has become payable by reason of alienation, the liability attaches severally upon each of the severed portions of the estate. All goods found upon the land, except such as are privileged from distress [DISTRESS], may be taken as a distress for a heriot-service, whether they belong to the tenant or to a stranger, such goods being held merely as a pledge for the performance of the service. But where a heriot-service is by the terms of the reservation commuted for a money payment (or rather, where the reservation of a contingent money payment is improperly designated a heriot), the reservation will be in substance a rent; and therefore the distress taken for this reservation (so miscalled a heriot), if not redeemed by payment, or replevied within five days after notice, may be sold as a distress for rent under the provisions of 2 William and Mary, c. 5.

Heriots were known in England before the complete development of the feudal system which followed upon the Norman conquest. The Normans introduced reliefs [RELIEF] without abolishing the analogous heriot. The *heregeate* (heriot) is mentioned and fixed by the laws of Canute, 67, &c. The Dano-Saxon 'heregeat' is derived by Spelman, and after him by Wilkins, from *herge* (more properly *here*), army. A more probable derivation would be from the word 'herr,' lord. In Scotland, where the render upon the death of the tenant is a pecuniary payment, it is called 'lord's money,' 'hergeld,' or 'herrezeld.'

HERM, sometimes called *Erm* and *Arm*, one of the smaller Channel Islands, lying three miles east of Guernsey, is held by lease, under the governor of Guernsey for the time being, for sixty-one years, renewable every twenty-one years. In February, 1837, the privy-council decided that for all legal purposes Herm forms part of the Island of Guernsey. For a description of Herm see GUERNSEY.

HERMANN, the Arminius of the Roman historians, the son of Sigimer, chief of the Cherusci, was born about 16 or 17 years B.C. [CHERUSCI.] Being sent in early youth as a hostage to Rome, probably in consequence of the victories of Drusus, which had established the supremacy of Rome over the Catti, Cherusci, and other tribes of North Germany, he obtained the favour of Augustus, and was inscribed among the Roman knights. On his return to his native country, he conceived the project of delivering it from the Romans, whose oppression had become intolerable. Quintilius Varus, a rapacious man, was then the Roman governor in Germany. Hermann pretended to be his friend, while at the same time he kept up a secret understanding with the chiefs of the Catti, Bructeri, and other tribes that lived between the Rhine and the Albis (Elbe), some of which broke out into insurrection. Hermann offered Varus his assistance in reducing them to subjection, and thus enticed him to advance some distance from the Rhine into the interior. Varus began his march with three legions, six cohorts, and a body of cavalry, and Hermann served him as a guide through the forests. The Romans were thus drawn into an ambuscade, and found themselves all at once surrounded by numerous bodies of Germans, who were directed by Hermann himself. The Romans fought desperately; but being unacquainted with the localities, and unable to form their ranks owing to the thickness of the forests and the marshy nature of the ground, they remained exposed for two days to the missiles of the Germans, who destroyed them in detail. At last, Varus, being wounded and seeing no chance of escaping, run himself through with his sword, and the other chief officers followed his example. The legions were entirely destroyed, and the cavalry alone cut their way through the enemy and regained the banks of the Rhine. By this defeat the Romans lost all their conquests beyond that river; and although Germanicus some years after again carried their arms to the Weser, they never established anything like a solid dominion over those regions. The defeat of Varus occurred, according to various chronologists, in tho year 763 of Rome (A.D. 9). The scene of the defeat is conjectured to have been in the country of the Bructeri, near the sources of the Ems and the Lippe. The news of this calamity, the greatest that had befallen the Roman arms since the defeat of Crassus, caused much alarm at Rome.

The fears however which were entertained that the Germans might invade Gaul, were not realized. L. Asprena guarded the banks of the Rhine, and the Germans were too little united among themselves to attack the Empire. Augustus in the following year sent Tiberius to the Rhine with a fresh army, who does not seem to have effected anything of importance. Hermann meantime quarrelled with Segestes, chief of the Catti, whose daughter Tusnelda he had carried off, and married against her father's consent. When Germanicus, after tho death of Augustus, marched into the interior of Germany to avenge the defeat of Varus, he was assisted by Segestes, and also by the Chauci and other tribes. [GERMANICUS.] In the first battle against Hermann his wife Tusnelda was taken prisoner by the Romans, and she afterwards figured in the triumph of Germanicus. Germanicus having reached the scene of Varus's defeat, paid funeral honours to the remains of the legions; but Hermann, who was hovering about his line of march, without coming to a pitched battle, harassed him in his retreat, and occasioned a great loss to Cæcina, the lieutenant of Germanicus. (Tacitus, *Annal.*, 1.) In the following year Germanicus advanced again as far as tho Visurgis, or Weser, where he found Hermann encamped ready for battlo. A desperate fight took place, in which Hermann, after performing prodigies of valour, was defeated, and escaped with difficulty. When Tiberius recalled Germanicus, he observed that the Cherusci, Bructeri, and other unsubdued tribes might be left to their own internal dissentions. He seems to have guessed right, for a war broke out soon after between Hermann on one side and Maroboduus, king of the Suevi, on the other, who was accused of aspiring to absolute dominion. The Semnones and the Langobards joined Hermann, who defeated Maroboduus on the borders of the Hercynian Forest, and obliged him to seek refuge among the Marcomanni, from whence he applied to Rome for assistance. Tiberius then sent his son Drusus into the Illyricum; but the Romans did not advance beyond the Danube, and Hermann remained unmolested in Northern Germany. Shortly after however Hermann was killed by his own relatives, being accused, as it would seem, of aspiring to absolute dominion. He died at the age of thirty-seven, in the twenty-first year of our æra, after being for twelve years the leader and champion of Germany.

HERMANSTADT. [TRANSYLVANIA.]

HERMAPHRODITE. [MONSTER.]

HERMAS, a Christian writer of the first century; who is said by Eusebius (*Hist. Eccl.*, iii. c. 3) and Jerome (*De Illustr. Viris*, c. 10) to have been the same individual whom St. Paul salutes in his epistle to the Romans (xvi. 14). He was the author of a work entitled 'The Shepherd;' which is called by this name because the angel who bears the principal part in it is represented in the form of a shepherd. This work is divided into three books; of which the first contains four visions; the second, twelve commands; and the third, ten similitudes. Du Pin remarks (*Eccles. Hist.*, vol. i., p. 27, Eng. Transl.) that 'these three books comprehend very many moral instructions concerning the practice of Christian virtues; but the great number of visions, allegories, and similitudes make them tedious; and all these moral truths would have been more useful if the author had propounded them simply, as the apostles have done in their epistles.' But Hermas appears to have followed the plan of the Apocalypse; which he has imitated in many parts of his work. Lardner in his 'Credibility of the Gospel History' (*Works*. vol. ii., p. 69—72) has given many instances of such imitations. Mosheim (*Eccles. Hist.*, vol. i., p. 100-1, ed. of 1826) and many other critics have mantained that the 'Shepherd' was written by Hermes, who was a brother of Pius, bishop of Rome, in the year 141.

The 'Shepherd' of Hermas is frequently quoted with the greatest respect by almost all the early Christian writers. We learn from Eusebius (*Hist. Eccl.*, iii., c. 3, 5) and other writers that it was received by many churches as a canonical work. It is quoted by Irenæus and Clement of Alexandria as a part of Scripture, and also by Tertullian, before he became a Montanist (see the passages in Lardner's *Works*, vol. ii., pp. 186, 249, 303, 304). Origen also considered it of divine authority; but informs us that it was rejected by some churches. After the time of Origen its canonical authority appears to have been generally denied. Eusebius, Jerome, Athanasius, Ruffinus, Gelasius, and Prosper expressly declare that it should not be included in the canon.

The 'Shepherd' contains no express citations of any books of the Old or New Testament. This work was originally written in Greek; but there is only an antient Latin version of it extant. There is an English translation by Wake, London, 1693 and 1710.

(Lardner's *Works*, vol. ii., pp. 57—73; Du Pin's *Ecclesiastical History*, vol. i., pp. 26, 27; Wake's *Preliminary Discourse*, c. viii.; Tillemont's *Mém. Eccles.*, vol. ii., part 1.)

HERMES, an antient Greek divinity, known to the Romans as Mercurius, was, according to Hesiod (*Theog.*, 942), the son of Zeus and Maia, the daughter of Atlas. The attributes of this deity are numerous and of opposite kinds; but it appears probable that he was originally considered to preside over flocks and herds. Hesiod says (*Theog.*, 441) that the shepherds address their prayers to him; for which reason the statues of Hermes are frequently represented with a ram by his side or on his shoulders. (Pausan., ii. 3, 4; v. 27, 5; ix. 22, 2. See also *Iliad*, xiv. 490-1.) The phallic form, which distinguished the statues of Hermes at Athens (Herod., ii. 51), also appears to indicate that this god was considered to increase the fruitfulness of the fields and cattle. Herodotus informs us (ii. 51) that the Athenians were taught by the Pelasgians this manner of representing the statues of Hermes; and that the reasons for this custom are explained in the Samothracian mysteries. Hermes was represented in a similar manner at Cyllene in Elis. (Pausan., vi. 26, 3.) This custom is also maintained by Cicero (*De Nat. Deor.*, iii. 22) and Macrobius (*Saturn.*, i. 19). According to some traditions, Hermes is said to have been born in Arcadia (Pausan., viii. 16, 1), and to have been the father of Pan; but according to another tradition, he was born at Tanagra in Bœotia. (Pausan., ix. 20, 3.) He was worshipped by the Thessalians above all other deities. (Herod., v. 7.)

In Homer the name of this deity is usually Hermeias. Ho is represented as the messenger of Zeus and the gods, and he conducts the souls of the departed to Hades. In later times he was regarded as the god of eloquence; the inventor of the lyre and weights and measures; the patron of merchants and of gain, and even of thieving; and the protector of heralds, poets, musicians, and wrestlers. Statues of Hermes, which were originally square blocks with a carved head upon them, were placed in the doorways of most private houses and temples at Athens. (Thucyd., vi. 27.) They were also erected where several roads met, to point out the way, and in the gymnasia, or public places of exercise.

Hermes is usually represented with a chlamys, or cloak; a petasus, or winged cap; talaria, or winged sandals; and a caduceus, or wand, with two serpents twined about it, in his hand.

The Egyptian god Thoth was also called Hermes by the Greeks. His attributes correspond in many respects with those of the Grecian deity. According to Plutarch (*Sympos. Probl.* 3), the Egyptian Hermes is said to have invented letters in Egypt. According to Diodorus Siculus, who appears to have confounded the attributes of the Egyptian and Grecian deity, he was the inventor of almost all the arts and sciences (i., p. 14, 15, 41, *Rhodoman; Egyptian Antiquities*, i. 46, 105; ii. 309, 366).

A great number of philosophical and astrological works, purporting to be written by the Egyptian Hermes, were in circulation in the early ages of the Christian æra; most of them appear to have been written at Alexandria by Gnostic Christians or philosophers of the Aristotelian or of the new Platonic schools. Clement of Alexandria mentions (*Strom.* iv., p. 633) forty-two works which bore the name of Hermes; and the number became much greater afterwards. A few of these works are still extant, and are entitled—1, 'Pœmander, on the power and wisdom of God.' The Greek text of this work was first published by Turnebus, Paris, 1554; a Latin translation had previously been published by Ficinus, 1472, 1483. The Greek text has also been published by Rosellus, Cologne, 1630, the best edition; and by Patricius, in his 'Nova de Universis Philosophia,' Venice, 1593; reprinted at London, 1611. The 'Pœmander' has been translated into Italian by Benci, Florence, 1548; into French by De Foix, Bordeaux, 1579; into English by Everard, London, 1650; into German, Anonymous, Hamburg, 1706; and by Tiedemann, Berlin and Stettin, 1781. Tiedemann thinks that the 'Pœmander' was not written before the fourth century. 2, 'Asclepius' is a dialogue between Hermes and Asclepius, the grandson of the inventor of medicine, on the deity, mankind, and the world. This work was originally written in Greek; but there is only a Latin translation extant, which is attributed by some critics to Apuleius. The 'Asclepius' is printed with most of the editions of the 'Pœmander.' 3, 'Iatromathematica,' in which the origin and termination of disease are taught by astrology. The Greek text of this work was first published by Camerarius, together with other astrological works, 4to., 1532; it was reprinted by Hoeschelius, 8vo., 1597. 4, 'Two Books on Nativities,' supposed to have been written by an Arab, published at Basel, 1559. 5, 'Astrological Aphorisms,' published at Venice, 1493; Basel, 1533 and 1551; Ulm, 1651 and 1674. 6, 'Curanides,' on the medical and medicinal virtues of precious stones, plants, animals, and fishes; published by Rivinus, 8vo., Leip., 1638, and 12mo., Frankfort, 1681. There are also several works, attributed to Hermes, on the virtues of metals and the secrets of the philosopher's stone; of which an account is given by Fabricius, in his 'Bibliotheca Græca,' vol. i., book i., c. 10, p. 75—80, ed. Harles.

HERMEIAS. [ARISTOTLE.]

HERMIT CRAB, the common English name for the well-know crustaceans that occupy the empty turbinated shells of testaceous mollusks. [PAGURIANS.]

HERMO'GENES, surnamed Xyster, one of the first rhetoricians of antiquity, was a native of Tarsus, and lived under Marcus Aurelius. At the age of fifteen, it is said, he was professor of Greek eloquence at Rome, where his lectures were attended by that emperor. At the age of eighteen he wrote his work on the oratorical art, consisting of four sections: 1. De Partitione Statuum et Quæstionum Oratoriarum. 2. De Inventione. 3. De Formis Oratoriis. 4. De Eloquentia Methodus. His illustrations and quotations are chiefly taken from the 'Orations' of Demosthenes. The work of Hermogenes was held in high esteem, and became a standard book in all Greek schools. It has been repeatedly printed in the Greek text, and Gaspard Laurent published it with a Latin translation and commentaries, 8vo., Geneva, 1614. Hermogenes had joined to his work a book of 'Progymnasmata,' or specimens of oratorical exercises, which Priscianus translated into Latin, the Greek text of which has remained inedited till the end of the last century, when it was first published by A. H. L. Heeren, and has since been republished by Veesenmeyer, 8vo., Nürnberg, 1812, and by others. At the age of twenty-five Hermogenes is reported to have entirely lost his memory, and to have lived to an advanced age in a state bordering on idiotcy. (Philostratus, *Lives of the Sophists;* Suidas; Fabricius, *Bibliotheca Græca;* Schoell, *History of Greek Literature.*)

HERMOGENES, or HERMOGENIANUS. [CORPUS JURIS.]

HERMUND, or HELMUND. [AFGHANISTAN.]

HERMUS. [ANATOLIA.]

HERNAN, or FERNANDO DE PULGAR. [PULGAR.]

HERNIA (from ἔρνος, *ernos*, a branch), signifies the protrusion of any organ from its natural position in the body; as hernia cerebri, hernia pulmonis, when the brain or lung protrudes through an aperture in the skull or the chest. But when used alone, this term means what is commonly called a rupture, that is, the protrusion of any portion of the intestinal canal from the cavity of the abdomen.

Herniæ sometimes form without any evident cause, the intestine being gradually protruded; but more frequently they result from some violent bodily exertion, as lifting heavy weights, excessive coughing or straining; or from sudden jarrings or shocks, as in jumping or falling; or from blows on the abdomen.

The general characters distinguishing a hernia are, a tumour, neither red nor hot, and often not painful, situated at some part of the abdomen, most frequently in or near the groin; largest when the patient stands up, and often disappearing entirely when he lies down; distended by coughing or other violent expiration, and liable to variation in size by exercise or rest, by abstinence or taking food; often producing disorders of the digestive canal, as flatulency, colic, &c. In the cases in which the hernia forms suddenly, as in consequence of a great exertion, the patient feels as if something had given way at the groin or other part of the abdomen, and on putting his hand there he feels a tumour which may vary in size from that of a nut to that of his fist, is elastic, hard, and tense, and soon after the accident becomes painful and tender. In the other class of herniæ, which may be called spontaneous, the tumour forms almost imperceptibly to the patient, and grows larger regularly but slowly; is attended with no pain, but merely a sense of weakness about the part; and decreases greatly or entirely disappears in the recumbent posture. If a hernia can be returned into the abdomen at pleasure, it is not by itself a dangerous disease; but if it becomes strangulated, that is, if the intestine is so constricted by the parts through which it has passed that its contents cannot pass through it, and its vessels are so much compressed that active inflammation is excited, it constitutes one of the most serious accidents to which the human body is liable. The symptoms indicating strangulation of the intestine are obstinate constipation of the bowels; pain and tenderness of the tumour, and spreading from it over the whole surface of the abdomen; extreme restlessness and languor; nausea and vomiting; a hard, small, and rapid pulse; thirst and coldness of the limbs. If the hernia be not reduced, these symptoms will regularly increase, till mortification of the intestine ensues, and (except in some most rare cases) death rapidly follows.

The above symptoms and other circumstances are common to all herniæ wherever situated, and are only modified slightly by the part of the abdominal contents protruded, the narrowness of the part through which it is forced, and the constitution of the patient. But there are some local circumstances peculiar to each, according to the part at which the intestine is protruded, which require to be noticed in connexion with the mode of returning each into the abdomen and of retaining it there.

The most frequent kind of rupture is the Inguinal, and it is far more common in males than in females. It forms a tumour, occupying either the groin alone, or extending thence more or less obliquely downwards between the thighs. To reduce it the patient should be laid on his back with his loins lower than either his shoulders or his hips, and the knee of the side on which the hernia has formed should be raised and turned a little inwards. The operator grasping a convenient portion of the tumour with his right hand, should press it in the direction contrary to that in which it has protruded, and there retain it, while with his left finger and thumb placed at the narrowest part of the swelling he moves the intestine from side to side, alternately pressing and relaxing it, so as to empty some of its contents, and force it into the abdomen. If any portion be pressed through, a slight gurgling noise will be heard, and by continued efforts the whole will most probably follow.

An inguinal hernia may attain the size of an adult's head or more; but a Femoral hernia, which is the kind most common in females, is rarely more than two inches in diameter, and generally much less. It is usually of a rounded form, situated just below the groin, about two inches from the middle line of the body, and always feels hard and tense. The principal constriction is deep in the thigh, directly under the tumour, which tends to pass upwards over the groin. In reducing it the position of the patient should be the same as for inguinal hernia: if the tumour be large enough to grasp, it should be pressed directly backwards, as if to force it deeper into the thigh; but if it cannot be grasped, it should be pressed in the same direction, with the balls of the thumbs placed side by side upon it.

In umbilical and ventral herniæ, which come straight out from the front of the abdomen, the globular and pendant tumours which they form, and which often attain a considerable size, should be grasped with one hand, and pressed directly backwards towards the spine, while the opposite hand, as in inguinal herniæ, guides the successive portions through the aperture.

Whatever be the situation or condition of a hernia, it should be at once, if possible, reduced. The patient should go to bed, and, after lying a short time on his back, with his knees raised, the intestine will often of itself recede into the abdomen, especially if it have been frequently protruded; but if it do not, then the manual operation just described should be employed. The force used in it should never be so violent as to give much pain, and in old herniæ little or none should be caused; nor should the manipulation be continued for more than a quarter of an hour at a time, nor so long as to bruise the tumour or make it tender. If it fail, there are several auxiliary means that may be employed, of which a selection must be made according to the circumstances of each individual case. The warm bath should be first tried in all cases; the patient should be placed up to the neck in water at a temperature of from 94° to 100°, and remain there till he becomes quite faint. Any pain or irritation that previous attempts at reduction may have produced will be greatly relieved by these means, and the state brought on by the bath is peculiarly favourable for the return of a hernia, both by relaxing all the tissues surrounding it, and, when faintness occurs, by relieving the intestine from the pressure of the muscles, which often present the chief obstacle to its return, but which in that state become powerless. As soon therefore as the patient complains of faintness, or after he has been in the bath for ten minutes or a quarter of an hour, an attempt should be made to reduce the hernia by manipulating it as already directed under water. In strong and robust men, and especially in cases where the hernia has recently formed, bleeding to faintness, either before or while in the bath, should be employed, and the same opportunity taken to try to replace the intestine. The abstraction of blood will be useful, not only by the faintness which it produces being a favourable state for reducing the hernia, but by its relieving the inflammation which always arises when the intestine is strangulated, and by checking it in its fatal progress. If the warm bath and bleeding fail, the patient should be placed between warm blankets to recover from their depressing effects, and no more manual attempts should be made for some time. The next means employed should be the continued application of cold by ice or a rapidly evaporating lotion laid over the tumour, and kept there, unless it produces much pain, till all the tissues are contracted and hard, for it is by their equable and powerful contraction on the intestine, and by the diminution of its volume, that reduction is sometimes thus effected even without manipulation. Should this fail, and the symptoms of strangulation be increasing, the only means left before resorting to operation is the tobacco enema. Great caution is necessary in employing it; it should never be used except in otherwise healthy and tolerably strong persons, nor till the other means have failed. A dram of tobacco being steeped in a pint of boiling water for ten minutes, half the infusion thus made should be used first; and if it produce no evidently depressing effect, the other half may be injected in half an hour afterwards. The usual consequence is an extreme degree of languor and sinking, a kind of deadly coldness and paleness, and the last stage of depression: in this state a last attempt at reduction should be made; and if still unsuccessful, an operation must be resorted to. The tobacco enema should not be employed unless the symptoms of strangulation be quite evident. If the hernia seem merely irreducible, but is not strangulated, and if cold, and warm bath and bleeding (if deemed advisable), have failed, the patient should be left, and an active dose of aperient medicine given him, for sometimes the bowels will, under the operation of these means, return of themselves into the abdomen.

When a hernia has been completely reduced, its recurrence must be prevented by the wearing of a truss. A truss consists of a circular pad, having one side convex and soft, and the other flattened and made very firm by a plate of steel, by which the pad is riveted into the spring, which is a narrow band of highly tempered and very elastic steel, forming when extended somewhat more than a semicircle. In applying a truss, the soft convex surface of the pad should be placed accurately over the part where the neck of the tumour was situated, that is, over the ring through which the intestine first protruded, and which may be felt by the weakness of the abdominal walls, so that the finger may be easily pushed almost into the abdomen, carrying the skin and subjacent tissues before it. The pad being held there, the spring should be made to pass round the haunch to the back, so as to reach just beyond the spine; its elasticity, tending to bring its two extremities together, will thus act so as to press with a certain force upon the ring or the canal through which the hernia was protruded, and thus supply the defect of weakness at that part of the abdominal walls. At that extremity of the spring which is applied near the spine there is affixed, in what are called common trusses, a leathern band, which is to be passed round the opposite haunch, and buckled or buttoned on the pad, so as to prevent its shifting its position during exercise; and in some cases, where this is apt to occur, another band should pass from behind under and inside the thigh and be fixed to the pad. Another very useful form of truss is that commonly called Salmon and Ody's, or the self-adjusting truss, which has a second pad, to be placed behind on the spine, and which requires no bands to keep it fixed, but, by the steady pressure of its two pads towards each other, maintains a firm pressure on the ring, and permits the spring to move up and down upon the haunch during exertion. In applying this, one pad must be placed on the ring, the spring must pass round the opposite haunch, and the hinder pad must rest on the spine, just below the loins, where it is least moveable. When there is a hernia on each side, a double truss, that is, one with a pad for each side, and one or two springs long enough to reach quite round the body, must be worn: if there be two springs, they should be connected by a cross-band and buckle, so that they may be tightened or loosened behind, and another band should pass from one pad to the other to maintain them in their proper position. To determine the necessary length for the spring of the truss, a measure may be taken by a string fixed at one end over the centre of the ring, at the part where, when the patient coughs, the intestine may be felt endeavouring to protrude, and thence carried round in an oblique direction between the most prominent part of the hip and the top of the haunch-bone to an inch beyond the spine. The pad should be of a size proportioned to that of the ring, and the spring should be strong enough to make firm but not painful pressure.

HERO, HEROIC, HEROISM, are used, in their common English sense, to denote an unusual, and, as it were, superhuman degree of bravery and virtue. This meaning flows directly from the original Greek word, which denoted (at least in the times subsequent to the Homeric poems) a person intermediate between gods and men, and usually of divine descent on at least one side. Such were worshipped with divine honours by those cities and races of men which claimed them as their founders or ancestors. This divine origin however was not essential: thus Philippus of Crotona, who fell in battle against the Phœnicians and Egestæans, was made a hero for his beauty; a heroum, or shrine, was built on the spot where he was buried, and sacrifices were offered to him. (Herod., v. 47.) At a later age Aratus and Brasidas were worshipped as heroes at Sicyon and Amphipolis; and the Athenians slain at Marathon received similar honours. Concerning these last, legends were current which show that a supernatural and mythological character was really ascribed to them, and they probably were the latest of the Greeks to whom such a character was attributed. The Heroic age, properly so called, appears however to have terminated with the immediate descendants of the Greeks who returned from Troy, and to have extended backwards for an uncertain length, estimated by Mr. Thirlwall at six generations, or about 200 years. This is the fourth or Heroic age of Hesiod, in which Zeus 'made the divine brood of heroes, better and braver than the third or brazen race' (*Days and Weeks*, 157), the princes and warriors of mythological history, such as Theseus, Perseus, and those who fought in the sieges of Thebes and of Troy. In Homer the word hero occurs frequently, but in quite a different sense: it is applied collectively to the whole body of fighters, Argeii, Danai and Achæi, without reference to individuals of peculiar merit; and indeed often appears to be used for little more than an expletive, when *he*, or *the man*, or *the soldier*, would have done equally well. Indeed the application of the word is not even limited to warriors; but is applied to heralds, wise counsellors, kings, &c. It has been suggested, with considerable plausibility, that the word originally denoted the members of those roving bands who in the earliest times overran Greece, issuing forth from the south of Thessaly and giving extension to the name, first of Achæans, and afterwards of Hellenes, as we learn from the legends in Pausanias and Thucydides; so that in the same sense the Normans who colonized Italy, or the Saxons who settled in England, might justly be called heroes. The root of the word seems to be *her*, whence the Latin and German forms of herus and herr (master), here, hertha, heracles, vir, virtus, &c. The same root seems to exist in the word Arimann, which denoted a particular order of freemen among the Lombards, existing at the time of the establishment of their empire after the Lombard conquests. There seems little doubt that this class originated in the warrior caste of the Lombard invaders; and the establishment of the name thus furnishes an analogy to the theory suggested above as to the origin of the Homeric use of the word hero. Even the name of German, and the meaning of brother attached to the word in Latin, may originate in the same sense of a member of an armed family or body: the root in all cases appearing to involve the notion of might or mastery. The Sanscrit word *sūra* appears to contain the same element as 'heros.'

The promiscuous (or Homeric) use of the word hero disappeared in the age succeeding the Homeric poems. It seems probable that the Hellenic invasion, commonly called the Return of the Heraclidæ, put an end to it. The new conquerors of Southern Greece do not seem themselves to have borne or used the title; and afterwards, when they, or their descendants, looked back to the warlike legends of the earlier race who had borne the title, the lays, exploits, and persons were called heroic; and from the combined effect of poetical exaggeration, reverence for antiquity, and traditions of national descent, the more modern Greek use of the word arose, carrying with it notions of mythical dignity, and of superiority to the later races of mankind. The custom of showing respect or affection by making precious offerings, and celebrating costly sacrifices at the tombs of the dead; the imaginative temper of the Greeks, which, as it loved to ascribe a divine genealogy to the great, was equally willing to admit them to a share of the divine nature and enjoyments after death; and the love of magnifying past ages, common to all nations, will sufficiently explain the change of earthly leaders into protecting genii or dæmons, who were believed immortal, invisible, though frequenting the earth, powerful to bestow good or evil, and therefore to be appeased or propitiated, like the gods themselves. In the age of Hesiod, as is evident from the passage above referred to, the age of heroes was past, and they were already invested with their mythological character, which appears to furnish one, among other reasons, for believing him to have lived after the Homeric age. (Thirlwall's *History of Greece*, ch. v.; *Philolog. Mus.*, No. 4, 'On the Homeric use of the word Ἥρως;' Wachsmuth's *Hell. Alt.*; Von Savigny's *History of the Roman Law during the Middle Ages*, vol. i., ch. 4.)

HERO, or HERON. There are two of this name, both writers on mechanical subjects. Hero the elder was the pupil of Ctesibius, and lived at Alexandria about B.C. 100. The country of the younger Hero is uncertain; in a work attributed to him (on geodesy) he states that the precession of the equinoxes had produced seven degrees of effect since the time of Ptolemy, so that he must have been about 500 years later than Ptolemy: he is generally placed under the reign of Heraclius, A.D. 610—641.

Hero the elder must have enjoyed great reputation, since he is mentioned, by Gregory Nazianzen, with Euclid and Ptolemy: but he is now principally known by some fragments of his writings on mechanics, which are to be found in the 'Mathematici Veteres,' Paris, 1693. His extant writings are: 1. 'On the machine called the Chirohallistra,' which is in the 'Math. Vet.' already cited. 2. 'Barulcus,' a treatise on the raising of heavy weights, which is mentioned by Pappus, and which was found by Golius in Arabic, but has not yet been printed. 3. 'Belopœica,' a treatise on the manufacture of darts, published by Baldi, with an account of Hero, at Augsburg, in 1616, and also in the 'Math. Vet.' 4. 'Pneumatics,' published by Commandine, Urbino, 1575, and Amsterdam, 1680; and also in the 'Math. Vet.' with the additions of Aleotti, who had previously published an Italian version, Bologna, 1542, and Ferrara, 1589. 5. 'On the Construction of Automata,' which is in the 'Math. Vet.,' and was translated into Italian by Bernardino Baldi, with an account of the rise and progress of mechanics, Venice, 1589, 1601, 1661. 6. 'On Dioptrics,' a work said by Lambecius to exist in manuscript in the Vienna library. Other works of Hero, now lost, are mentioned by Pappus, Eutocius, Heliodorus of Larissa, &c., for which see Heilbronner, who is the authority for the preceding summary (see also J. A. Schmidt, 'Heronis Alexandrini Vita Scripta ot quædam inventa,' Helmstad. 1714, 4to.).

The writings of Hero the younger are: 1. a book 'On Machines of War,' edited in Latin by Barocius, Venice, 1572; together with 2. a book of 'Geodesy,' a term then meaning practical geometry. 3. 'On the Attack and Defence of Towns,' printed in the 'Math. Vet.' 4. A book 'On Military Tactics,' said by Lambecius to exist in manuscript in the library at Vienna. 5. 'On the Terms of Geometry;' printed at Strasburg, 1571; and also edited by C. F. F. Hasenhalg, Stralsund, 1826, 4to. with notes. 6. 'Geometrical Extracts,' printed by the Benedictines in the first volume of the 'Analecta Græca,' Paris, 1688, from a copious MS. in the Royal Library at Paris. 7. A Geometrical Manuscript, stated by Lambecius to be in the library at Vienna.

There was another Heron, the teacher of Proclus.

HEROD (HERO'DES), the name of several Jewish princes.

I. HEROD THE GREAT was the second son of Antipater, by whom he was appointed governor of Galilee at the age of twenty-five. In B.C. 43 he obtained from Sextus Cæsar the government of all Cœle-Syria. From this time he became, with his brother Phasael, the chief supporter of Hyrcanus II. against the attempts of Antigonus, the son of Aristobulus. By large presents he obtained the friendship of Antony, who appointed him and Phasael tetrarchs of Judæa. In B.C. 40 the Parthians invaded Judæa, and set Antigonus on the throne, making Hyrcanus and Phasael prisoners. Herod escaped to Rome, where, by the influence of Antony, he was appointed king of the Jews; but the Roman generals in Syria assisted him so feebly, that it was not till the end of the year 38 B.C. that Jerusalem was taken by Sossius. The commencement of Herod's reign dates from the following year. In the year 38 he had married Mariamne, the grand-daughter of Hyrcanus, hoping to strengthen his power by this match with the Asmonæan family, which was very popular in Judæa. On ascending the throne Herod appointed Ananel of Babylon high-priest, to the exclusion of Aristobulus, the brother of Mariamne. But he soon found himself compelled, by the entreaties of Mariamne and the artifices of her mother Alexandra, to depose Ananel, and appoint Aristobulus in his place. Not long after, Aristobulus was secretly put to death by the command of Herod. Alexandra having informed Cleopatra of the murder, Herod was summoned to answer the accusation before Antony, whom he pacified by liberal bribes. When setting out to meet Antony, he had commanded his brother Joseph to put Mariamne to death in case he should be condemned, that she might not fall into Antony's power. Finding on his return that Joseph had revealed this order to Mariamne, Herod put him to death. In the civil war between Octavianus (afterwards the Emperor Augustus) and Antony, Herod joined the latter, and undertook, at his command, a campaign against the Arabs, whom he defeated. After the battle of Actium he went to meet Octavianus at Rhodes; having first put to death Hyrcanus, who had been released by the Parthians, and had placed himself under Herod's protection some years before. He also imprisoned Mariamne and Alexandra, commanding their keepers to kill them upon receiving intelligence of his death. Octavianus received him kindly, and re-instated him in his kingdom. On his return Mariamne reproached him with his intentions towards her, which she had again discovered. This led to an estrangement between Herod and his wife, which was artfully increased by his sister Salome; till on one occasion, enraged at a new affront he had received from Mariamne, Herod assembled some of his friends and accused her of adultery. She was condemned and executed. After her death Herod suffered the deepest remorse, and shut himself up in Samaria, where he was seized with a sickness which nearly proved fatal. In the year 26 B.C. he put to death the sons of Babas, the last princes of the Asmonæan family. He now openly disregarded the Jewish law, and introduced Roman customs, a conduct which increased the hatred of the people towards him. Ten men conspired against his life, but were detected and executed with the greatest cruelty. To secure himself against rebellion he fortified Samaria, which he named Sebaste, and built Cæsarea, and other cities and fortresses. In the year 17 B.C. he began to rebuild the temple at Jerusalem. The work was completed in eight years, but the decorations were not finished for many years after. (*John*, ii. 20.) Herod's power and territories continued to increase, but the latter part of his reign was disturbed by the most violent dissensions in his family, of which a minute account is given by Josephus. He died in March, B.C. 4, in the thirty-fourth year of his reign and the seventieth of his age. Josephus relates that shortly before his death he shut up many of the principal men of the Jewish nation in the Hippodrome, commanding his sister Salome to put them to death as soon as he expired, that he might not want mourners. They were released however by Salome upon Herod's death.

The birth of Jesus Christ took place in the last year of Herod's reign, four years earlier than the æra from which the common system of chronology dates the years A.D. (Clinton's *Fasti Hellenici.*) [CHRIST.]

II. HEROD ANTIPAS, son of Herod the Great, was appointed by his father's will tetrarch of Galilee and Peræa. [ARCHELAUS.] He built the city of Tiberias. About A.D. 26 he divorced the daughter of Aretas, king of Arabia, and married his sister-in-law Herodias. John the Baptist, having remonstrated against this marriage, was imprisoned in the castle of Machærus, and afterwards put to death. (*Luke*, iii. 19, 20; *Mark*, vi. 17—29.) About the same time Aretas marched against Antipas and defeated him. In A.D. 39 Antipas was accused by Agrippa, king of Judæa, of a secret understanding with the Parthians, and was banished by Caligula to Lyon.

III. HEROD AGRIPPA, son of Aristobulus and grandson of Herod the Great, after experiencing many vicissitudes in early life, was appointed, upon the accession of Caligula, king of the dominions formerly held by Philip, namely, Gaulanitis, Batanea, and Trachonitis, to which Caligula added the tetrarchy of Lysanias; and afterwards, when Antipas was banished, the tetrarchy of Galilee and Peræa. Claudius added Judæa and Samaria to his dominions. His government was popular with the Jews, to please whom he persecuted the Christians. (*Acts*, xii. 1—3.) He died of a loathsome disease at Cæsarea, in the third year of his reign over all Palestine, A.D. 44. (*Acts*, xii. 20—23.)

IV. HEROD AGRIPPA, son of the above, was seventeen years old at the time of his father's death. Upon the death of Herod, king of Chalcis, four years afterwards, Claudius bestowed that kingdom upon Agrippa. He did not leave Rome till A.D. 53, when Claudius gave him the tetrarchies of Gaulanitis, Batanea, and Trachonitis. His dominions were enlarged by Nero. It was in A.D. 60 that the trial of Paul before Agrippa took place. (*Acts*, xxvi.) Agrippa exerted himself to the utmost to keep down the spirit of revolt which was now constantly increasing among the Jews. When war broke out, Agrippa joined the Romans. After the taking of Jerusalem he retired with his sister Berenice to Rome, where he died at the age of about seventy years.

(Josephus, *Antiquities of the Jews*, and *Jewish War*; Jahn's *Hebrew Commonwealth*; Prideaux's *Connection*.)

HERO'DES, TIBE'RIUS CLA'UDIUS ATTICUS, a native of Marathon, in Attica, and of an illustrious family, which numbered among its members several officers and magistrates of the latter period of the Athenian commonwealth, was born under the reign of Trajan. He inherited from his father a very large property, which is said to have been originally acquired under curious circumstances. His grandfather Hipparchus had lost his property by confiscation during the civil wars. His son, called Atticus by the historians, and the father of Herodes, supported himself by means of his wife's property. Atticus discovered one day in his grounds, in or near Athens, a vast treasure, probably hidden there during the preceding wars. He informed the then emperor Nerva of what he had found, and inquired what he was to do with it? The emperor's answer was short: 'Utere invento' ('Make use of what you have found'). Atticus represented that the wealth was much above his wants and his station in life; upon which the good-natured emperor replied again in the same laconic style, 'Etiam abutere' ('Do with it even as you list'). In consequence of this Atticus left his son Herodes possessed of enormous wealth. Herodes was educated by the best teachers of his time; he studied under Favorinus and Polemon, and he became an accomplished scholar, rhetorician, and philosopher. He was made by Antoninus Pius prefect of the Greek towns of Asia. Having removed to Rome, his wealth, his connections, and his extemporary eloquence, which is spoken of as wonderful, gave him a considerable degree of importance, and he was made consul with C. Bellicius Torquatus, A.D 143. He was also one of the preceptors of the younger Verus, the adopted son of Antoninus. Herodes married, at Rome, Annia Regilla, of an illustrious and wealthy family. She bore him four children, and died while pregnant of the fifth. His brother-in-law suspected Herodes, who was of a violent and jealous temper, of foul treatment of his wife, and he brought him to trial on the charge of murder: but Herodes was acquitted. Herodes displayed an excessive, and, as some believed, an assumed grief for the loss of his wife, and he dedicated her estate to Minerva and Nemesis. An inscription, which he wrote, or caused to be written, in Greek hexameters, records the fact. There is another inscription, likewise in Greek verse, in which the poet invites the Roman women to honour the memory of Regilla, descanting upon her beauty, virtue, and high lineage: he speaks of the Emperor Marcus Aurelius, whom he compares to Jupiter, for the consolation which he administered to the widower in his old age, left with two young surviving children, upon one of whom, named Atticus, the emperor bestowed the patrician and senatorial sandals, or shoes spangled with stars and ornamented with a crescent, which custom of the Roman patricians the poet derives from Mercury. He then launches out into mythological allusions, and speaks of his own descent from the Athenian heroes and demigods. The whole composition, as well as the one previously mentioned, is curious as a memorial of the Greco-Roman style of poetry in the age of the Antonines. These two inscriptions, which are on two large slabs of Greek marble, and were discovered in the early part of the seventeenth century, under Pope Paul V. (Borghese), have given much employment to critics and philologists. (Visconti, *Iscrizioni Tropee ora Borghesiane*, 4to., Rome, 1794.) Herodes, after the loss of his wife, returned to Greece, and died at Marathon, in the 76th year of his age, towards the end of the reign of Aurelius, or the beginning of that of Commodus. He erected monuments, temples, baths, and aqueducts, in Italy, Greece, and Asia. Pausanias (vii. 20) mentions an Odeon, or Music Theatre, at Athens, as built by him, called the Theatre of Regilla, after his wife: he also embellished the Stadium near the Ilissus, which was originally constructed by the orator Lycurgus, B.C. 350. [ATHENS, p. 12, &c.] Herodes was evidently a conspicuous personage in the age in which he lived, and is mentioned as such by Aulus Gellius, Philostratus, Capitolinus, Zonaras, Suidas, and a number of others. (Fiorillo, *Herodis Attici quæ supersunt*, 8vo., Leipzig, 1801.) Herodes is said by Philostratus to have written orations, epistles, and ephemerides; but none of these compositions have come down to us, except a fragment of an address to the Thebans, published by Reiske, Leipzig, 1773; but its genuineness is doubted by the critics. In the inscription above mentioned, in honour of his wife, he is styled 'the living language of Athens' and 'the king of oratory.' His son Atticus is said to have been a complete idiot all his life.

HERO'DIANS (Ἡρωδιανοί, *Matt.* xxii. 16; *Mark*, iii. 6;

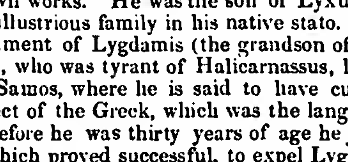
xii. 13; see also *Mark*, viii. 15), were in all probability a political party in Judæa, who were anxious to preserve the government in the hands of Herod's family. Many critics consider the Herodians to have been a religious sect. Tertullian, Jerome, Epiphanius, Chrysostom, and Theophylact maintain, without any sufficient reason, that the name was given to those Jews who owned Herod for the Messiah; and Grotius (*De Veritate Christ. Relig.*, v., s. 14; *Notes upon Matthew*, xvi. 6) and other modern critics hold the same opinion. The Herodians are not mentioned either by Philo, or by Josephus in his enumeration of the Jewish sects. In their religious opinions they probably belonged to the sect of the Sadducees; since that which is called by Mark (viii. 15) 'the leaven of Herod' is styled by Matthew (xvi. 6) 'the leaven of the Sadducees.'

(Prideaux's *Connection of the History of the Old and New Testament*, vol. ii., 478—482; Jennings' *Jewish Antiquities*, i., c. 12; Calmet's *Dissertations*, vol. i., p. 737—743; Lardner's *Credibility*, vol. i., p. 131—133, edition of 1831.)

HERODIA'NUS, a Greek author, who wrote a history, in eight books, of the Roman emperors who reigned successively in his lifetime, beginning with tho death of Marcus Aurelius, A.D. 180, and ending with the accession of the younger Gordianus, A.D. 238. This history comprehends a period of little more than half a century, but it is a most eventful one in the history of the empire, on account of the numerous and violent changes in the persons who held the sovereign power, and also with respect to the domestic and foreign wars, the depravity of manners, and the public calamities which characterized that age. The series of emperors which the history of Herodianus embraces comprises Commodus, Pertinax, Julianus, Niger and Albinus, Severus, Caracalla and Geta, Macrinus, Elagabalus, Alexander Severus, Maximinus, the two Gordiani, and Balbinus. The style of Herodianus is plain and unaffected, and his narrative in general seems written in a spirit of sincerity, but it has no claims to philosophy or critical art. (F. A. Wolf, *Narratio de Herodiano et libro ejus*, prefixed to his edition of Herodianus, Halle, 1792.) Of the private history of Herodianus we know nothing, except that he seems to have lived at Rome, and to have been well acquainted not only with the political events, but also with the court intrigues and scandal of his time. He is the last of the Greek historians of antiquity who lived before the partition of the Roman empire. Among the editions of his history that of Irmisch, in 5 vols. 8vo., Leipzig, 1789—1805, in Greek and Latin, contains numerous notes, chronological and genealogical tables, and several copious indexes. The last edition and the best text is by Bekker, Berlin, 1826, 8vo. There are several German translations of Herodian.

HERO'DII. [HERONS.]

HERO'DOTUS (Ἡρόδοτος), a native of Halicarnassus, a Dorian city in Caria, and once a member of the confederation called the Hexapolis, or Six Cities, was born about B.C. 484. If the passages in his own History (i. 130; iii. 15) were written by himself. he was probably alive in B.C. 408. The facts of his life are few and doubtful, except so far as we can collect them from his own works. He was the son of Lyxus and Dryo, and of an illustrious family in his native stato. Not liking the government of Lygdamis (the grandson of the heroic Artemisia), who was tyrant of Halicarnassus, he retired for a time to Samos, where he is said to have cultivated the Ionic dialect of the Greek, which was the language of that island. Before he was thirty years of age he joined in an attempt, which proved successful, to expel Lygdamis. But the banishment of the tyrant did not give tranquillity to



Coin of Halicarnassus.

British Museum. Actual size. Silver. Weight, 56 grains.

Halicarnassus, and Herodotus, who himself had become an object of dislike, again left his native country, and joined, as it is said, a colony which the Athenians sent to Thurium, in South Italy (B.C. 443). He is said to have died at Thurium, and was buried in the Agora. (Suidas, Ἡρόδοτος, Πανύασις, Θουκυδίδης; Strabo, xiv., p. 656; Photius, *Bibl.* 60.) Herodotus presents himself to our consideration in two points of view; as a traveller and observer, and as an historian. The extent of his travels may be ascertained pretty clearly from his History, but the order in which he visited each place and the time cannot be determined. The story of his reading his work at the Olympic games, which has found its way into most modern narratives, has been well discussed by Dahlmann, and we may perhaps say disproved. (Herodot., *Aus seinem Buche sein Leben*, Altona.) The story is founded on a small piece by Lucian (Ed. Reiz., 4to., p. 831), entitled 'Herodotus or Aetion,' which apparently was not intended by the writer himself as an historical truth; and in addition to this, Herodotus was only about twenty-eight years old (Suidas, Θουκυδίδης) when he is said to have read to the assembled Greeks at Olympia a work which was the result of most extensive travelling and research, and bears in every part of it evident marks of the hand of a man of mature age. The Olympic recitation is not even alluded to by Plutarch in his treatise on the Malignity of Herodotus (iv., p. 431, ed. Wyttenbach). The arguments derivable from this circumstance, as to the truth or falsehood of the story, are considered by Dahlmann (p. 33). Heyse endeavours to maintain the story of the Olympic recitation, and to relieve it from some of its difficulties; but, in our opinion, not successfully. Another recitation at Athens is mentioned by Plutarch and Eusebius.

With a simplicity which characterizes his whole work, Herodotus makes no display of the great extent of his travels. He frequently avoids saying in express terms that he was at a place, but he uses words which are as conclusive as any positive statement. He describes a thing as standing behind the door (ii. 182), or on the right hand, as you enter a temple (i. 51); or he was told something by a person in a particular place (ii. 28); or he uses other words equally significant. In Africa he visited Egypt, from the coast of the Mediterranean to Elephantine, the southern extremity of the country (ii. 29); and he travelled westward as far as Cyrene (ii. 32, 181), and probably farther. In Asia he visited Tyre, Babylon, Ecbatana (i. 98), and probably Susa (v. 52-54; vi. 119). He also visited various parts of Asia Minor, and probably went as far as Colchis (ii. 104). In Europe he visited a large part of the country along the Black Sea, between the mouths of the Danube and the Crimea, and went some distance into the interior. He seems to have examined the line of the march of Xerxes from the Hellespont into Attica, and certainly had seen numerous places on this route. He was well acquainted with Athens (i. 98; v. 77, &c.), Delphi, Dodona, Olympia (ix. 81), Tegea (i. 66), Thasos, Delos, Zacynthus (iv. 195) and numerous other places in Greece. That he had visited some parts of South Italy is clear from his work (iv. 99; v 44, 45). The mention of these places is sufficient to show that he must have seen many more. So wide and varied a field of observation has rarely been presented to a traveller, and still more rarely to any historian, either of antient or modern times; and if we cannot affirm that the author undertook his travels with a view to collect materials for his great work, a supposition which is far from improbable, it is certain that without such advantages he could never have written it, and that his travels must have suggested much inquiry, and supplied many valuable facts which afterwards found a place in his History.

The Nine Books of Herodotus contain a great variety of matter, the unity of which is not perceived till the whole work has been thoroughly examined; and for this reason, on a first perusal the History is seldom well understood. But the subject of his History was conceived by the author both clearly and comprehensively. 'The object of the inquirics (for so we may render the word ἱστορίη) of Herodotus of Halicarnassus is this, that the acts of man may not be forgotten through lapse of time, and that great and wondrous achievements, performed partly by Greeks and partly by Barbarians, may not be without their fame; and also how it came to pass that Greeks and Barbarians waged war together' (i. 1). His object then was to combine a general history of the Greeks and the Barbarians (that is, those not Greeks) with the history of the wars of the Greeks and Persians. Accordingly, in execution of his main subject, he traces the course of events from the time when the Lydian kingdom of Crœsus fell before the arms (B.C. 546) of Cyrus, the founder of tho Persian monarchy, to the capture of Sestos (B.C. 478), an event which crowned tho triumph of the Greeks over the Persians.

The great subject of his work, which is comprised within this space of sixty-eight years, not more than the ordinary term of human life, advances with a regular progress and truly dramatic development, from the first weak and divided efforts of tho Greeks to resist Asiatic numbers, to their union as a nation, and their final triumph in the memorable fights of Thermopylæ, Salamis, and Platæa. But with this subject, which has a complete unity well maintained from its commencement to its close, the author has interwoven, conformably to his general purpose, and by way of occasional digression, sketches of the various people and countries that he had visited in his widely-extended travels. The more we contemplate the difficulty of thus combining a kind of universal history with a substantial and distinct narrative, the more we admire, not tho art of tho historian (for such, in the proper sense of the term, he could not well possess), but that happy power of bringing together and arranging his materials which was the result of the fulness of his information, the distinctness of his knowledge, and the clear conception of his subject. These numerous digressions are among the most valuable parts of his work, and if they had been omitted or lost, barren indeed would have been our investigation into the field of antient history, over which the labour of one man now throws a clear and steady light. It would be difficult to mention any single writer, antient or modern, whose personal knowledge forms so large a part of the materials of his work, and it would not be easy to name one whose accuracy of observation and felicity of description were accompanied with such singleness and rectitude of purpose. Of modern travellers Carsten Niebuhr is the only one whom wo can call to mind as worthy, in this respect, to be placed by the side of the Historian of Halicarnassus. But we know no complete parallel to a writer whose mere digressions elevate him to the rank of an intelligent traveller, and who could combine in harmonious union with a great historical work, designed to perpetuate the glories of his own nation, so endless a variety of matter collected from the general history of mankind. His predecessors in historical composition appear generally to havo chosen subjects of a limited nature, partaking chiefly of the character of local annals. Herodotus chose for his subject a series of events which concerned the universal Greek nation, and not them only, but the whole civilized world; and by the way in which he executed his great undertaking he has earned the honourable and well-merited appellation of the Father of History.

That he was not duly appreciated by all his countrymen, and that in modern times his wonderful stories havo been the subject of merriment to the half-learned, who measure his experience by their own ignorance, we merely notice, without thinking it necessary to say more. The incidental confirmations of his veracity which have been accumulating of late years on all sides, and our more exact knowledge of tho countries which he visited, enable us to approciate him better than many of the Greeks themselves could do; and it cannot now be denied that a sound and comprehensive study of antiquity must be based upon a thorough knowledge of the Father of History.

The style of Herodotus is simple, pleasing, and generally perspicuous; often highly poetical both in expression and in sentiment. But it bears evident marks of belonging to a period when prose composition had not yet become a subject of art. His sentences are often ill-constructed and hang loosely together; but his clear comprehension of his own meaning, and the sterling worth of his matter, have saved him from the reproach of diffuseness and incoherence. His acquirements were apparently the result of his own experience. In physical knowledge he was certainly behind the science of his day. He had no doubt reflected on political questions; but he seems to have formed his opinions mainly from what he had himself observed. To pure philosophical speculation he had no inclination, and there is not a trace of it in his writings. He had a strong religious feeling, bordering on superstition, though even here he could clearly distinguish the gross and absurd from that which was decorous (i. 199). He seems to have viewed the manners and customs of all nations in a more truly philosophical way than many so-called philosophers, considering them as various forms of social existence under which happiness might be found. He treats with decent respect the religious observances of every nation, a decisive proof, if any were wanting, of his good sense.

There is no translation of Herodotus which has yet done justice to the original. and no commentary has yet exhausted one-tenth of the matter which admits and requires illustration.

Tho first edition of Herodotus was the Latin translation of L. Valla, Venice, 1474, fol. The first Greek edition was printed by the elder Aldus, Venice, 1502, fol., reprinted by Hervagius, Basel, 1541, 1557, fol., under the superintendence of Camerarius. The edition of Hervagius is very correct and useful. Tho most complete edition of Herodotus is by J. Schweighäuser, Strasburg, 1816, 6 vols. 8vo. Since that time, Professor Gaisford has again collated the Sancroft manuscript (ono of the best manuscripts of Herodotus) for his edition of Herodotus, Oxford, 1824, but the result of the collation has added nothing of any value to the text of Schweighäuser. The differences between the text of Schweighäuser and Gaisford are shown in the reprint of Schweighäuser, by Taylor and Walton, London, 1830 and 1838. The Lexicon to Herodotus, by Schweighäuser, is a useful aid to students, though it is far from being complete. Rennell's 'Geography of Herodotus' is a valuable work, which will enable a student to appreciate the merits of the old traveller; and Niebuhr's 'Dissertation on the Geography of Herodotus,' of which there is a notice in the 'Westminster Review,' No. 26; Dahlmann's Essay above referred to, and that of Heyse, 'De Vita et Itineribus Herod.,' Berl. 1827, are worth the student's attention. 'The Apology of Herodotus,' by H. Stephens, prefixed to his corrected edition of Valla's translation, Frankfort, 1595, is a clever and amusing vindication of Herodotus against the charge of falsehood, made on the ground that many of his stories were so singular and improbable. L'Archer's French translation, Paris, 9 vols. 8vo., with the Commentary, is a useful book; and Creuzer's 'Commentationes Herodoteæ,' Leip., 1819, may be consulted with profit. The German translation by Lange, Breslau, 1824, 2 vols. 8vo., has the merit of fidelity, and to a considerable degree is a successful attempt to convey a notion of the literary character of the original. There is no English translation that deserves to be recommended. That by Beloe is perhaps in every respect the worst. (*Journal of Education*, vol. i., p. 322.)

A Life of Homer, which bears the name of Herodotus, is subjoined to most editions of the text; but evidently comes from another hand.

HEROIC AGE. [HERO.]

HEROIC VERSE in its antient sense means that which was the vehicle of Greek, and subsequently of Latin epic poetry, of which the actions of the heroes were the appropriate subject. [HEXAMETER.] In English our common ten-syllable couplet passes under this name, chiefly, it should seem, because it is the measure into which the epics of antiquity have been most frequently translated. The Alexandrine of twelve syllables however has been also used by our elder writers for this purpose, as by Chapman in his translation of the 'Iliad.'

HERONS. Under this head it is our purpose to treat of the Cranes (*Gruidæ*) as well as the Herons (*Ardeidæ*), including the Storks, &c.

Willughby thus generally defines his section of *Cloven-footed Piscivorous Water-fowl.* 'These have very long necks; their bills also are long, strong, ending in a sharp point, to strike fish, and fetch them from under stones or brinks: long legs to wade in rivers and pools of water: very long toes, especially the hind toe, to stand more firmly in rivers: large crooked talons, and the middle serrate on the inside, to hold eels and other slippery fishes the faster, or because they sit on trees; lean and carrion bodies, because of their great fear and watchfulness.' He makes the section to consist of the Herons, Bitterns, &c., Storks, 'the Ibis of Bellonius' (*Belon*), and the Spoonbills.

Ray places at the head of the *Aves Aquaticæ*, the '*Fissipedes*' (cloven-footed), 'quæ circa aquas versantur, iis tamen non innatant' ('which haunt the waters, but do not swim in them'). The first section of these, consisting of the 'Maximæ, singulares et sui generis,' contains the Cranes (Grus, including the *Grus Indica* and *Grus Balearica*, the *Jabirus*, the *Cariama*, and the *Anhima*). Then come the *Aves aquaticæ fissipedes piscivoræ, ranivoræ et serpentivoræ*, the Storks and the *Ibis nigra*. Next to these are arranged the *Ardeurum genus* (Herons and Bitterns), and then the *Ardeæ exoticæ*, including the *Soco*, &c., and the Spoonbills.

The Stork, the Heron, the Spoonbill, &c., with a heterogeneous crowd of other birds, are brought under Brisson's 17th order.

The genus *Ardea*, in the 12th edition of the *Systema Naturæ*, embraces the Herons, the Bitterns, and the Cranes (including the Balearic Crane and the Demoiselle, *Anthropoïdes*): the Jabiru, Boatbill, and Spoonbill are generically distinguished under the names of *Mycteria*, *Cancroma*, and *Platalea*. They form part of Linné's fourth order, *Grallæ*.

Dr. Latham's seventh order, *Grallæ*, embraces the *Ardeidæ* and *Gruidæ* among the rest of the wading-birds.

The same families are scattered through M. Lacépède's *Oiseaux de Rivage* (*Grallatores*).

M. Duméril's fifth order of Birds, *Échassiers* (Waders), contains his 16th, 17th, 18th, and 19th families. The Oyster-catcher is included in the 16th (Pressirostres, or Ramphostènes); the open-beak, *Bec-ouvert*, (Anastomus of Illiger), the Heron, the Stork, the Crane, the Jabiru, and Ibis (Tantalus), form the 17th family, the *Cultirostres*, or *Ramphocopes*. The Spoonbill and Boatbill belong to his 18th family, the *Latirostres*, or *Ramphoplates*.

Among the *Grallatores* of Illiger the *Herodii* contain the genera *Grus*, *Ciconia*, *Ardea*, *Eurypyga*, *Scopus*, *Cancroma*, and *Anastomus*. The genera *Tantalus* and *Ibis* form the *Falcati*, and *Platalea* is placed among the *Hygrobatæ*.

Cuvier's *Échassiers* comprehend the *Brevipennes*, the *Pressirostres*, the *Cultirostres*, the *Longirostres*, and the *Macrodactyles*.

The *Cultirostres* consist of the Cranes, the Boatbills, the Herons, the Storks, the Jabirus, the *Ombrettes*, the Open-beaks, the *Tantali*, and the Spoonbills.

M. Vieillot's Echassiers are divided into two tribes: the 1st, the *Di-tridactylous*; the 2nd, the *Tetradactylous*. The 6th family of these waders (*Latirostres*) consists of the Spoonbills and Boatbill; the 7th (Herodions) comprehends the *Ombrette*, the Open-beak, the Herons, the Storks, and the Jabirus, &c.; and the 8th (*Ærophones*), the Cranes (*Grus* and *Anthropoïdes*).

The *Ardeidæ* and *Gruidæ* are placed by M. Temminck under his 2nd family of *Gralles* (waders).

In M. De Blainville's method the *Ardeidæ* and *Gruidæ* are comprehended under the *Ciconiens*, his third family of *Grallatores*, and in the same method as further developed by M. Lherminier, the 23rd family (first subclass or Normal birds), consists of the Cranes (*Grus* of Pallas); and the 24th family (same subclass) of the Herodii of Illiger.

Mr. Vigors considers that the Grallatores are naturally divided into these five families:—*Gruidæ*, *Ardeidæ*, *Scolopacidæ*, *Rallidæ*, *Charadriadæ*; and he places the *Ardeidæ* in the Normal group and the *Gruidæ* in the Aberrant group. He remarks that the species that enter into the family of *Gruidæ*, most of which were comprised originally in the genus *Ardea* of Linnæus, are separated from the remainder of that group by their food, which is chiefly vegetable; by their manners, which approach nearer to those of the land-birds; and by the formation of their bills and feet, the former of which are more obtuse at the end, and the latter shorter than is observable in the true *Ardeæ*. In these characters, Mr. Vigors observes, as well as in their general appearance, more particularly with respect to their plumage, they have a near alliance with the *Struthionidæ*. *Psophia* [AGAMI,* vol. i.] of Linnæus is the first genus of this family to which Mr. Vigors calls our attention. This genus, in the comparative shortness of the bill, is considered by Mr. Vigors to be connected with the *Anthropoïdes* of M. Vieillot, the Numidian Demoiselle; while he regards the Crowned Crane of Africa (the Balearic Crane of authors, *Ardea pavonina* of Linnæus) as uniting this genus to the true *Grus* of the present day. 'If the genus Dicholophus of M. Illiger,' continues Mr. Vigors, 'be found to belong to the wading-birds, of which I have little doubt, its situation will most probably be in the present family, to which it bears a nearer resemblance in plumage and general structure than to any other division of the order. In this case it will form a more immediate link than any group at present known in the family with the *Charadriadæ*, which meet it at the corresponding extreme of the order; its shorter and more elevated hind-toe forming the passage between the fully tetradactyle foot of the *Gruidæ* and the tridactyle foot of the *Charadriadæ*.' We have seen [CARIAMA, vol. vi.] that the habits of *Dicholophus* are not those of the wading-birds, although in the whole of the visceral arrangement a close affinity may be observed to the *Gruidæ*.

Mr. Vigors remarks further that Cuvier has noticed the union that takes place between the last groups alluded to by Mr. Vigors and those of the *Ardeidæ* by means of the genera *Aramus* of Vieillot and *Eurypyga* of Illiger. These, he observes, lead to the extensive assemblage of species contained under *Ardea*, Linn., and *Ciconia*, Briss., both of which groups are connected by their general form and habits, but differ by some minute yet strongly-marked generic distinctions. Intermediate between *Ardea* and *Ciconia* appear those forms which display so remarkable a dilatation of the bill, viz. *Cancroma*, *Phœnicopterus*, and *Platalea* of Linnæus. The two last of these groups, continues Mr. Vigors, are equally distinguished by a greater development of the membrane that connects the toes than is observable in the other waders, which join them on each side; and in one of them, the *Phœnicopterus*, this character, he remarks, is carried so far to the extreme as to have occasioned some systematists to place the birds of that genus among the *Natatores*. [FLAMINGO, vol. x.] 'But,' says Mr. Vigors in conclusion, 'the whole of the family have a membrane more or less extensive at the base of the toes; and if we compare the feet of the common *Ciconia alba*, of the *Platalea*, and the *Phœnicopterus* together, we shall see a gradual increase of this membrane in extent until it reaches the extreme in the latter genus. Among the groups that are allied to *Ciconia* there are many that resemble it in general character, but deviate from it in the form of the bill. Among these we may particularize *Scopus*, Linn.,* distinguished by its more compressed and furrowed mandibles; the *Mycteria*, Linn., where the point of the bill turns upwards; and the *Anastomus*, Ill., where the mandibles, united at the base and at the point, leave an open space in the centre. The genus *Tantalus*, Linn., bears an evident affinity to the same group, and has consequently been united to it in the arrangement of every systematic naturalist. It differs chiefly by the downward curvature of the bill. To this genus may be united the *Ibis* of M. Lacépède, which, in its more slender bill, bears an affinity to *Eurypyga*, from whence we commenced our inquiries into the family.' The same author unites the *Scolopacidæ* with the *Ardeidæ* by means of *Numenius* of Brisson, as approaching *Ibis* most closely in its bill.

The Prince of Musignano (C. L. Bonaparte) makes the *Herodii* the third family of the order *Grallæ*, and includes under it the genera *Grus*, *Ciconia*, *Ardea*, and *Aramus* his fourth family (*Falcati*) consists of the genera *Tantalus* and *Ibis*. (*Specchio Comparativo*.)

Mr. Swainson ('Natural History and Classification of Birds,' vol. ii.) is of opinion that the '*Ardeadæ*,' or Herons, by means of the Cranes, show the strongest affinity to the Ostriches, and thus unite the rasorial with the wading order. 'Nearly all the cranes,' writes Mr. Swainson, 'are large birds, with short and powerless wings, long and frequently naked necks, and more terrestrial in their habits than any of their congeners. The beautiful genus *Phosphia* (Psopbia?), if truly belonging to this family, is more of a gallinaceous than a wading bird.' After referring to the genus *Anthropoides*, Mr. Swainson thus continues:—'The more typical cranes (*Grus*, Pallas) are large birds, few indeed in species, but dispersed over Europe, America, and Asia: they seem to prefer the seclusion and security of marshes, and feed both upon seeds, herbage, worms, and small reptiles. The *Ardeadæ*, or typical herons, differ from the last in being composed of birds decidedly carnivorous: they are known by a larger and more pointed bill, and by the superior length of the legs. The herons, as a whole, are the most beautiful of all the waders, not so much from the colours of their plumage as from the elegant crests and prolonged feathers which ornament nearly all the species. They build in societies, but generally feed and live solitary. Like the Kingfishers and many of the fissirostral birds, the greater part watch for their prey from a fixed station: a sheltered nook by the side of a river, or a projecting rock by the sea-side, over deep water, frequently serves them as a convenient post; here they watch for passing fish, which they dexterously spear or transfix by

* The scientific name of this bird, *Psophia crepitans*, is erroneously printed in the article referred to, where it stands as *Trophia crepitans*.

* The genus Scopus is Brisson's, and there is no such genus in Linné's last edition of the *Systema Naturæ*. Gmelin adopts it in his edition, and places it between *Cancroma* and *Ardea*.

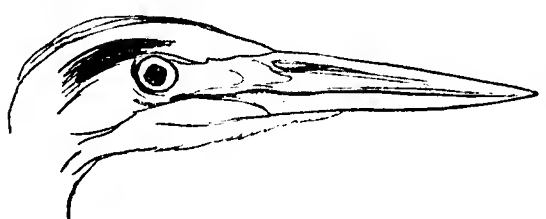
their long and sharp bill. Some of these birds are of a gigantic size; others are very small, but have all a very long neck, covered more or less by strong and loose feathers. The tiger-bitterns (*Tigrisoma*, Sw.) are exclusively found in South America, but the true bitterns seem restricted to no particular climate. The boat-bills (*Cancroma*, L.) differ most essentially from the herons, since they have a short and very broad bill, shaped something like a boat with its keel uppermost.' [BOAT-BILL, vol. v.] * * 'The spoonbills (*Platalea*) show a different but a no less singular form of beak, from which their name has been derived. The storks (*Ciconia*) are among the largest of the heron family; one species (*Ciconia gigantea*) measuring, when standing erect, near five feet and a half: they are social and useful birds, and from destroying vast numbers of reptiles and other vermin, are encouraged in many countries to build on the habitations of man: the chin and eyes are bare of feathers; but in *Mycteria*, which possibly enters into this family, the greatest part of the head and neck is entirely bare: one species inhabits America, one Asia, and one Australia. The tufted umbre forms the African genus *Scopus*, and is the only species known; the plumage is particularly soft, and the back of the head furnished with a lax tuft of feathers: this is obviously allied to the open-bills (*Anastomus*, Ill.), a singular form, remarkable for a thick and very powerful bill gaping in the middle. * * These are the principal genera which appear to enter this family, of which the herons and cranes form the two most typical groups.'

In the Synopsis (same vol.) Mr. Swainson places the '*Ardeadæ*' as the first family of the *Grallatores*, or Waders, with the following definition:—'Size large. Bill long, conic, very hard, straight, and compressed. Hind toe moderate, and placed on the same level as the others.' The family, according to this author, includes the following genera and subgenera:—Ardea = *Ardea*, *Egretta*, *Butor* (Bitterns), *Tigrisoma* (Tiger-Bitterns), *Nyctiardea*, Sw. (Night-Herons); Cancroma; Platalea; Ciconia (including *Mycteria* as a subgenus); Hæmatopus; and Scopus.

Geographical Distribution of the Ardeidæ and Gruidæ. The birds of this group are to be found in all the four quarters of the globe. They seldom occur in the very cold regions.

HERONS.

M. Temminck thus defines the Herons properly so called:—*Bill* much longer than the head, as large as it is high, or larger, at the base; upper mandible nearly straight; a great portion of the tibia naked. Food, fish principally.



Bill of Common Heron.

As our limits will not permit us to give more than a sketch of the leading forms of this group, we proceed to illustrate M. Temminck's first section of the True Herons by the Common Heron, which most authors consider as the type.

The *Common Heron* then is, in the opinion of Belon and some others, the Ἐρωδιός (Erodius) of Aristotle, but we do not consider this as certain: the term Ἐρωδιός is doubtless applied by Aristotle to the form (*Hist. Anim.*, b. viii., c. 3), but what species is meant by him is not so clear; for he says (b. ix, c. 1), *Τῶν δ' ἐρωδιῶν ἐστι τρία γένη· ὅ τε πέλλος, καὶ ὁ λευκὸς, καὶ ὁ ἀστερίας καλούμενος* ('There are three kinds of Erodii, the blackish and the white, and that called Asterias'); the latter being most probably the Bittern. Now the term *πέλλος* is hardly applicable to the plumage of the Common Heron, *Ardea cinerea*. But the bird is, without doubt, the *Ardea* of the antient Italians, and the *Becca-pesce*, *Airone*, *Oca cicogna*, and *Garza*, of the modern Italians; *Garza* of the Spaniards; *Reyger* and *Rheier* of the Germans; *Héron* of the French; *Cryr glâs* of the antient British; and *Common Heron*, or *Heronshaw*, of the modern British.

Description.—Plumage bluish-ash; middle toe, the nail included, much shorter than the tarsus.

Male and Female after the third year.—Long, loose black feathers (plumes effilées) on the back of the head, similar plumes of a lustrous white depend from the lower part of the neck; the equally elongated and subulate scapulars are of a silvery ash. Forehead, neck, middle of the belly, border of the wings and thighs, pure white; occiput, sides of the breast, and flanks, deep black. On the front of the neck are large longitudinal black and ash spots. Back and wings very pure bluish-ash; bill deep yellow; iris yellow; naked skin of the eye bluish-purple; feet brown, but of a lively red towards the feathered part. Length three feet and upwards. In this state M. Temminck, whose description we have given, states the bird to be the *Ardea cinerea* (Mas.) of Latham (Ind.); *Ardea Major* of Gmelin; *Le Héron Huppé* of Buffon; *Héron commun* of Gérard; *Common Heron* (male) of Latham (Syn.), Pennant (*Brit. Zool.*), and Albin; *Ashgrauer Rheier* of Meyer and others; and *Sgarza cenerino* of the *Stor. degl. Ucc.*

Common Heron.

Young up to the age of three years.—No crest, or, at most, the plumes composing it very short; no long loose feathers at the lower part of the neck, nor above the wings; forehead and top of the head ash colour; throat white; neck clear ash, with numerous spots of a deeper colour than the ground; back and wings bluish-ash, mingled with brown and whitish: breast marked with longitudinal spots; upper mandible of the bill blackish-brown, with yellowish spots; lower mandible yellow; iris yellow; skin round the eyes greenish-yellow; feet blackish-ash, but yellowish towards the feathered part. In this state M. Temminck considers the bird to be the *Ardea cinerea* (Femina) of Latham (Ind.); *Ardea Rhenana* of Sander; *Le Héron*, Buff.; *Common Heron* (fem.), Lath. Syn.; *Sgarza marina*, 'Stor. degl. Ucc.;' and *De Blaauwe Reiger* (being the young in the first year) of Sepp.

The edge of the bill is serrated near the point, and the nail of the middle toe pectinated, as in the Herons generally.

Variety.—Nearly perfectly white. A variety of this description is figured by Frisch (t. 204); but it is very rare.

Habits, Food, Reproduction, &c.—The solitary habits of the Common Heron, excepting at the season of reproduction, are well known. At that period they congregate at their breeding stations, or heronries, for which the loftiest trees are generally chosen. Pennant says that at Cressi Hall, near Gosberton, in Lincolnshire, he counted more than eighty nests in one tree. Montagu notices a heronry on a small island in a lake in the north of Scotland, whereon there was only one scrubby oak. This being too small to contain all the nests, the herons, rather than abandon their society and a favourite station, had many of them placed their nests on the ground. In the south and west of England the heronries at Brockley, in Somersetshire, and at Powderham Castle, in Devonshire, are worthy of notice. The nest is built of sticks, and is large and flat. It is lined with wool or other soft materials, and on this lining are deposited four or five bluish-green lustreless eggs. The young are less prepossessing in appearance than nestlings in general, but few of which are pleasant to look upon, and they remain in the nest for five or six weeks, during which time the old birds unceasingly supply them with fish, &c. There are sometimes deadly feuds between the herons and the rooks, originating in a dispute for the possession of the nest-trees. Dr. Heysham's account of one of these battles at Dallam Tower, in Westmoreland, originating in the felling of the fine old oaks occupied by the herons, and their consequent attempt upon the grove in the tenure of the rooks, is well worth perusal. The herons had the best of the fray for two successive seasons, and at length a sort of peace was patched up between the combatants; the rooks and the herons severally setting up their rest on a particular part of the now only remaining grove, and leaving the other moiety to the opposite faction.

Buffon draws largely upon his imagination for a picture of wretchedness, and then makes the heron a personification of it, with as much foundation as characterizes most of his fancies of this description. When on its fishing station, the bird stands immovable as a stump, with the neck bent and between the shoulders, watching for the passing fish, which it unerringly spears with its sharp bill. But besides fish and reptiles, such as frogs, newts, &c., mice, young water-rats, and even young water-fowl, are occasionally devoured by it. Mr. Selby, in his excellent 'Illustrations of British Ornithology,' gives, on the authority of Mr. Neill, of Canonmills, near Edinburgh, two interesting anecdotes in illustration of the habits of this bird in a state of half-domestication. 'The Common Heron (a male),' says Mr. Neill, 'which was winged on Coldingbam Muir in autumn, 1821, when a young bird, and given to me in 1822 by Mr. John Wilson, of the College, has since resided in my garden at Canonmills, and is now so tame that he often follows me, expecting a piece of cheese, which he relishes. Four years ago Mr. Allan, of Lauriston, sent me a young female which had been taken during a severe storm. She soon associated with the older bird. In summer, 1828, she laid three or four eggs (I am not sure which) on the top of a wall next to the mill-pond. She then laid one or two on the flower-border below the wall, and close by the box-edging· here some eggs were broken by the birds suddenly starting off when alarmed by strangers walking in the garden. We supplied their place by some bantam eggs, and only one heron egg at last remained. Alas! the poor hen, having strayed to the margin of the mill-pond, was shot by some thoughtless young man with a fowling-piece. The cock continued to sit for several entire days after the death of the hen, but at last tired. He used to sit when she went off for food. During the whole time of pairing the cock was very bold, raising his feathers and snapping his bill whenever any one approached.'

Mr. Neill further adds a fact, showing that the bird can swim upon occasion. 'A large old willow-tree,' writes Mr. Neill in continuation, 'had fallen down into the pond, and at the extremity, which is partly sunk in the sludge, and continues to vegetate, water-hens breed. The old cock heron swims out to the nest, and takes the young, if he can. He has to swim ten or twelve feet, where the water is between two and three feet deep. His motion through the water is slow, but his carriage stately. I have seen him fell a rat by one blow on the back of the head, when the rat was munching at his dish of fish.'

Geographical Distribution.—Very extensive, and embracing the greater part of the old world. (Selby.) It is permanent in England. Dr. Latham says, 'In England, and the milder climates, this species of heron is stationary, migratory in the colder, according to the season; is rarely seen far north. Inhabits Africa and Asia in general, the Cape of Good Hope, Calcutta, and other parts of India, and is found in America from Carolina to New York.' With regard to the American locality, Dr. Latham appears to have taken the Great Heron, *Ardea Herodias*, Linn., for the *Common Heron*, which last is not mentioned by any of the ornithologists who have made the birds of America their study, as an inhabitant of the New World. Dr. Von Siebold mentions this our European species among the birds which he observed in Japan.

Utility to Man.—In days of old, when the Heron was a principal feature in the noble sport of hawking, and when the destruction of its eggs was visited with a penalty of twenty shillings, it seems to have held as high a place at the tables of the great as it did in the field. Thus, at the 'intronazation' of George Nevell, archbishop of York, in the reign of Edward IV., we find in the bill of fare 400 Heronshawes and 200 Feasauntes (pheasants); and it seems, at one period, to have been valued as a dish at the same price as the latter bird, for from the prices in the household-book of the fifth earl of Northumberland, we find *Hearon-sewys* (Herons) marked at twelve pence, and pheasants at the same rate to a penny. At a marriage-feast in Henry VIII.'s time, we find *Heron-sews* noted at the same price, and at another marriage-feast in the same year two dozen *Heron-sues* marked at twenty-four shillings.* In the first of these records no mention is made of pheasants, but in the second they appear at that earlier time to have been rather more highly valued than Herons, for eighteen pheasants are priced at twenty-four shillings, the amount placed against the two dozen Herons. And in the charges of Sir John Nevile of Chete (the knight in whose family the marriages above alluded to took place), at Lammas assizes, in the twentieth year of the reign of king Henry VIII., the pheasants appear to have cost somewhat more than the *Heronsews*, thirty of which are priced at thirty shillings, while twelve pheasants cost twenty shillings. The heron-plume, made up of the fine large depending feathers, especially those above the wings, was highly valued.

In the present day the bird seems to have sunk into comparative insignificance. Mr. Selby however considers that 'the low estimation in which the flesh of the heron is now held would seem to be in a great degree the effect of prejudice, or the fashion of taste, as under proper treatment and good cookery the Heron, when fat and in fine condition, is but little inferior to some of our most approved wild-fowl.'

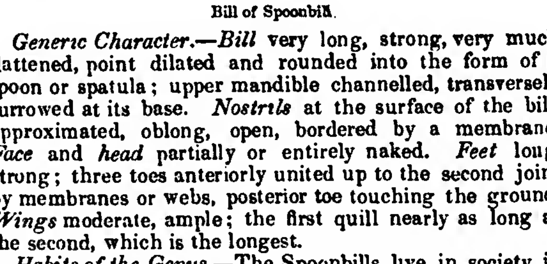
The well-known adage expressive of ignorance, 'He does not know a hawk from a handsaw,' is a corruption of 'He does not know a hawk from a heronshaw.'

Temminck's second section of *Herons* consists of the *Bitterns*, including the Night Herons. As an illustration of this section we must refer to Bittern, vol. iv., and Nycticorax.

Next to the *Bitterns* we may notice the *Boat-bills*. The form of the bill is indeed widely different; but the habits and food of the bird approach very nearly to those of the Herons and Bitterns. [Boat-Bill.]

Spoonbills.

Another extraordinary form of the bill, joined to the general appearance of the Heron tribe, and decided piscivorous habits, is to be found in the Spoonbills, genus *Platalea*, Linn.



Bill of Spoonbill.

Generic Character.—*Bill* very long, strong, very much flattened, point dilated and rounded into the form of a spoon or spatula; upper mandible channelled, transversely furrowed at its base. *Nostrils* at the surface of the bill, approximated, oblong, open, bordered by a membrane. *Face* and *head* partially or entirely naked. *Feet* long, strong; three toes anteriorly united up to the second joint by membranes or webs, posterior toe touching the ground. *Wings* moderate, ample; the first quill nearly as long as the second, which is the longest.

Habits of the Genus.—The Spoonbills live in society in wooded marshes, generally not far from the mouths of rivers, and are rarely seen on the sea-shore. Their food consists of small fishes, spawn, and small fluviatile testaceous mollusks, as well as small reptiles and aquatic insects. According to circumstances they build their nests either in high trees, in bushes, or among rushes. Their moult is

* Marriages in the family of Sir John Nevile, of Chete, Knight.

simple and ordinary, but the young bird does not take the confirmed livery of the adult till the third year; the bill is gradually developed, and appears covered with a membrane. The crest makes its appearance at the second year. The sexes have external distinctions, but the characters are but slightly marked. (Temminck.)

We select as an example the Common White Spoonbill, *Platalea leucorodia*, Linn.

This species is, there can be little doubt, the λευκερωδιος (Leucerodius) of Aristotle (*Hist. Anim.*, book viii., c. 3), of which he says that it haunts περὶ τὰς λίμνας καὶ τοὺς ποταμοὺς ('about the lakes and rivers'); and which he thus describes:—'In size it is less than the other,' the Ἐρωδιός (one of the Herons, perhaps *Ardea cinerea*), 'and has a broad and long bill;' a description which, when coupled with the white colour indicated by the name, can hardly be deemed inapplicable; nor can the term 'broad' be with any propriety referred to the bill of any of the true Herons. It is the *Becquaroueglia* (Belon) and *Cucchiarone* (Bonaparte) of the modern Italians; *Pale, Poche, Cueiller, Truble* (Belon), and *Spatule* of the French; *Weisser Laffler* and *Laffel Gans* of the Germans; *Lepelaar* of the Netherlanders; *Y Llydon big* of the Antient British; and *Spoonbill* and *White Spoonbill* of the Modern British.

Description.—A very full long occipital crest, formed of loose and subulate feathers.

Very old Males.—All the *plumage* pure *white*, with the exception of that of the *breast*, where there is a large patch of *reddish yellow;* the extremities of this patch lessen into bands which unite on the upper part of the back. Naked skin about the eyes and throat pale yellow; but slightly tinged with red on the lower part of the throat. *Bill* black, but bluish in the hollow of the furrows; apex ocreous yellow; *iris* red, *feet* black. Total length 2 feet 6 inches; length of bill 8 inches 6 lines.

Old Females.—Dimensions rather less than those of the male; the crest is less full and shorter, and the sternal patch is only very feebly indicated.

Young of the Year.—White on leaving the nest, with the exception of the external quills, which are black along the shafts and at their ends; all the shafts are also of a deep black. *Head* covered with short rounded feathers; the *bill*, 4 inches and 6 lines long at most, is of a deep ash-colour, soft, very flexible, and covered by a smooth skin; *iris* ash-coloured; naked parts tarnished white. The yellow sternal patch does not begin to appear till the second or third year. (Temminck.)

Mr. Selby observes that in its anatomy it shows an affinity to the Cranes in the form of the windpipe, which, previous to entering the thorax, undergoes a double flexure to the extent of about two inches, and forms a convolution similar to the figure 8. The flexures touch, but do not cross each other, the points of contact being united by fine membranes. This double flexure, according to Willughby and Temminck, was supposed peculiar to the males, but Mr. Selby remarks that Montagu disproves that idea, as the specimen he dissected was a female, and yet possessed the flexure to the extent above described; and this indiscriminate characteristic was corroborated by the dissection of the specimens which Mr. Selby obtained.

Food.—Very small fish, spawn, testaceous mollusks, insects and aquatic worms, small reptiles, and the roots of some weeds and grasses.

Habits, Reproduction, &c.—The Common Spoonbill haunts the mouths of rivers. Its nest is built sometimes on lofty trees, sometimes in rushes and reeds, according to circumstances, and the eggs are from two to four in number, generally three, sometimes entirely white, but most frequently white marked with obscure red spots. They bred annually in the time of Ray in a wood at Sevenhuys, not far from Leyden, but the wood has been long destroyed.

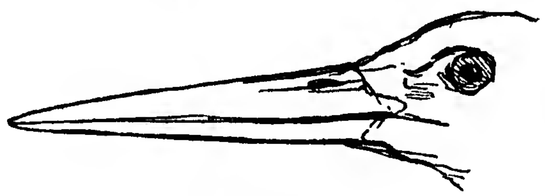
Geographical Distribution.—Europe generally. Holland appears to be a principal place for their summer meetings; and Temminck states that it has two periods of passage along the maritime coasts, and that it journeys with the storks. As winter approaches it migrates to more southern regions till the milder weather recals it. Mr. Bennett states that in winter it takes up its quarters in various parts of Africa, extending southwards even to the Cape of Good Hope. It is, he observes, rarely met with in inland countries except on the banks of the larger rivers; but it is by no means uncommon during the season on the coasts of the great extent of country which it embraces in its visits. In England it only appears occasionally; Pennant mentions a large flight which arrived in the marshes near Yarmouth in April, 1774. Montagu records it as having been sometimes seen during winter on the coast of South Devon, and mentions the receipt of two specimens from that part of the country, one in November, 1804, and a second in 1807. Mr. Yarrell records two specimens which were shot in Lincolnshire in 1826, and Mr. Selby, when in London in 1830, obtained a male and female, in fine adult plumage, from Norfolk. Dr. Latham states an instance of its occurrence on the Kentish coast. The old quatrain in the 'Portraits d'Oyseaux,' speaks of the Spoonbill under the name of *Pale*, as living 'es marches de Bretagne.'

Platalea Leucorodia. Common Spoonbill.

Utility to Man.—The flesh of the Spoonbill, when well fed and fat, is said nearly to resemble that of the goose in flavour.

STORKS. (Ciconia, Brisson.)

Generic Character.—*Bill* long, straight, subcylindrical, in form of an elongated cone, pointed, trenchant, butt (arête) rounded of equal height with the head; lower mandible a little curved upwards. *Nostrils* slit longitudinally in the horny substance of the bill, placed near the base. *Eyes* surrounded with a naked space, which does not communicate with the bill; the *face*, the space *round the eyes*, or a part of the *neck*, often naked. *Feet* long; three *toes* forward, united by a membrane up to the first joint, the posterior toe articulated on the same level with the others; *nails* short, depressed, without dentilations. *Wings* moderate; the first quill shorter than the second, which is rather shorter than the third, fourth, and fifth, which are the longest. (Temminck.)



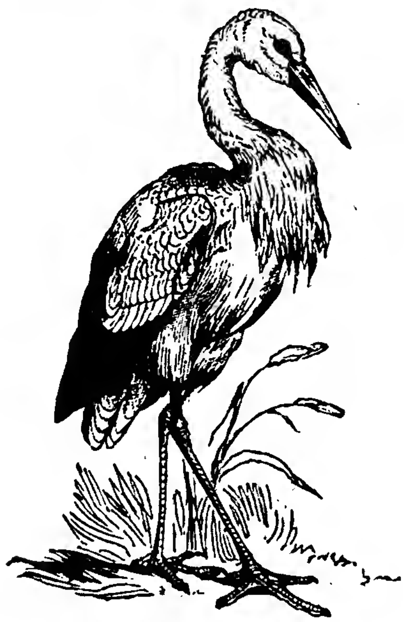
Bill of Stork.

M. Temminck observes that the Storks live in marshes, and feed principally on reptiles, frogs and their spawn, as well as fishes, small mammiferous animals, and young birds. They are, in all the countries of the world where they occur, a privileged race, on account of their utility and of the havoc they make among noxious animals. Their migration takes place in great flocks; they are easily tamed. The moult is autumnal. The sexes do not differ. All the species make a clattering noise with their bills.

The species best known are the White Stork, *Ciconia alba*, and the Black Stork, *Ciconia nigra*. We select the former as an example of that part of the genus which consists of the Storks properly so called.

The White or Common Stork is the Πελαργός of Aristotle and the Greeks; *Ciconia* of the Antient Italians;

Cicogna, Cicogna Bianca and *Zigognia* of the Modern Italians; *Cicogne* and *Cigogne Blanche* of the French; and *Weisser Storch* of the Germans.



Ciconia alba. Common Stork.

Description.—*Bill* straight, smooth naked skin of the cheeks very small, and not communicating with the bill; *plumage white*. *Head, neck*, and all the parts of the body pure white; *scapulars* and *wings* black; *bill* and *feet* red; naked skin around the eyes black; *iris* brown. Length 3 feet 5 or 6 inches.

Young.—The tarnished black of the wings is tinged with brown in the young birds, and the bill of a reddish black.

Habits, Food, Reproduction, &c.—Assured by the kindness with which it is treated in requital for its services in clearing the land of dead as well as living nuisances, the White Stork approaches the dwellings of man without fear. In Holland and Germany especially the bird is treated as a welcome guest, and there, as indeed elsewhere, it annually returns to the nest which has cradled many generations on the steeple, on the turret, on the false chimney that the Hollander has erected for its site, in the box, or on the platform which the German has placed for its use. The stump of a decayed tree is sometimes chosen by the bird, and the nest is made of sticks and twigs, on which are laid from three to five cream-coloured or yellowish-white eggs, about the size of those of a goose. The incubation continues for a month, at the expiration of which period the young are hatched and carefully attended to by the parents until they are fully feathered and able to procure food for themselves. Frogs, lizards, snakes, and other reptiles, mice, moles, worms, insects, eels, the young of ducks and other waterfowl occasionally, and even partridges, according to M. Temminck, are devoured by these birds. In the Continental towns domesticated Storks which have been taken from the nest when young may be often seen parading about the markets, where they are kept as scavengers to clear the place of the entrails of fish and other offal, which they do to the satisfaction of their employers.

Geographical Distribution.—The arrival of the Stork in Europe takes place in the spring. In Seville it is very common; but, according to the Prince of Musignano, it is very rare and only an accidental visiter near Rome. Though so common in Holland, it very rarely arrives in Britain. The general drainage of our marshes may have something to do with this, but is hardly sufficient to account for so striking a difference in the migratory distribution of the bird, more especially as it proceeds to higher latitudes; for it regularly visits Sweden and the north of Russia, and breeds there. The winter is passed by the bird in the more genial climates of Asia, and in the northern part of Africa, Egypt especially. Those who have seen these birds in the act of migration, speak of their numbers as very large: thus Belon remarks, that the Storks are never seen in flocks, except when they are in the air; and he relates how, being at Abydos, in the month of August, a great flight of storks came from the north, and when they reached the commencement of the Mediterranean Sea they there made many circuitous turns, and then dispersed into smaller companies. When Dr. Shaw was journeying over Mount Carmel he saw the annual migration of those which had quitted Egypt; and he states that each of the flocks was half a mile in breadth, and occupied three hours in passing over.

Utility to Man.—The utility of this bird to man in clearing away noxious animals and filth has given it a claim to protection that has rendered it quite at its ease in his presence wherever that protection has been afforded.

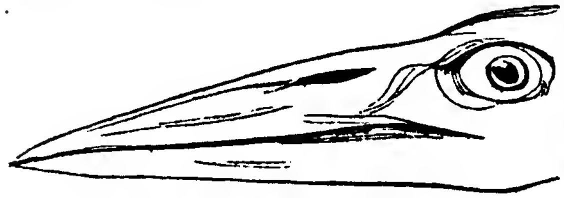
M. Temminck remarks that all those gigantic species of foreign storks arranged by systematists under the name of *Mycteria*, have the same external characters with the European Storks, the same manners and the same habits, and he further refers to the fact that Illiger in his 'Prodromus' has given his opinion that the genera *Mycteria* and *Ciconia* ought to be united.

Mr. Selby, after giving the characters of the genus *Ciconia*, says, 'My readers will observe that these generic characters are not applicable to all the species of the genus *Ciconia* of Bechstein, Cuvier, Temminck, and Wagler, but only to that group of which *Ciconia alba* may be considered the type. The larger species, viz. *Ciconia Marabou, Argala, Mycteria*, &c., seem to me possessed of characters sufficiently distinct to warrant such a separation, a fact indeed admitted by the necessity under which these authors have found themselves of subdividing their genus into sections.'

Of these, the three gigantic species of Stork remarkable for the comparative nakedness of the head and neck, a kind of pouch which hangs externally in front of the neck and a sort of vesicular apparatus or portion of skin at the back of the neck which can be inflated by the bird, and the greater enlargement of the bill, deserve especial notice. These extraordinary and uncouth-looking birds are natives of Africa and the eastern parts of Asia, and have only been known to modern naturalists within the last forty or fifty years.

Ives in his voyage to India (1773) made known a gigantic grallatorial bird from which Dr. Latham described the Adjutant of the British residents at Calcutta (the Argala of the natives), with the name of the Gigantic Crane. At the same time he noticed the observations made by Smeathman the African traveller, on the habits of a bird seen by the latter on the western coast of that quarter of the globe. Gmelin upon this information founded a species, *Ardea dubia*, and Latham, who had figured the bird, and related some additional particulars of its habits in the first supplement to his 'Synopsis' (1787), changed the name in his 'Index Ornithologicus' to Ardea Argala. Mr. Bennett, who adverts to these points, proceeds thus: 'Mr. Marsden, in his "History of Sumatra," makes mention of a bird, called by the natives of that island Boorong-Cambing, or Boorong-Oolar, which was generally believed to be of the same species with the Adjutant of Bengal. Dr. Horsfield however, in a paper published in the thirteenth volume of the "Linnæan Transactions," separates a Javanese bird, which is probably the same with the Sumatran, as a distinct species. Subsequently M. Temminck, in his "Planches Coloriées," has shown that the African species differs in several essential particulars from that of the continent of India, and still more remarkably from that of Java and the neighbouring islands. By his figures of the three species, all taken from living specimens, he has so clearly determined their characters that it is scarcely possible they should ever again be confounded. In one point however he has himself given rise to a different kind of confusion, that of their nomenclature. They all furnish, in more or less perfection, the beautiful plumes, superior in estimation even to those of the ostrich, known by the name of Marabous, from their appellation in Senegal. But those of the Indian species being far superior to the others, M. Temminck has thought fit to transfer to that bird the name of *Ciconia Marabou*, and to rob it of its native appellation *Argala*, which he has bestowed upon the African. The consequence of this perversion of their native names has been such as might have been expected. In the late edition of his "Règne Animal," M. Cuvier quotes the *Ciconia Marabou* of Temminck, with the characters of the Indian bird, as a native of Senegal; while he states the *Ciconia Argala* of the same author, to which he attributes the characters of the African species, to be brought from India. Nothing could more strongly evince the necessity of restoring, as Mr. Vigors had previously done, in the appendix to Major Denham's "Travels in Africa," the name of *Argala* to the Indian, and that of *Marabou* to the African species.'

We shall illustrate this group by *Ciconia Marabou*, Vigors.



Bill of African Gigantic Stork. Ciconia Marabou.

Description of the African Marabou, and differences between that species and the Indian Argala.—M. Temminck has clearly pointed out the differences between these two species. The *African Marabou* is less in size than the *Indian Argala*, the latter sometimes reaching six or even seven feet in height, while the former seldom exceeds five, even when the neck is elongated. The bill of the *Argala* is enlarged in the middle, the culmen of the upper mandible and the edges of the lower form a curved line from the base to the apex; in the *Marabou* the lines are straight and the bill is regularly conical: the nostrils of the Indian bird are ovate; those of the African species are oblong. The iris of the former approaches to pure white; that of the latter is dull-brown. The cervical or sternal pouch often hangs down more than a foot in the *Argala*; in the *Marabou* it is much shorter. The back and wings of the *Argala* are dull-black; in the *Marabou* there is a greenish tinge on the black of the back, with the exception of the larger wing-coverts and secondaries, which are of a more decided black, edged more or less broadly and distinctly, according to the age of the individual, with pure white bands. In the young birds these last distinctions are imperceptible. In both species the bill is inclined to livid yellow in colour, and is more or less spotted with black towards the base, as is the head, which is dusky. When the bird is at rest the pouch as well as the neck are of a pale flesh-colour, but when it is excited they acquire a redder tinge. These parts are sparingly covered with a few scattered brownish hairs, most numerous in the young birds, and resembling down in the early stages of its growth. The tail is black; the under parts pure white, more especially the under tail coverts, which afford the beautiful plumes. These are sometimes of a greyish-slate colour in the Indian species; but the white of the African feathers is not so clear and brilliant as that of the Indian plumes, to which a decided and just preference is given. The natural colour of the legs is dusky-black, but in living birds these limbs are generally whitened by the dust shaken out of the plumage and other excrement.

African Gigantic Stork, or Crane Ciconia Marabou.

Geographical Distribution of the African species, or Marabou.—Nearly the whole of Tropical Africa to the Cape of Good Hope, where it is not common. (Temminck.) Banks of the Nile. (Rüppell.) Neighbourhood of the large towns of the interior. (Denham.) Western coast. (Smeathman.)

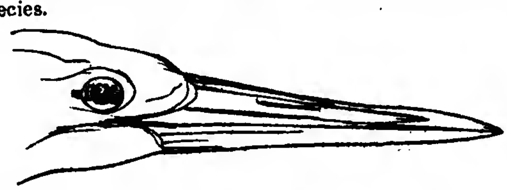
Habits, Food, &c.—Nearly resembling those of the White Stork, like which, it is privileged on account of its utility as a scavenger in freeing the villages and towns of offensive substances, like its Indian congener. Its omnivorous voracity is well described by Denham. Where carrion and filth are scarce, reptiles, small birds, and small quadrupeds fall victims to its appetite. These are usually swallowed entire. Smeathman gave to Dr. Latham an anecdote of a domesticated individual which roosted very high among the silk-cotton trees and would descry the servants bringing the dishes to the dinner-table from a distance of two or three miles from its perch. It stood behind its master's chair waiting to be fed, and occasionally helped itself, notwithstanding the guardianship of the servants who carried switches to prevent its snatching the meat, which it nevertheless sometimes contrived to do: in this way it had been known to swallow a boiled fowl at a single mouthful. Besides the pouch the skin at the back of the neck can be inflated so as to have somewhat the appearance of a counterpoise to the former. When the sun is shining upon the bird, we have observed this latter pouch, if pouch it may be called, very prominent, apparently from the rarefaction of the air. The bird flies high and roosts high, probably for the purpose of taking in a large area of observation to enable it to perceive those objects on which its feeds. May not these pouches assist, balloon-like, in supporting or balancing the great head and bill?

CRANES.

We now come to a subfamily whose food is much more vegetable than that of any of the others which we have noticed; and there is, as might be expected, a conformable change in the structure of the bill and stomach.

Grus (Pallas).

Generic Character.—*Bill* of the length of the head or rather longer, strong, straight, compressed, the point in the form of an elongated cone, obtuse towards the end; lateral base of the mandible deeply channelled; base of the bill elevated. *Nostrils* in the middle of the bill, pierced through and through in the groove, and closed backwards by a membrane. *Region of the eyes* and base of the bill often naked, or covered with warty excrescences (mamelons). *Feet* long and strong, a large naked space above the knee; three anterior *toes*, the middle one united to the external by a rudiment of a membrane, interior toe divided, posterior toe articulated higher on the tarsus. *Wings* moderate; first *quill* shorter than the second, which last is nearly as long as the third, and that is the longest; *secondaries* nearest to the body arched, or very long and subulate in some foreign species.



Bill of Common Crane.

In the greater part of the species the trachea of the male forms circumvolutions upon itself; in the other similar sinuosities occur in both sexes, which do not differ in external appearance. Moult once in the year. (Temminck).

Example, *Grus Cinerea*.

Description.—General *plumage* ashy grey; throat, front of the neck, and occiput very deep blackish grey. *Forehead* and space between the eye and the bill furnished with black hairs; top of the *head* naked and red. Some of the *secondaries* arched, longer, and loose-barbed. *Bill* greenish black, horn-coloured towards the point, and reddish at the base; *iris* red brown. *Feet* black. Length from the bill to the end of the tail, 3 feet 8 or 10 inches.

Old Birds.—These have a large whitish space behind the eyes and along the lateral part of the upper portion of the neck.

Young Birds before their second autumnal moult.—No nakedness on the top of the head, or the space hardly visible. The blackish ash colour of the front of the neck and occiput non-existent or only indicated by longitudinal spots.

This is the Γέρανος (Geranus) of the Greeks; *Grus* of the Antient Italians; *Grue* and *Grua* of the Modern Italians; *Grue* of the French; *Grulla* of the Spanish; *Kranich* and *Aschgrauer Kranich* of the Germans; *Trane* of the Danes; *Goran* of the Antient British; and *Crane* and *Common Crane* of the Moderns.

Habits, Food, Reproduction, &c.—The habits of the Crane are migratory and gregarious. Mr. Selby remarks that in its contour and gait it bears a considerable resemblance to some of the *Struthionidæ*, and that we are reminded of the ostrich by the long flowing plumes that overhang the tail. He is of opinion that through this and other families its affinity to the Rasorial birds is readily traced; and he observes that in its internal conformation it differs very essentially from the more typical families of the *Grallatores*, and that its strong and muscular stomach indicates a different general economy from that of the *Ardeidæ*. This is quite true; but whilst the Crane frequents open and cultivated lands for the sake of the newly sown corn and seeds to be found in such tracts, it is far from averse to small testaceous mollusks, worms, frogs, and other reptiles. Temminck says that the nest is placed among the rushes, &c., and sometimes on the walls of isolated houses. The pale bluish-green eggs, marked with brown, are two in number.

Grus cinerea. Common Crane.

Geographical Distribution.—Temminck states that this crane inhabits the marshy plains of the Oriental countries; that it is common in the north, migrates regularly in spring and autumn, is rare in its passage in Holland, and only in very severe winters. Asia is one of the tracts of country much frequented by it. Dr. Von Siebold notices it in his list of birds killed at Japan. Mr. Selby states that its equatorial migrations extend to India, Egypt, and other warm parts of Asia and Africa, but that it retires in summer to the northern and eastern parts of Europe to breed. The migrations are performed high in the air, and the progress of the flock may be traced by the loud cries of the birds when they are beyond the reach of sight. The night-time is frequently chosen for these changes of locality. The Prince of Musignano notes it as very rare and accidental near Rome; Willughby however saw many of them in the poulterers' shops in winter. But it is in England that the alteration of the country by drainage and enclosure has caused perhaps the most remarkable absence of these fine birds. They were numerous in the time of our ancestors, and highly esteemed by them, both as objects of sport and as furnishing a dish fit for the table of princes. By 25 H. VIII., c. 11, confirmed by 3 & 4 Edw. VI., c. 7, twenty pence was the forfeiture for each egg of the crane taken and destroyed. Willughby says, 'They come often to us in England; and in the fen countries in Lincolnshire and Cambridgeshire there are great flocks of them; but whether or no they breed in England (as Aldrovandus writes he was told by a certain Englishman, who said he had often seen their young ones), I cannot certainly determine, either from my own knowledge or from the relation of any credible person.' In Pennant's time he had come to the conclusion that the Cranes had forsaken our island. 'A single bird,' says he, 'was killed near Cambridge, about three years ago, and is the only instance I ever knew of the Crane being seen in this island in our time.' Dr. Latham mentions only four instances as occurring within his memory of the Crane having been met with in England. (Pennant, *Brit. Zool.*, 1812.) Montagu and Dr. Fleming mention a small flock that visited Zetland in 1807, and Mr. Selby received information of one killed in Oxfordshire, in December, 1830. The Crane can now be only regarded as an accidental and rare visitant to our islands.

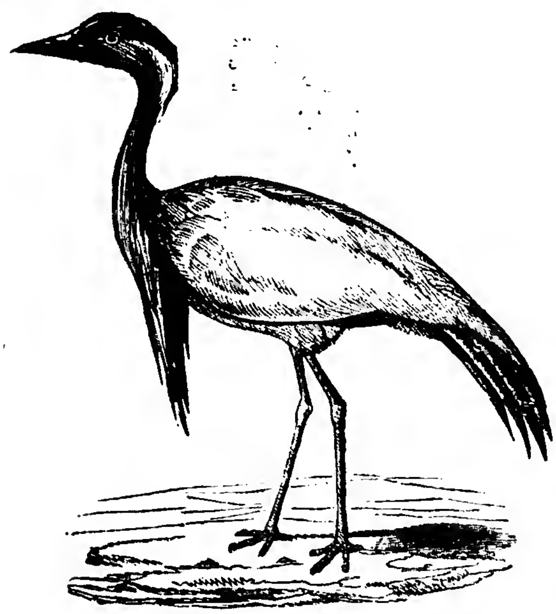
Utility to Man.—'The flesh is very savoury and well tasted, not to say delicate' (Willughby), and indeed it seems to have been highly prized in former days. At the 'intronazation of George Nevell, the archbishop above alluded to, 204 Cranes were served, and in the Northumberland Household-book the price of the Crane (Cranys) is marked sixteen pence. At the marriage-feasts also above mentioned, one of the items in the first is '9 Cranes, every Crane three shillings and four pence;' and in the second we find 'Item for a Standert, Cranes 2 of a dish' for the second course; and in the expenses we find 'Item, in Cranes 9.. £0 30s. 0d.' The long drooping feathers are valuable as plumes.

Anthropoïdes. (Vieillot.)

Mr. Bennett remarks (*Gardens and Menagerie of the Zoological Society*) that the name of *Anthropoïdes*, conferred upon this genus by its founder, M. Vieillot, owes its origin to a mistaken reading of a passage in Athenæus, which the French academicians of the seventeenth century improperly applied to the Demoiselle, or Numidian Crane, regarding the resemblance to man implied by the term *Anthropoïdes* as a convincing proof that the *Otus* of the Greeks was a synonym of the bird, which they were themselves describing under the name of Demoiselle, from its elegant attitudes. 'It is difficult however,' says Mr. Bennett, 'to conceive how these learned men, with Mr. Perrault at their head, could have stumbled on so gross a misapprehension; for the passages cited by them from the Greek and Roman authors prove beyond all question that the *Scops* and *Otus* of the former and the *Asio* of the latter were in truth nothing else than owls, and had consequently no connexion with the Numidian Crane. M. Savigny, on the other hand, refers the latter bird to the *Crex* of Aristotle and other classical authors; but we must confess that we entertain considerable doubt of this opinion also. The scattered notices of the antient *Crex* appear to us by far too scanty and indefinite to admit of their positive appropriation; and they combine moreover several traits which are quite irreconcilable with the identity of the two animals. With the exception of this distinguished naturalist, almost all the modern authors who have spoken of the Demoiselle have merely copied Buffon, who with singular inconsistency, at the same time that he corrects the error of synonymy into which the academicians had fallen, adopts all their quotations founded upon this very mistake. The truth is, that the real history of the bird cannot be traced with certainty beyond the period of M. Perrault's memoirs, in which it was for the first time described under the fanciful denomination which it has since attained.' We have given this passage entire, because the exemplary and industrious zoologist who penned it is, in our opinion, borne out in his observations, and because it conveys a good lesson of the danger of hastily appropriating Greek or Roman names to existing animals. Such an appropriation should never be made without the clearest evidence of the identity of the species. But however right Mr. Bennett may be, the term *Anthropoïdes* is now generally received by ornithologists as the generic appellation for certain species of cranes, and must be retained, the only question being what species should be arranged under it. The Demoiselle and the Balearic Crane were the only two species of *Anthropoïdes* (Vieillot), till a third and most elegant species, *Anthropoïdes*

Stanleyanus (Vigors), *Anthropoïdes Paradisæus* (Bechstein), was added. Mr. Vigors would include the whole of these three species in the genus; but Mr. Bennett remarks, that the discovery of that species, closely allied as it is to the Demoiselle, seems to determine the existence of that form as a distinct type, and to render it more necessary to isolate the Crowned or Balearic Crane, *Balearica pavonina*, *Ardea pavonina*, Linn., under another generic name, *Balearica* (Brisson).

The *Demoiselle* (*Anthropoïdes Virgo*, *Ardea Virgo* of Linnæus) is about 3 feet 6 inches high, measured to the top of the head: from the point of the bill to the tip of the tail it is about 3 feet in length. Upper part of the *head* light grey; sides of the *head*, *neck*, and *depending breast feathers*, blackish; head and neck fully feathered. A tuft of pure white loose-barbed feathers, three or four inches long, directed backwards with a curvature downwards behind each eye. General tint slaty-grey; outer portions of all the quill-feathers dingy-black. Secondaries longer than the primaries, forming when the wings are folded dependent downward-curved plumes. *Bill* yellowish or flesh-coloured; *iris* reddish-brown.



Demoiselle. Anthropoides Virgo.

Habits, Food, &c.—The habits of the Demoiselle are migratory, and its food consists in great measure of grain and seeds, though it occasionally takes small fishes, mollusks, and insects. Gizzard muscular. The Demoiselle produced young in the menagerie at Versailles, and one which was hatched and bred there lived twenty-four years.

Geographical Distribution.—Africa. It has been observed in the north, along the Mediterranean, the west from Egypt to Guinea, in the interior, and in the south near the Cape of Good Hope. It has been killed in Nepaul, according to Mr. Gould; is found on the southern coasts of the Black Sea and Caspian, and has been observed at Lake Baikal. It is occasionally seen in Europe, and appears about Constantinople in October. At the inundation of the Nile great numbers arrive in Egypt.

The Stanley Crane, *Anthropoïdes Stanleyanus* (so named by Mr. Vigors in honour of the earl of Derby, then Lord Stanley, President of the Zoological Society of London), *Anthropoïdes Paradisæus* of Bechstein, is in its general plumage bluish-grey, the top of the tumid head, which is well covered with soft feathers, is whitish, and there is a brownish post-ocular band; the irides are chestnut-black, and the points of the quills, tail, &c., are brownish-black. Length from the tip of the bill to the end of the tail 3 feet 6 inches. Mr. Vigors mentions particularly the greater length and development of the *hallux* in this species, in which character, he observes, the bird seems to be intermediate between *Anthropoïdes Virgo* and the more typical *Gruidæ*. He considers the Balearic Crane as according with this species in this particular, and by the additional character of the naked cheeks and caruncle under the chin, as exhibiting a still nearer approach to the true *Grus Anthropoïdes Virgo*, on the other hand, by the slight development of the *hallux*, appears to him to possess the nearest affinity of all the birds in the group to the *Charadriadæ*.

Stanley Crane. Anthropoides Paradisæus (Bechstein).

Habits, &c.—'In manners and gestures,' says Mr. Vigors, 'the *Anthropoïdes Stanleyanus* appears to conform most intimately with the *Demoiselle*, displaying the same delicacy and elegance of attitude, and the same majesty, together with the same graceful playfulness in all its movements. I once had the good fortune to see it when released from the place of its confinement and set at liberty into an adjoining yard; and it was scarcely possible to witness a scene of more grace and animation. The bird, when after a few movements it felt itself free, bounded into the air, and traversed the yard with singular velocity, and a peculiarity of motion which could neither be termed running nor flying with its wings expanded, and its long quill-feathers streaming just above the ground, it sailed and swept along the open space, without regard to the numerous spectators who watched its movements, luxuriating in all the buoyancy and excursiveness of new-felt liberty. I understand that it is particularly eager in its pursuit after insects, which it takes when they are upon the wing; and that they seem to be its natural and most acceptable food. We may readily conceive what myriads of winged creatures it would encircle within its wings as it swept along its native marshes, in the manner observed above, and which it would thus bring within the compass of its prey.' (*Zool. Journ.*, vol. ii.)

Locality.—East Indies.

The Balearic or Crowned Crane (*Anthropoïdes pavoninus* of Vieillot and others; *Balearica pavonina* of Brisson and others; *Ardea pavonina* of Linnæus) received its English and French common name from its being supposed to be the Balearic Crane of the antients. Its height when full grown is about four feet. We select Mr. Bennett's description: 'Its plumage is of a bluish-slate colour on the neck and on both surfaces of the body; the quill-feathers of the tail and the primaries of the wings are of a beautiful black; the secondaries, which extend beyond the base of the tail, of a bright and glossy brown; and the wing-coverts pure white. The cheeks and temples are entirely naked, and are coloured of a bright rosy red, which sometimes over spreads the whole of the naked surface, and sometimes is confined to a portion of it, the remainder in this latter case becoming perfectly colourless and of a dull white. Beneath the upper part of the throat a similar naked space is gradually developed, which terminates in a dependent fold of the skin, like the wattle of a turkey, but more uniform on its surface, and of a brilliant red. As this prolongation is not always met with, it has been considered by some writers as a mark of sex; but of the two birds examined by the

French academicians, the one possessed it and the other not, and yet both were females: it may therefore with greater probability be considered as the result of age. The fore part of the head is covered by a close tuft of short, smooth, even, velvety feathers of a deep black; and behind these rises a very remarkable crest, consisting of a large number of flat yellowish filaments, each twisted spirally on itself, fringed along its edges with a series of black-pointed hairs, and terminating in a blackish pencil. These filaments are of nearly uniform length, and measure four or five inches from base to tip. They take their origin from a roundish space on the back of tho head, and expand equally at their extremities into a circle of considerably larger diameter than the head itself. The bill, legs, and feet are of a dusky black; and the iris is remarkable for being almost destitute of colour. As in most of the birds of this family, the feathers of the lower part of the neck are long, narrow, and gracefully dependent over the breast.'

This description is so good in the main that we have given it in the author's own words; but his observations with regard to the wattle require observation. Indeed, he himself, as secretary to the Zoological Society, subsequently (1833) brought under tho notice of a meeting of its members specimens, from the Society's museum, of Crowned Cranes from Northern and from Southern Africa, with the view of illustrating the characters which distinguish as species the birds from those several localities. Their specific distinction, he stated, on the authority of Professor Lichtenstein, had been pointed out, nearly thirty years from that timo, by the Professor's father, who gave to the Cape bird the name of *Grus Regulorum.* This distinction had not however, Mr. Bennett remarks, been generally known among ornithologists, although to those connected with the Society it had for some time been familiar, from observation both of numerous skins and of living individuals. In the bird of North Africa, for which the specific name of Pavoninus will be retained, the wattlo is small, and there is much red occupying tho lower two-thirds of the naked checks: in that of South Africa the wattle is large, and the cheeks are white, except in a small space at their upper part; the neck also is of a much paler slate-colour than that of the North African species. Mr. Bennett added that the latter characters had been observed to be permanent in an individual presented to the Society in April, 1829, from the collection of the late Marchioness of Londonderry, then still living at the Gardens. They existed also in both the individuals presented by Sir Lowry Cole.

Mr. Gray at the same time took occasion to remark that the oval form of the nostrils in the *Crowned Cranes,* added to other distinguishing characters which had frequently been pointed out, might be regarded as indicating a generic difference between them and the *Demoiselle* and *Stanley Cranes,* in which the nostrils have the lengthened form usual in the genus *Grus,* a genus from which they scarcely differ, except in the comparative shortness of their bill. For the group including the *Crowned Cranes* the name of *Balearica* might, he thought, be retained, and that of *Anthropoïdes* be appropriated to the one comprehending *Anthropoïdes Virgo,* Vieill., and *Anth. Paradisæus,* Bechst. (*Zool. Proc.,* 1833.)

The species with the small wattle and other differences will, according to this proposition, stand as *Balearica pavonina: Locality,* Northern and Western Africa. The species with the large wattle, &c., will stand as *Balearica Regulorum: Locality,* Southern Africa.

Habits, &c.—Presumed to be migratory; but little is known of them, except in captivity, to which the birds are easily reconciled, living in friendship with the domestic poultry, and other captives, and even, as we have heard, interfering to prevent disputes. In a stato of nature they are said to frequent swampy places, and to subsist partly upon fishes, worms, and insects, and partly on vegetable substances. They run with the wings expanded, and with great rapidity. Their note is loud, trumpet-like, and hoarse. In the catalogue to the African Museum, now (June, 1838) just coming to the hammer, one of the species, there called the *Kaffir Crane,* is said to be held sacred by the Kaffirs bordering upon the Cape colony; and if one should happen to be killed, even by accident, a calf or young cow must be slaughtered as an atonement. Mr. Swainson ('Classification of Birds') notices specimens of *Ardea pavonina,* Linn., as having been brought to him when in Malta, from the little island of Lampidosa, where, he says, they are by no means scarce.

Crowned Crane. Balearica.

Our English readers will find most of the birds above described living in the Gardens of the Zoological Society in the Regent's Park, together with many others of this great family. Among them there is a fine specimen of the gigantic *Indian* or *Sarrus Crane, Grus Antigone* of Linnæus

HERO'PHILUS, a native of Chalcedon, was one of the most celebrated physicians of the Alexandrian school, and lived in the reign of the first Ptolemy of Egypt. Of his works, which appear to have been very voluminous, nothing now remains except the extracts made from them by Galen and Cœlius Aurelianus, in which they are so interwoven with those of his contemporary Erasistratus, that it is impossible to say what portion of the progress which medicine made in their time was owing to the labours of each.

The chief feature which marks the time of Herophilus in the history of medicine is the commencement of the study of anatomy from dissections of tho human body, for which purpose the bodies of all malefactors were appropriated by the government. With such zeal did Herophilus pursue this science, that he is said to have dissected 700 subjects, and it was against him and Erasistratus that the very improbable charge was first made of having frequently opened living criminals that they might discover the secret springs of life. (Celsus, *Præfat.*) From tho peculiar advantages which the school of Alexandria presented by this authorised dissection of the human body, it gained, and for many centuries preserved, the first reputation for medical education, so that Ammianus Marcellinus, who lived about 650 years after its establishment, says that it was sufficient to secure credit to any physician if he could say that he had studied at Alexandria.

By the labours of Herophilus and Erasistratus nearly every part of the anatomy of the human body was rendered clearer, and many most important discoveries were made. They first determined that the nerves are not connected with the membranes which cover the brain, but with the brain itself, though as yet the distinction of tho nerves from the tendons and other white tissues had not been made out. The description which Herophilus gave of the brain itself was far superior to those of previous authors: he discovered the arachnoid membrane, and showed that it lined tho ventricles, which he supposed were the seat of the soul; and the chief meeting of the sinuses into which the veins of the brain pour their blood still bears the name of Torcular Herophili. He noticed the lacteals, though he was not aware of their use; he pointed out that the first division of the intestinal canal is never more than the breadth of twelve fingers in length, and from this fact proposed for it the name (duodenum) by which it is still called.

Herophilus practised surgery as well as medicine, but it is probable that very soon after his time the division of surgery and medicine into distinct professions took place. Of his knowledge of medical practice there is not sufficient evidence in the extracts which Galen makes from his works to enable us to form an accurate idea, and his fame must rest rather on the indirect assistance which he afforded by his anatomical researches, than on any immediate addition to the means of curing disease. He does not appear to have drawn many pathological conclusions from his knowledge of the healthy structure, but his observations on the pulse, of which his master Praxagoras had taught him some of the value as a means of discriminating diseases, were important and interesting; and it was he who first showed that paralysis is the result not of a vitiated state of the humours, as was previously imagined, but of an affection of the nervous system. Herophilus seems to have founded a school which took its name from him. According to Strabo (xii. p. 580) there was a great school (διδασκαλεῖον) of Herophilists in his time established in a temple between Laodiceia and Carura in Phrygia.

HERPES. The word herpes was employed in a very vague sense, and applied to many eruptions of different kinds, until restricted by Willan to a well-defined affection of the skin, characterised by the eruption of clusters of transparent globular vesicles, situated on a red and inflamed base extending some lines beyond them. The vesicles of each cluster commonly vary in size from a millet-seed to a very small pea; the clusters themselves are distinct, being separated by portions of perfectly healthy skin, and they generally rise in quick succession.

The eruption is preceded and accompanied by a degree of constitutional disturbance which generally varies with the extent of the local affection, being often slight and attracting no notice, when this is limited and consists of a few clusters only, but very great and marked by a high degree of fever, when the clusters are numerous and spread over an extensive surface in a young and plethoric subject.

The local affection is announced by a sensation of heat and tingling experienced in the part, and first appears as a small bright red spot, having in its centre a few very minute vesicles. These vesicles, which contain a transparent colourless fluid, rapidly enlarge, and, in the course of some hours, attain the size and present the form and aspect of very small pearls: in the thickest part of the cluster two or three of the vesicles coalesce, forming one of irregular figure and larger size. There is a sensation of pricking and smarting pain experienced in the part. The vesicles gradually become opaque, in the course of a few days shrivel, and are succeeded by brownish scabs: the heat and irritation of the portion of skin on which they are situated subside; and the scabs fall off, leaving a tender and reddened state of the skin, which soon disappears. The duration of the individual clusters, from their first appearance to the falling off of the scabs, varies from one to two weeks. When there is a succession of clusters, they all follow the same march; the febrile state persists as long as fresh vesicles continue to arise, and the affection may be prolonged to three or four weeks. In some cases the fluid is absorbed, the vesicles shrivel, and, at the end of four or five days the affection terminates in desquamation; in others, the fluid in the vesicles becomes purulent, and they are succeeded, especially when seated on the back, by superficial ulcerations, which prolong considerably the duration of the disease.

The clusters of vesicles, though they retain in all cases the same characters, and follow nearly the same march, are sometimes confined to a particular locality, justifying the designation, *H. labialis*, *H. præputialis*, or assume a particular arrangement, giving rise to the varieties, *Herpes zoster*, when they are situated on one half of the body and extend in a line or band; *H. phlyctenodes*, when they are disseminated; and *H. circinnatus*, when they occur in circles or rings

In *H. labialis* the clusters are disposed irregularly about the mouth, generally on the external surface of the lips, in some cases extending to the cheeks and alæ nasi, and in rare instances occurring also in the pharynx. It occasionally comes on after irregularities in diet, or unusual exposure to cold winds, or to the atmosphere, as in travelling; at the termination of the hot stage, in ague; and during the course of catarrhal fevers and pneumonia. It is always a slight affection in itself, requiring no treatment beyond that of the disorder which it accompanies.

Herpes præputialis. In this variety there are one or more small clusters of vesicles, either on the external or internal surface of the prepuce. When situated externally, they follow the ordinary march or terminate in desquamation, and require no treatment, with the exception of the application of lint soaked in the lotion of acetate of lead, for the purpose of alleviating the itching and preventing the rupture of the vesicles and the consequent formation of an ulcer. When they occur on the internal surface of the prepuce, the vesicles are kept continually moist, break at the end of four or five days, and often give rise to an excoriation or superficial ulceration, which by an inattentive observer may be mistaken for a syphilitic sore. It soon heals under the influence of cleanliness, the local application of the lead lotion, and the administration of a few alteratives.

In *Herpes zoster*, familiarly known by the name of shingles, there is a succession of clusters of white silvery vesicles, forming an oblique line or band, limited to one-half of the body, and almost always occurring on the trunk. It is generally ushered in by severe febrile symptoms, and by smarting or deeply-seated pains, which indicate the future course of the eruption. Each cluster follows the march we have described, and the febrile state continues as long as there is a succession of vesicles. It is unattended with danger, excepting in old persons, where the clusters are occasionally followed by gangrenous and sloughy sores. In young and plethoric subjects the treatment should consist of bleeding, saline purgatives, diet, and the application to the part of a sedative lotion. This treatment alleviates the sufferings of the patient, but has very little influence on the march of the vesicles. Mr. Plumbe says, 'If care be taken to puncture each vesicle early, so as to allow the free escape of the fluid, the pain is much diminished, and the irritation sooner subsides.' In old persons, care should be taken that they do not lie on the affected side.

Herpes phlyctenodes differs from the preceding variety in the arrangement of the clusters, which are disseminated, and have no particular seat. When occurring extensively, the vesicles do not attain the size common to more limited forms of the eruption. It is often met with in children during dentition.

In *Herpes circinnatus*, or herpetic ringworm, the eruption is limited in extent, frequently of a circular form, and consists of extremely minute vesicles, which dry up and terminate in exfoliation, leaving a scurfy areola. It occurs frequently on the cheeks in children and in women of delicate complexion, and is often confounded with a disease entirely different in its nature, contagious, and also, in popular language, denominated ringworm. This form of Herpes soon disappears under the influence of the local application of almost any astringent solution.

None of the varieties of Herpes are contagious, and all occur most frequently in the young, during spring and autumn, and in warm climates.

The existence of distinct groups of vesicles on red and inflamed bases is sufficient to distinguish Herpes from every other cutaneous affection.

HERPESTES. [ICHNEUMON.]

HERPETO'LOGY, that branch of science which treats of the organization, natural history, and arrangement of *reptiles*. The term, literally construed, means a discourse upon reptiles, from 'Ερπετόν (Herpeton) a reptile, and Λόγος (Logos) a discourse. [REPTILE.]

HERRE'RA, FRANCISCO DE, surnamed *El Viejo* (the Elder), was born at Seville, 1576. He was one of the most eminent of the Spanish painters of the school of Seville. He excelled both in design and colouring, and though his execution was decided and rapid, his works will bear the test of minute investigation. Among his best works are the Last Judgment in the church of St. Barnard, the Descent from the Cross and the Effusion of the Holy Ghost, in the church of S. Ines, and, in fresco, the cupola of S. Bonaventura; all at Seville. His easel pictures, mostly representing subjects of common life, kitchens, alehouses, inns, &c., are admirable, and fetch high prices. He also worked in bronze, and has left some etchings. In 1647 he completed his works in the episcopal palace at Seville, and went, in 1650, to Madrid, where he died, some say, in the same year; others in 1656.

HERRE'RA, FRANCISCO DE, the Younger (*El*

Mozo), painter and architect, son of the preceding, inherited his father's talents. The father being a man of a tyrannical disposition, his son left him, and went to Rome to pursue his studies. After his father's death he returned to Seville, and painted for the churches. An academy being established in 1660, he was made sub-director; but being too proud to brook the superior authority of Murillo, he went to Madrid, where he rivalled the most eminent artists. He painted both in oil and fresco. His frescoes in the chapel of St. Philip so pleased King Philip IV., that he commissioned him to paint the chapel of the Madonna de Atocha, where he painted the Assumption of the Virgin. This and other works procured him the honour of principal painter to the king, and superintendant of the royal edifices. He died in 1685, aged 63.

HERRE'RA, ANTONIO, Coronista mayor de las Indias y Castilla, born at Cuellar, 1549, died at Madrid on the 19th March, 1625. He is extolled by Robertson (*Hist. of Amer.*, h. v., note 70), and many other distinguished writers. Quintana (*Vida de Pizarro*, appendice vii.) points out some inaccuracies, which however he extenuates as unavoidable in that work, the chief and still the best source of information which Herrera left for subsequent writers on American history from 1492 to 1554. The first and now rare edition of that laborious performance bears the title of 'Historia General de los Hechos de los Castellanos en las Islas y Tierra Firma del Mar Oceano, en 8 décadas,' 4 vols. fol., Madrid, 1601. A second edition, that of Antwerp, 4 vols. fol., 1728, is very incorrect. A highly-improved edition, with corrections and additions, is entitled 'Descripcion de las Indias Occidentales,' 4 vols. fol., Madrid, 1730. Barlæus published this history in his 'Novus Orbis,' 1622; and Nicolas Coste, in his 'Histoire Générale des Voyages des Castillans,' 1659; and Captain Stevens, in his 'History of America,' 1725. The rarest perhaps of several other politico-historical works of Herrera is entitled 'Historia de lo Sucedido en Escocia y Inglaterra en 44 años que vivió Maria Estuarda,' 8vo., Madrid, 1589, and 8vo., Lisbon, 1590. (Nicolaus Antonius, *Biblioth. Hispa. Nova; Allgemeine Encyclopädie*, von Hassel und Hoffman; and Brunet, *Manuel du Libraire.*)

HERRERA, FERNANDO, a native of Seville, lived in the sixteenth century, the golden age of Spanish poetry, among the reformers of which he was prominent. He won the admiration of his contemporaries, who prefixed to his name the epithet of Divine. Inspired by Pindar, he became the first classical ode writer in modern Europe; and however severely he may be judged by Bouterwek, the Allgemeine Encyclopädie, in Lardner's Cyclopædia, or by any other critics, his odes on the battle of Lepanto are worthy of his Greek model, and equal to those of Horace. Indeed Bouterwek himself acknowledges this, and moreover bestows just and high commendation on his 'Ode to Sleep.' An attempt so congenial to Herrera's aspirations, and to those of his age—that of elevating his native poetry to the level of the Greek and Roman—led Herrera to overstrain the powers of his own language by the adoption of antique modes of expression, which the learned of that age endeavoured to establish as the sole expressions of the beautiful and the sublime.

It was chiefly to inculcate these principles, or to foster a corresponding taste, that Herrera commented on Garcilaso, a practical way of developing a theory, which has been followed by a host of commentators.

An edition, now rare, of his poetical works appeared after his death under the title 'Obras en Verso de Hernando de Herrera,' Sevilla, 1582, 4to. Another equally raro is, 'Versos de Hernando de Herrera, emendados y divididos por él en 3 libros,' Sevilla, 1619, 4to.

Of his prose writings those remaining are, 'Relacion de la Guerra de Chipre, y Suceso de la Batalla de Lepanto,' Sevilla, 1572, 8vo.; and 'Vida y Muerte de Thomas Moro,' (translated from the Latin of Stapleton), Sevilla, 1592, 8vo., and Madrid, 1625, 8vo.

HERRERA, GABRIEL ALONSO, a native of Talavera, called the New Columella, lived in the second half of the fifteenth and the beginning of the next century. He was a professor at the university of Salamanca, and had from an early age a predilection for rural economy. Accordingly he collected the best information that he could derive from the antients, as well as from his travels at home and abroad, in a treatise which he published under the patronage of Cardinal Cisneros, with the title of 'Obra de Agricultura copilada de Diversos Autores,' Alcala, 1513, fol. (black letter) None of its 28 subsequent editions presented, according to Juan Iriarte, the original text; but this was restored at last by the Sociedad Económica Matritense, in their 'Agricultura General, corregida y adicionada,' Madr., 1818, 4 vols. 4to.

HERRICK, ROBERT, was born in the year 1591. Of his life few or no particulars are known, except that he was vicar of a parish called Dean Prior in Devonshire for the space of twenty years, was ejected by Cromwell and restored by Charles II., and long held in remembrance by his parishioners as a poet. His poems are of two very different kinds, sacred and love pieces; the latter often disgraced by indecency, but both exhibiting a richness of fancy mingled with the quaintness of the age in which he lived, such as to render him worthy of one of the highest places in the scale of British lyrical poets. His poems were published in 1647-8 under the title of 'Hesperides, or the Works, both Human and Divine, of Robert Herrick, Esq.' The 'Hesperides' have been reprinted in 2 vols. 4to. and 2 vols. sm. 8vo.; 'Select Poems,' 1 vol. sm. 8vo.; 'Poetical Works,' 2 vols. sm. 8vo.

(*Retrospective Review*, vol. v.; *Quarterly Review*, vol. iv)

HERRING. [CLUPEIDÆ.]

HERRING FISHERY. [FISHERIES.]

HERRNHUT, or HERRNHUTH, a small town in the Saxon province of Upper Lusatia, the original and principal seat of the Moravian brethren. It lies between Zittau and Lobau, on the southern declivity of the Hutberg, from which it has its name. It was founded in 1722 by Count Zinzendorf. The situation is pleasant, and the buildings, especially the house of the Brothers, and that of the Sisters, very neat. The inhabitants, about 1500 in number, are very simple and pious, and order and cleanliness prevail even among the poorest. [MORAVIANS.]

HERSCHEL, WILLIAM, frequently, but erroneously, written Herschell. The materials for the life of this singularly gifted man are but few, and those few not well authenticated. There is no need to say to what quarter the public should look for such an account of his life and labours as shall be worthy of the sagacious activity of the first, and the enormous extent and value of the second.

William Herschel was the second son of a musician at Hanover, and was born November 15, 1738. His father brought him up to his own profession, with four other of his sons, giving them at the same time a good education in other respects. At the age of fourteen, he was placed, it is said, in the band of the Hanoverian regiment of guards, which regiment he accompanied to England at a period which is variously stated from 1757 to 1759. Another account states that he came to England alone. After his arrival, he was for some time at Durham, where he is said to have superintended the formation of a band for the militia, and afterwards was for several years organist at Halifax, where he employed himself in teaching music and studying languages. There is a mass of stories relating to his musical occupations, none of which have any certain foundation, as—that he played in the Pump-room band at Bath—that upon the occasion of being a candidate for the situation of organist, he helped his performance by little bits of lead placed upon holding notes, which he dexterously removed in time—that in Italy, to procure money to pay his passage home, he gave a concert, at which he played at once upon a harp and two horns, one fastened to each shoulder—&c. The last story must be incorrect, as he never was in Italy; and, though much given to music, he never (latterly at least) played the French horn, or any other military instrument, but only the violin and organ; from which, as well as the vagueness of the accounts, it may be doubted whether his professional talents were ever employed in a band.

About 1766 he was organist of the Octagon chapel at Bath; in which place he began to turn his attention to astronomy. How well his talents suited that pursuit was afterwards seen, and his preliminary studies had been amply sufficient for the purpose. Though not a mathematician of the first order, his attainments in that science were more than respectable, and his power of applying his knowledge was, like that of Young, so great as to make it a source of regret that he did not pay special attention to the exact sciences. The earliest writing of Herschel which has come to our knowledge is the answer to the prize question in the 'Ladies' Diary' for 1779, proposed by Peter Puzzlem (a name which the celebrated Landen always adopted in his contributions to that work), namely 'The length, tension, and weight of a musical string being given, it is required to find how many vibrations it will make in a given time, when a small given weight is fastened to its middle and vibrates with it.'

His astronomical pursuits led him to desire a telescope, and as the purchase of a good reflector was 'fortunately' above his means, he resolved to make one for himself. After many trials he succeeded in making a Newtonian telescope of five feet focal length, and we find him before long not only in possession of adequate means, the work of his own hands, but employing those means with a true perception of the field in which his services were wanted, and a persevering determination to throw light upon our knowledge of the organization of the universe.

There are two great branches of astronomy; the first consisting of those investigations, theoretical and practical, by which the mighty clockwork of the heavens is made our measure of time, and our means of settling the relative positions of places on the earth, and of guiding a vessel from one port to another; the second consisting of inquiries, theoretical and practical, into those phenomena which guide us to such knowledge as we can obtain of the constitution of the heavenly bodies. The study of the science of optics, the improvement of telescopes, the application of sound reasoning to the collective phenomena pointed out by such instruments, and, subordinate to the last, a knowledge of the past history of observation, are the keys to the advance of this part of the science. Herschel devoted himself sedulously to every part of this task, and the consequence was success such as the world had never seen before, and a reputation of twofold splendour, appreciable in its different parts by men of the lowest as well as of the highest order of cultivation.

Herschel began to contribute to the Philosophical Transactions in 1780, and in 1781 announced to the world his discovery of a supposed comet, which soon turned out to be a new planet. [URANUS.] We have not here to describe the details of this discovery, the merit of which in itself is small. It is the method which gave rise to it on which this part of Herschel's fame must rest. Perceiving how much depended upon an exact knowledge of telescopic phenomena, and a perfect acquaintance with the effect produced by differences of instrumental construction, he commenced a regular examination of the heavens, taking the stars systematically in series, and using one telescope throughout. If an indifferent person were by accident to pick up a manuscript out of a large number lying in a library, and were to find it on examination to be a lost classic author, he would be entitled to praise, since it is not every one who would know what he had got hold of, even when the writing was in his hands; but if the same person were to make the same discovery while voluntarily engaged in the formation and classification of an immense catalogue requiring knowledge of antient and modern languages and literature, the credit due to the discovery would be very much increased. This case is analogous with that of Herschel, who was not a mere dilettante star-gazer, but a volunteer carrying on with no great pecuniary means a laborious and useful train of investigation.

The announcement of this comet or (as it turned out) planet drew Herschel immediately into the full blaze of fame; and George III. honoured his reign by immediately attaching the new astronomer to his court under the title of private astronomer to the king, and with a salary of 400*l.* a year. Herschel fixed his residence first at Datchet, and afterwards at Slough, near Windsor, and his abode became, as Fourier remarks, one of the remarkable spots of the civilized world. His family consisted at first of one of his brothers, and his sister, Miss Caroline Herschel, who was his coadjutor and assistant in his computations and reductions, and also actively employed in observation, having been, among other things, the discoverer of more than one comet. This lady retired to Hanover at the death of her brother, and is still alive, though much past eighty years of age.

Herschel married a widow lady, Mrs. Mary Pitt, and left one son, whose name has long been known to the public as one of the most active and successful adherents of science that our day has produced. We write this on the eve of the public dinner given to Sir John Herschel on his return from the Cape of Good Hope, where he has been for the last four years engaged in making a survey of the southern hemisphere similar to those which his father made of the northern. Amidst the gratification with which all who are interested in the progress of astronomy will regard this truly remarkable fête, it may suggest itself to some that the clear and powerful results of William Herschel's mind lie buried in the Philosophical Transactions, inaccessible to the larger portion of those who might learn from them to form a true taste in speculative astronomy and a true notion of the state of our knowledge of the fabric of the universe. A public subscription to defray the expense of reprinting all those writings would be a compliment worthy of the fame of both father and son, and of the sentiments with which the whole community regards the recent expedition of the one in continuation of the labours of the other.

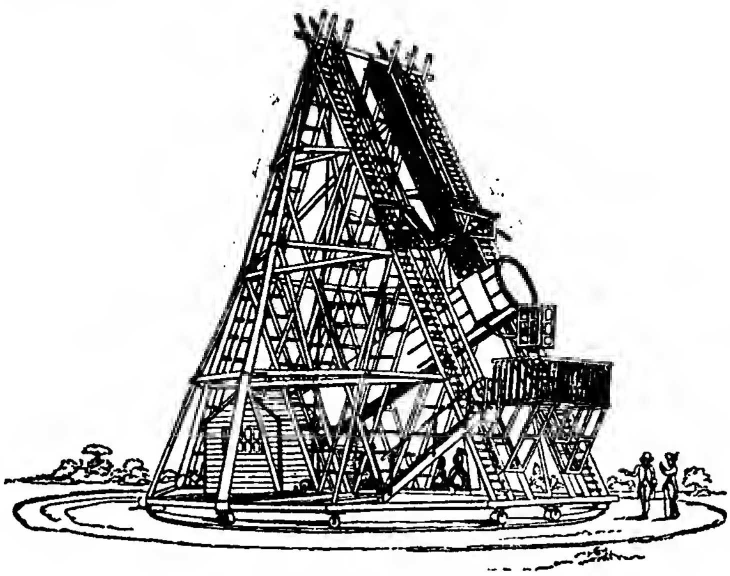
The deficiency of authentic information leaves us little more to say on the private life of Herschel. He was knighted, and received the degree of doctor of laws from the university of Oxford, but we cannot find the dates of either. He was soon in affluent circumstances, partly by the profits arising from the sale of his mirrors for reflecting telescopes, and partly by the jointure of his wife, which was considerable, and he died wealthy. His death took place on the 23rd of August, 1822.

Instead of giving any detailed account of Herschel's labours, we have preferred to extract the titles of his papers in the Philosophical Transactions, both because no words could give so good an idea of the unwearied activity of their author, and because many of the subjects are such as are well described by titles. It may also be useful to the astronomical reader to know in what volume and in what year the several communications were made. A few words therefore preceding this list will be all which its length will allow us to give.

Herschel must be remembered by the number of bodies which he added to the Solar system, making that number half as large again as he found it. Including Halley's comet, and the four satellites of Jupiter and five of Saturn, the number previously known was eighteen; to which he added nine, namely, Uranus and six satellites, and two satellites to Saturn. His discovery of the rotation of Saturn's ring, his measurements of the rotation of Saturn and Venus, his observations of the belts of the former, and his conjectural theory, derived from observation, of the rotation of Jupiter's satellites, with a large number of minor observations, prove that no one individual ever added so much to the facts on which our knowledge of the solar system is grounded. To this we must add, that his announcement (in 1803) of the motions of binary stars round each other was accompanied by the first proof that there exist in the universe organized systems besides our own; while his magnificent speculations on the Milky Way, the constitution of nebulæ, &c. &c., first opened the road to the conception that what was called the universe might be, and in all probability is, but a detached and minute portion of that interminable series of similar formations which ought to bear the name. [MILKY WAY; NEBULÆ; STARS, DOUBLE, &c.] Imagination roves with ease upon such subjects; but even that daring faculty would have rejected the ideas which, after Herschel's observations, became sober philosophy. On matters of detail the views of Herschel are beyond enumeration in an article like the present; the list given below will furnish some notion of them.

The instrument by which this great work was achieved was the reflecting telescope, the second reflecting surface which is found in the constructions of Newton, Gregory, and Cassegrain having been rejected, and the eye-piece applied directly to the image produced from the large mirror, which is the distinguishing feature of the Herschelian telescope. Herschel had constructed more than one such instrument of 20 feet focal length before he attempted the enormous one of 40 feet, the apparatus for supporting and directing which strikes the eye of the traveller in passing through Slough. This instrument was begun in 1785, and Herschel dates the completion from August 28, 1789, on which day he discovered with it the sixth satellite of Saturn.

The catalogues of double stars, nebulæ, &c., and of the comparative brightness of stars, would alone constitute a title to the name of a distinguished astronomer; and the optical researches, with those on the refrangibility of heat, are highly valuable; while the papers on the power of telescopes should be read by all who wish to understand those instruments. But we have no further room for specification, and shall therefore proceed at once to the list of Herschel's labours, observing that though no well authenticated account of his private character has appeared, the testimony of many now living has been given to the rectitude of his conduct and the goodness of his heart.



Herschel's great telescope at Slough.

List of Sir William Herschel's Papers in the Philosophical Transactions, specifying the year and volume in which each appeared.

1780, vol. 70. Astronomical observations on the Periodical Star in Collo Ceti. In his abridgment of the Phil. Trans., Dr. Hutton adds the following note to this title of Herschel's first memoir: 'See some authentic memoirs of this extraordinary character in the European Magazine for January, 1785.'

1780, vol. 70. Astronomical observations relating to the Mountains of the Moon.

1781, vol. 71. Astronomical observations on the rotations of the planets round their axes, made with a view to determine whether the earth's rotation is perfectly equable.

1781, vol. 71. Account of a Comet. This supposed comet was afterwards found to be the planet now called Uranus [URANUS], discovered on Tuesday the 13th of March, between 10 and 11 in the evening.

1781, vol. 71. Description of a Micrometer for taking the angle of position.

1782, vol. 72. On the Parallax of the fixed Stars.

1782, vol. 72. Catalogue of double Stars (containing 269 stars).

1782, vol. 72. Description of a Lamp Micrometer and the method of using it.

1782, vol. 72. A paper to obviate some doubts concerning the great magnifying powers used.

1783, vol. 73. On the name of the new Planet. Herschel called it Georgium Sidus, 'as an appellation which will conveniently convey the time and country where and when it was brought to view.'

1783, vol. 73. On the diameter and magnitude of the Georgium Sidus, with a description of the dark and lucid disc and periphery micrometers.

1783, vol. 73. On the proper motion of the Sun and Solar system, with an account of several changes that have happened among the fixed stars since the time of Mr. Flamsteed.

1784, vol. 74. On the remarkable appearances at the polar regions of the planet Mars, the inclination of its axis, the position of its poles, and its spheroidical figure; with a few hints relating to its real diameter and atmosphere.

1784, vol. 74. Of some observations tending to investigate the construction of the heavens.

1785, vol. 75. Catalogue of double Stars (second catalogue, containing 434 new ones).

1785, vol. 75. On the construction of the heavens.

1786, vol. 76. Catalogue of 1000 new nebulæ and clusters of stars.

1786, vol. 76. Investigation of the cause of that indistinctness of vision which has been ascribed to the smallness of the optic pencil

1787, vol. 77 An account of a new comet, by Miss Caroline Herschel, with remarks by Sir William Herschel.

1787, vol. 77. Discovery of two satellites revolving round the Georgian planet.

1787, vol. 77. Of three Volcanos in the Moon.

1788, vol. 78. Of the Georgian planet and its satellites

1789, vol. 79. Observations of a Comet.

1789, vol. 79. Catalogue of a second thoussnd of new nebulæ and clusters of stars, with a few introductory remarks on the construction of the heavens.

1790, vol. 80. Discovery of a sixth and seventh satellite of the planet Saturn; with remarks on the construction of its ring, its atmosphere, its rotation on an axis, and its spheroidical figure.

1790, vol. 80. On the satellites of the planet Saturn, and the rotation of its ring on an axis.

1791, vol. 81. On nebulous Stars, properly so called.

1791, vol. 81. On the ring of Saturn and the rotation of the fifth satellite on its axis

1792, vol. 82. Miscellaneous Observations—account of a Comet—periodical appearance of o Ceti—disappearance of 55 Herculis—remarkable phenomena in an eclipse of the Moon.

1793, vol. 83. Observations on the planet Venus.

1794, vol. 84. Discovery of a Comet, by Miss Caroline Herschel.

1794, vol. 84. Observations of a quintuple belt on the planet Saturn.

1794, vol. 84. On some particulars observed during the late eclipse of the Sun.

1794, vol. 84. On the rotation of the planet Saturn on its axis.

1795, vol. 85. On the nature and construction of the Sun and fixed Stars.

1795, vol. 85. Description of a 40-feet reflecting telescope

1796, vol. 86. Discovery of a new Comet, by Miss Caroline Herschel, with remarks by Sir W. Herschel.

1796, vol. 86. On the method of observing the changes that happen to the fixed Stars; with some remarks on the stability of the light of our Sun: to which is added a catalogue of the comparative brightness, for ascertaining the permanency of the lustre of Stars.

1796, vol. 86. On the periodical star α Herculis, with remarks tending to establish the Rotatory Motion of the Stars on their axes. To which is added a second catalogue of the comparative brightness of the Stars.

1797, vol. 87. A third catalogue of the comparative brightness of the Stars; with an introductory account of an index to Mr. Flamsteed's observations of the fixed stars contained in the second volume of Historia Cœlestis; to which are added several useful results derived from that Index.

1797, vol. 87. Observations of the changeable brightness of the Satellites of Jupiter, and of the variation in their apparent magnitudes; with a determination of the time of their rotatory motion on their axes; to which is added, a measure of the diameter of the second satellite, and an estimate of the comparative size of all the four.

1798, vol. 88. On the discovery of four additional Satellites of the Georgium Sidus: the retrograde motion of its old Satellites announced; and the cause of their disappearance at certain distances from the planet explained.

1799, vol. 89. A fourth catalogue of the comparative brightness of the Stars.

1800, vol. 90. On the power of penetrating into space by telescopes; with a comparative determination of the extent of that power in natural vision, and in telescopes of various sizes and constructions; illustrated by select observations.

1800, vol. 90. Investigation of the powers of the prismatic colours to heat and illuminate objects; with remarks that prove the different refrangibility of radiant heat. To which is added, an inquiry into the method of viewing the Sun advantageously with telescopes of large apertures and high magnifying powers.

1800, vol. 90. Experiments on the refrangibility of the invisible rays of the Sun.

1800, vol. 90. Experiments on the solar and on the terrestrial rays that occasion heat, with a comparative view of the laws to which light and heat, or rather the rays which occasion them, are subject, in order to determine whether they are the same or different. Two papers in the same volume.

1801, vol. 91. Observations leading to investigate the nature of tho Sun, in order to find the causes or symptoms of its variable emission of heat and light; with remarks on the use that may possibly be drawn from solar observations.

1801, vol. 91. Additional observations on the same, with trials to set aside darkening glasses, by transmitting the solar rays through liquids; and a few remarks to remove objections against the former paper.

1802, vol. 92. Observations on the two lately discovered celestial bodies (Ceres and Pallas).

1802, vol. 92. Catalogue of 500 new nebulæ, nebulous Stars, planetary nebulæ and clusters of Stars; with remarks on the construction of the heavens.

1803, vol. 93. Observations of the transit of Mercury over the disc of the Sun, to which is added an investigation of the causes which often prevent the proper action of mirrors.

1803, vol. 93. Account of the changes that have happened during the last twenty-five years, in the relative situation of Double Stars; with an investigation of the cause to which they are owing.

1804, vol. 94. Continuation of the last paper.

1805, vol. 95. Experiments for ascertaining how far Telescopes will enable us to measure very small angles, and to distinguish the real from the spurious diameters of Celestial and Terrestrial objects; with an application to Mr. Harding's lately discovered star (Juno).

1805, vol. 95. On the direction and velocity of the motion of the Sun and Solar System.

1805, vol. 95. Observations on the singular figure of the planet Saturn.

1806, vol. 96. On the quantity and velocity of the Solar Motion.

1806, vol. 96. Observations and remarks on the figure, the climate, and the atmosphere of Saturn and its ring.

1807, vol. 97. Experiments for investigating the cause of the Coloured Concentric Rings, discovered by Sir Isaac Newton, between two object-glasses laid on one another.

1807, vol. 97. Observations on the nature of the new Celestial Body (Vesta) discovered by Dr. Olbers; and of the Comet which was expected to appear last January in its return from the sun.

1808, vol. 98. Observations of a Comet, made with a view to investigate its magnitude and the nature of its illumination. To which is added, an account of a new Irregularity lately perceived in the apparent figure of the planet Saturn.

1809, vol. 99. Continuation of the last paper but two (Newton's rings).

1810, vol. 100. Supplement to the last.

1811, vol. 101. Astronomical observations relating to the Construction of the Heavens, arranged for the purpose of a critical examination, the result of which appears to throw some new light upon the organization of the celestial bodies.

1812, vol. 102. Observations of a Comet, with remarks on the construction of its different parts.

1812, vol. 102. Do. of a second Comet, with do. do.

1814, vol. 104. Astronomical observations relating to the Sidereal part of tho Heavens, and its connexion with the Nebulous part, arranged for the purpose of a critical examination.

1815, vol. 105. A series of observations of the satellites of the Georgian planet, including a passage through the node of their orbits; with an introductory account of the Telescopic Apparatus that has been used on this occasion; and a final exposition of some calculated particulars deduced from the observations.

In the first volume of the Memoirs of the Astronomical Society (1822) is to bo found (with the date 1821) a paper entitled 'On the places of 145 new Double Stars.'

HERSCHELLITE, a mineral which occurs in attached hexagonal crystals, associated with Phillipsite, in the cavities of trap, and also in granular olivine. Primary form a rhomboid; cleavage not ascertained; fracture conchoidal; hardness 4 to 4·5; specific gravity 2·11; translucent or opaque; colour white. Found at Aci Reale in Sicily.

HERSFELD. [FULDA.]

HERTFORD. [HERTFORDSHIRE.]

HERTFORD COLLEGE, one of the colleges of Oxford. As a college this foundation was comparatively recent, but as a hall it had been of much greater antiquity. Hertford Hall, or, as it was corruptly designated, Hert or Hart Hall, appears to have obtained its name from Elias de Hertford, who, in the reign of Edward I., let it out to clerks. Chalmers, in his 'History of the University of Oxford,' traces the conveyance of the building through several hands previous to its becoming the property of De Hertford.* Its situation was then nearly on the site of the hall of the college, in New College Lane. In A.D. 1312 it was conveyed to Walter Stapledon, bishop of Exeter, and founder of Exeter College, who procured a licence from the king to grant this and another messuage, called 'Arthur Hall,' to twelve scholars studying in Oxford. The scholars of these halls, which appear to have been incorporated together, under the title of Hertford or Hart Hall, were, with their rector, removed to Exeter College, of which the hall became a dependency. The principals were appointed by the authorities of Exeter College, except during a short period, when the scholars of New College, which was then building, were admitted, and the society was governed by tho wardens of that college.

In 1710 Dr. Richard Newton was inducted as principal. This gentleman, having conceived the project of raising Hart Hall to the rank of a college, settled a yearly annuity as an endowment for four senior Fellows, at the rate of 13*l.* 6*s.* 8*d.* each per annum. He also expended about 1500*l.* in building a new chapel and in adding to the previously existing buildings of the foundation. In the year 1739 he completed the body of statutes which he had drawn up for his intended foundation; and on August 27, 1740, obtained a royal charter for raising Hart Hall into a perpetual college for the usual studies. The society was to consist of a principal; four senior fellows or tutors, whose allowance has been mentioned above; eight junior fellows or assistants, who were to have 26*l.* 13*s.* 4*d.* yearly; eight probationary students, with an allowance of 6*l.* 13*s.* 4*d.* each; twenty-four actnal students, with an allowance of 13*l.* 6*s.* 8*d.* each, which might be augmented by an allowance of sixpence per diem for commons; and four scholars.

The statutes of Dr. Newton appear to have been injudiciously framed. The regard to rigid economy which led him to fix the maximum of remuneration was inconsistent with a consideration of the rise of markets; and the benefactions which were added subsequent to the foundation of the college were insufficient for its maintenance.

The society subsisted for some years on its scanty funds; but upon the death of the principal, Dr. Bernard Hodgson, A.D. 1775, the office was not filled up. The foundation was dissolved in the year 1818. A certain portion of the college funds, reserved for the use of the then only surviving Fellow, was, on his death, appropriated to the establishment of a university scholarship for the encouragement of Latin literatnre. The election is yearly. The greatest proficient in

* 'Before the foundation of colleges all education in the university was carried on in certain houses, or sets of buildings, called halls, inns, or hostels, which were the property of citizens of Oxford, who let them partially to individuals, or generally to societies connected under one roof, in which case they were denominated 'halls.' When they thus became halls, though the proprietors still continued to receive rent, and to be in other respects the landlords yet they could not divert them from the purposes of education; nor does it appear they could raise the rents at pleasure.' (Chalmers.)

the Latin language among the candidates is elected, and no scholar is admissible for re-election.

Among the eminent men who were scholars of Hart Hall may be enumerated Lord Buckhurst, Selden, Dr. Donne (afterwards of Cambridge), Sir William Waller, Sir Richard Baker, author of the well-known 'Chronicle.' Among those who were scholars of Hertford College are Edward Lye, the Saxon lexicographer; Thomas Hutchinson, the editor of Xenophon; Dr. Thomas Hunt, professor of Arabic; Dr. Benjamin Blayney, the translator of Jeremiah; and Charles James Fox. Dr. Newcome, archbishop of Armagh, translator of Ezekiel, the Minor Prophets, and the New Testament, is also claimed by this college.

HERTFORDSHIRE, an inland county of England, situated between 51° 36′ and 52° 5′ N. lat., and 0° 13′ E. and 0° 45′ W. long. It is bounded on the north by Cambridgeshire, on the east by Essex, on the south by Middlesex, on the west by Buckinghamshire, and on the north-west by Bedfordshire. Its greatest length is from north-east, near Royston, to south-west, not far from Rickmansworth, 39 miles; its greatest breadth is, from the neighbourhood of Hitchin to Waltham Cross, 25 or 26 miles. Its area is estimated at 630 square miles. The population, in 1831, was 143,341, being about 228 to a square mile. It is in point of size the thirty-fifth of the English counties, in number of inhabitants the thirty-fourth, and in density of population the sixteenth. Hertford, the county-town, is 20 miles due north of St. Paul's, London, in a straight line, or 21 miles from Shoreditch Church, London, by the road through Cheshunt, Hoddesdon, and Ware.

Surface, Hydrography, Communications.—Hertfordshire has no lofty hills. The highest elevations are the Chalk Downs, which form the continuation of the Chiltern Hills north-eastward into Essex and Cambridgeshire. Kensworth Hill, just within the border of the county, near Dunstable (in Bedfordshire), is 908 feet high. The surface of the county is generally undulating, and from the abundance of woods presents a variety of pleasing scenery.

The rivers for the most part belong to the basin of the Thames. The principal are the Colne and the Lea: the Hiz and some other streams in the northern part of the county belong to the system of the Ouse. The Lea rises in Luigrave or Leagrave Marsh, near Luton, in Bedfordshire; and flowing first east and then south-east for ten miles, enters Hertfordshire on the north-west side of the county, and flows 9 miles south-east to the neighbourhood of Hatfield: from thence it flows east-north-east 9 miles by Hertford to Ware. At Hertford it receives the Maran or Mimram and the Beane, and between Hertford and Ware the Rib; all on the left bank. From Ware, just below which it receives the Ash on the left bank, it flows 4 miles to the border of Hertfordshire and Essex, where it receives the Stort, also on the left bank. From the junction of the Stort the Lea flows south 6 miles to Waltham Cross, where it quits Hertfordshire altogether. Its whole length, from the source to its junction with the Thames at Bromley, near London, is above 50 miles. The navigation commences at Hertford.

Of the feeders of the Lea mentioned above, the Stort, which rises in Essex and flows on or near the border of Essex and Herts, is 21 miles long, and is navigable for about half its length, namely, to Bishop Stortford.

The Colne, a feeder of the Thames, rises between Idlestree, or Elstree, and Barnet, and flows through a projecting part of the county of Middlesex into Hertfordshire again. It has a very circuitous course of 13 miles to the junction of the Verlam, or Muse, on its right bank, near St. Alban's: from this point it flows 13 miles south-west by Watford and Rickmansworth, partly through and partly on the border of the county, till it quits it to form the boundary of Buckinghamshire and Middlesex. Its whole length is about 40 miles. It receives, between the junction of the Verlam and Rickmansworth, the Gade and the Chess, both on the right bank.

Some of the feeders of the Thame, another affluent of the Thames, have their source in the north-western part of the county, near Tring.

The streams which belong to the system of the Ouse have but a small part of their course in this county. They rise on the northern slope of the Chalk Downs. They are the Oughton, the Hiz Proper, and the Pirral, which are commonly considered as the sources of the Ivel [BEDFORDSHIRE], but are rather the sources of the Hiz, a feeder of that stream. The Rhee, which rises at Ashwell, a few miles from Baldock, is a feeder of the Cam.

The New River, which is brought to London from springs in the neighbourhood of Ware, has a feeder from the Lea near that town. A part of its course is in Hertfordshire: it is carried along the valley of the Lea, and nearly parallel to the course of that stream. The New River was begun A.D. 1608.

The only navigable canal in Hertfordshire is the Grand Junction, which enters the county near Tring, and runs first south-east along the valley of the Quin, then south along that of the Gade, and finally south-west along the valley of the Colne, till it enters Middlesex. It passes by or near the towns of Tring, Berkhamsted, Hemel Hempstead, Watford, and Rickmansworth. Near Rickmansworth it passes through a small tunnel. There are cuts from the main line of this canal in the neighbourhood of Tring, one to Aylesbury, and another to Wendover; and one in the neigbourhood of Watford to the town of Watford. The Wendover Cut is a feeder rendered navigable.

The high North road runs through this county, through Chipping Barnet, Hatfield, Welwyn, Stevenage, and Baldock: the Liverpool road branches off from the North road, and runs through St. Alban's to Dunstable: the Cambridge road runs by Waltham Cross, Hoddesdon, Ware, and Puckeridge, where it divides into two branches, one of which passes through Buntingford and Royston.

The London and Birmingham railroad runs through this county, nearly in the line of the Grand Junction Canal.

Geological Character.—This county is comprehended in the chalk basin of London. The south-eastern corner at Cheshunt, and the south-western part, comprehended within a line drawn from North Mimms by Ridgehall, Aldenham, and Bushey, to Harefield, in Middlesex, are occupied by the London clay. From under this the plastic clay crops out, and extends to a line drawn from the Stort, between Sawbridgeworth and Bishop Stortford, to the north of Ware, Hertford, and Hatfield, to St. Alban's, and from thence along the valley of the Colne. To the north-west of this line all the county is occupied by the chalk, excepting a few spots along the border of Bedfordshire, where the subjacent strata crop out.

This county has no minerals of any value: there are a few medicinal springs, chiefly chalybeate; the principal are on Barnet Common, Northaw Common, and at Cuffley, in Northaw parish, all near the Middlesex border.

Agriculture.—The climate of Hertfordshire is as mild and genial as that of most of the inland counties. The harvest is early where the soil is light and rich, as is the case in some of the valleys. On the cold wet clays, which are found in some parts of the county, and the most exposed tops of the chalky hills, the crops are later. The soil may be divided into chalk, clay, and gravel, according as each ingredient prevails; and the mixture of them forms loams of various qualities. The whole of the county is upon chalk at a greater or less depth below the soil; and in the north-western part, towards Bedfordshire, the chalk rises to the surface in considerable hills. Where the chalk lies deeper, the soil on the hills is mostly a heavy clay; and the valleys between them have variations of gravel and loam much intermixed.

The proportions of these soils are stated by Arthur Young as follows, in his view of the agriculture of Hertfordshire:—

Chalk	46,720 acres.
Clay.	90,240
Loam	142,720
Rich loam	5,120
Poor gravel. . . .	17,280
Total . .	302,080

The rich loam occurs on the borders of Essex along the road from London to Bedford, and has given a greater reputation to Hertfordshire for general fertility than the average quality of the soils in the county will warrant.

The loams are generally well cultivated, but the heavy clays are capable of much improvement. Wherever the turnip husbandry prevails, the superiority of the crops is striking. The supply of manure from London gives also an advantage to the southern part of the county, where the soil is inferior and will only produce good crops by abundant manuring. Wherever the soil is not adapted to the growth of turnips, few improvements are visible. Wheat, beans, oats, and fallows, are the only varieties. Clover is much less in quantity than might be desired, and by no means so clean as it ought to be. Draining has been resorted to by some spirited proprietors and lessees; but where farms are let at rack-rent, and from year to year, as is often the case, no permanent improvement can be expected. Even if the landlord is liberal, and offers to furnish draining tiles, the tenant has not a sufficient interest to avail himself of the offer, or to put them down in the most efficacious manner.

The number of resident gentry in Hertfordshire tends to introduce a high state of cultivation around their immediate residences; but, as the mansions are generally erected in the driest and best situations, the cold wet clays are neglected; the roads also on the clay soils are not so good; the fences are not so well kept; and a more slovenly husbandry is observed. The old heavy plough with four horses in a line may still be seen; and in some places the heavy loam mixed with flints and stones can scarcely be moved with less power: but a great improvement might be made in the construction of the plough; and effectual draining, with the use of the subsoil plough, would greatly lighten the texture, and enable lighter ploughs and fewer horses to stir them sufficiently.

Hertfordshire has been remarkable for its high banks and hedges. In many of the lanes, where two carriages could scarcely pass one another, it is difficult for a man standing on a waggon to see over the hedge. This makes the surface of the country look rich when seen from the hills, especially when there are woods and coppices interspersed amongst the fields, and many trees in the hedgerows; but these hedges are a great impediment to the proper cultivation of the soil. They are left to grow till the wood in them is valuable for fuel, and they are cut down more for the sake of the faggots than to keep up the fence. Hence there are many large gaps, which are stopped up by cutting half through some of the stems in the hedge, and laying them down, which is called *plashing*. [HEDGE.] Wherever the old high banks have been levelled, and neat quick hedges have been planted in their stead, and kept cut and trimmed, the ground which has been gained, together with the earth of the old banks, to mix up with lime and vegetable matters in a compost, have soon repaid the expense. The injury done by a hedge in a growth of ten or twelve years is poorly repaid by a few faggots sold to the bakers or brick-burners.

It cannot be said that there is any peculiar system of cultivation in Hertfordshire. Every system may be occasionally met with. The resident proprietors, many of whom hold considerable farms in their own hands, employ bailiffs, who come from various parts of the country, and introduce the systems which they are accustomed to: some are from Norfolk, others from Northumberland or Scotland. Before the common fields were enclosed, as they are now almost universally, a fixed rotation was unavoidable, as there were rights of pasture over certain portions of the field in what was called the fallow year; but as soon as the fields were freed from this impediment to good cultivation, each proprietor introduced his own method, whether good or bad. The consequence has been a very great difference in the crops of adjoining farms, according as they have fallen into the hands of industrious men with science and capital, or remained with those who follow the example of their forefathers. The crops are reaped as close to the ground as possible, in order that the straw may be sold in London and manure brought back in return. The corn is threshed chiefly by hand, the straw thus produced being of greater value for horse litter. Fewer cattle are fed in winter than in more distant counties, as manure can be obtained without them.

A species of rough garden husbandry has been introduced on the best soils nearest to London for the growth of early potatoes, cabbages, peas, and other culinary vegetables, which are succeeded in the same year by other crops, the whole being forced by an abundance of manure. The plough is used, but a great portion of the labour is done by the spade and the hoe.

There are many orchards in Hertfordshire, chiefly for apples and cherries, which are sold in London. No cider is made. A good cherry-tree full-grown will give in a good year fifty dozen pounds of cherries, and occupies nine square perches of land. The grass under the trees is generally fed off. Many old orchards have ceased to be productive, although young trees have been planted where the old were past bearing. This is caused by the deterioration of the soil. But good orchards might be made by planting a succession of young trees in fresh soil, and converting old orchards into arable land. The old orchards will be admirably calculated to produce lucerne or any other valuable crop.

There are many woods and coppices in the poorer soils, but they are fast diminishing in number, and the land is gradually brought into cultivation as arable or pasture. They are usually cut every ninth year. Where they contain Spanish chestnut, which is valuable for hurdles and rough fences, the produce is considerable, while the timber-trees are improving in value every year; but unless they are well managed, woods do not pay a rent proportionate to the value of the land, if it were in cultivation.

There are no breeds of cattle peculiar to Hertfordshire. The Suffolk cart-horses are esteemed for farm-work, being active and tractable. Some farmers buy young horses of the black Northampton or Lincolnshire breed, which they sell again with a good profit for dray-horses in London when they are six years old. Few horses are bred in the county. The grass-lands are reserved for hay, and there are few rough pastures. A few pigs are bred, as they are on most well managed farms; the breeds are the Essex or Berkshire, and crosses of these with the Chinese and Neapolitan, than which there are none more profitable. By judicious crossing the principal qualities of the hog may be kept up to a high degree, uniting prolific breeding with early fattening.

The principal fairs in Hertfordshire are the following.—St. Alban's, March 25, October 1; Baldock, March 7, last Thursday in May, August 5, October 2, December 11; Barnet, April 8, 9, and 10, September 4, 5, and 6 (both these are great cattle fairs); Berkhamsted, August 5, September 29, October 11; Buntingford, June 29, November 30; Hempstead, Thursday after Whit-Wednesday; Hertford, May 12, July 5, November 8; Hitchin, Easter Tuesday, Whit-Tuesday; Redburn, first Wednesday after January 1, Easter-Wednesday, Whit-Wednesday; Rickmansworth, July 20, November 24; Royston, Ash-Wednesday, Easter-Wednesday, Whit-Wednesday, Wednesday after October 11; Sawbridgenorth, April 23, October 20; Stevenage, day after Holy Thursday; Ware, last Tuesday in April, Tuesday before September 21; Watford, March 28, August 31, September 9.

Divisions, Towns, &c.—The county is divided into eight hundreds, namely:—

Name.	Situation.	Pop. in 1831.
Braughing	E.	17,827
Broadwater	Central	17,043
Cashio	Central and S.W.	33,291
Dacorum	W.	28,872
Edwinstree	N.E.	9,237
Hertford	S.E.	19,217
Hitchin & Pirton	N.W.	10,711
Odsey	N.	7,143
		143,341

In the foregoing table we have given the general situation of each hundred; but it is to be observed that several of the hundreds of this county are most irregularly formed. Cashio hundred, in particular, has detached or outlying portions in various parts of the county, as the parishes of Norton and Newnham near Baldock, Hexton near Hitchin, and others. Dacorum and Broadwater hundreds have also outlying portions.

Hertfordshire has no city: it contains two boroughs and market-towns, namely, Hertford and St. Alban's; and twelve other market-towns, namely, Baldock, Barnet, Berkhamsted, Bishop Stortford, Hatfield, Hemel Hempstead, Hitchin, Hoddesdon, Royston, Tring, Ware, and Watford. The markets of Buntingford and Rickmansworth have fallen into disuse; but these places are still frequently enumerated as market-towns. Of some of these an account is given elsewhere. [ALBAN'S, ST.; BARNET; BERKHAMSTED; BISHOP STORTFORD.]

Hertford, the county-town, is in a low valley below the junction of the Maran or Mimram, and just above that of the Beane with the Lea, which last-mentioned river runs through the town. It is in the hundred of Hertford. The limits of the borough jurisdiction, as determined by the Boundary Act and the Municipal Reform Act, include parts of the parishes of St. Andrew, St. John, and Bengeo, the parish of All Saints, and parts of the liberties of Brickendon and Little Amwell, which, together with the parish of St. John, are attached for ecclesiastical purposes to the parish of All Saints.

The parliamentary borough was, before the Reform Act, much smaller than the municipal borough, which was divided into two parts, distinguished as the in-borough (parliamentary), and the out-borough. By the Boundary Act the parliamentary borough comprehends the whole of the out-borough, with the addition of a small space beyond the then municipal boundaries, and the Municipal Reform Act extended the municipal boundary, and made it co-extensive with the parliamentary. The population of the in-borough, by the census of 1831, was 4028: with that of the out-borough (partly determined by conjecture), it amounted to 5631. The part added by the Boundary Act contained probably about 200 persons. The town is irregularly laid out, but the streets are well paved and lighted with gas, and the general appearance of the place indicates prosperity and improvement. It has two parish churches: All Saints, a large cross church, with a square tower and spire at its western end, and St. Andrew's. There aro some remains of an antient castle, consisting of little except a lino of embattled wall and a mound. A handsome brick edifice was built on tho site of tho castle probably in the time of James I. or Charles I.; but some parts of it are perhaps of older date. This building was occupied for a time by the East India College. It is now occupied by the East India Company as a preparatory school to the college now at Hailcybury. The shire-hall is over the corn and general market. The county gaol and house of correction is out of the town, on the east side: one ward of it is appropriated as the borough prison. There is a town-hall. Near the east end of tho town is a large building belonging to the governors of Christ's Hospital, in London, at which a number of the girls and of the younger boys of that charity receive their education. The buildings will contain 500 children, with their needful attendants.

No manufacture is carried on at Hertford, but a good deal of business is done in malting, and thero are many corn-mills on the Lea or the Mimram. The market, which is on Saturday, is one of the largest corn-markets in the kingdom. There aro four yearly fairs, chiefly for cattle. The borough council consists of four aldermen and twelve councillors; the borough has a commission of the peace. There are quarter-sessions held for the borough, and the assizes and sessions for the county are also held here. Hertford returns two members to parliament.

Hertford is a place of considerable antiquity. Sir Henry Chauncy would have fixed here the Durocobrivæ of Antoninus, which is now more commonly fixed at Maiden Bower near Dunstable. In A.D. 673 a national ecclesiastical council was held at Hertford; and about A.D. 905 Edward the Elder built the castle, and rebuilt the town, which had probably been ruined by the Danes. In the civil war of the reign of John this castlo was taken, after a brave defence, by the Dauphin Louis and the revolted barons: it subsequently came to the crown, and was granted in succession to John of Gaunt, and to the queens of Henry IV., V., and VI. Jean II., king of France, and David, king of Scotland, spent part of their captivity here during the reign of Edward III. Queen Elizabeth occasionally resided and held her court in this castle.

The living of All Saints is a vicarage united with that of St. John, of the yearly value of 290*l.* with a glebe-house; that of St. Andrew (with which are incorporated St. Mary and St. Nicholas) is a rectory of the clear yearly value of 271*l.* with a glebe-house. Both livings are in the deanery of Hertford, the archdeaconry of Huntingdon, and the diocese of Lincoln. There are several dissenting places of worship.

In 1833 there were in Hertford the following schools: the branch school of Christ's Hospital; a free grammar-school with 33 day-scholars on the foundation and 24 boarders; the green charity-school, with 45 boys; two national schools, with 161 boys and 45 girls; another charity-school with 45 girls; an infant school with about 20 children, and eleven other day or boarding and day-schools, with 329 children; one evening-school with 40 girls; and three Sunday-schools with 196 children.

Haileybury College, two or three miles from Hertford, has residences for the principal and for several professors, and accommodation for 100 students, who are trained for the civil service of the East India Company; about 30 are sent out to India every year.

Baldock is in the hundred of Broadwater, [illegible] miles from London, on the great North-road. The parish contains only 200 acres; the town occupies a low situation, surrounded on all sides by an open chalky country. It is said to have been built by the Knights Templars before the time of Henry III. The church is a large and handsome Gothic edifice, with a square embattled tower at its west end. There is a range of six almshouses in the High-street. The population of Baldock in 1831 was 1704, about one-fifth agricultural. A considerable trade is carried on in malt, the barley of the surrounding district being of excellent quality. The market is on Thursday: there are five fairs in the year. The living is a rectory of the yearly value of 126*l.*, in the deanery of Baldock, the archdeaconry of Huntingdon, and diocese of Lincoln. There are places of worship for Methodists and Independents.

There were in 1833 nine day or boarding and day schools, with 277 children; and three Sunday-schools, with 361 children; a school-room was then building for a national school, to contain 200 children.

Hatfield, distinguished as Bishop's Hatfield, is in Broadwater hundred, on the high North road, 19½ miles from London. The parish comprehends 12,700 acres, or, according to others, 12,312 acres, 2 roods, 27 poles; it is subdivided into five hamlets, of which the 'town quarter' is one. The manor of Hetfelle (as it is called in Domesday) was granted by King Edgar to the abbey or monastery of St. Ethelred at Ely, and upon the erection of that abbey into a bishopric, A.D. 1108, is supposed to have acquired the designation of Bishop's Hatfield. The town lies on the slope of a hill, and consists of a principal street intersected by a smaller one. The bishops of Ely had a palace at Hatfield, which, with the manor, was made over to the crown in the time of Henry VIII.: the palace was tho residence of Prince Edward, afterwards Edward VI., immediately before his accession. The princess (afterwards queen) Elizabeth was here in the care or custody of Sir Thomas Pope, during the latter part of the reign of her sister Mary: upon tho intelligence of whose death she held her first privy-council here. The palace and manor were, soon after the accession of James I., made over in exchange for Theobalds, in the parish of Cheshunt, to Sir Robert Cecil, afterwards earl of Salisbury, in whose family they have ever since continued. The gateway and west end of the palace are still standing. Hatfield-house, tho residence of the earls (and now of the marquis) of Salisbury, was built by Sir Robert Cecil, and is a fine specimen of the architecture of the Elizabethan period. It was almost destroyed by fire in the month of November, 1835. The grounds are beautifully laid out. The church is at the upper end of the town: there is an Independent chapel. The population of the parish was, in 1831, 3593, three-fifths agricultural. There is a weekly market on Thursday for corn and provisions, and two yearly fairs. The living is a rectory united with the chapelry of Totteridge in the deanery of Hertford, the archdeaconry of Huntingdon, and the diocese of Lincoln, of the yearly value of 2097*l.* There were, in 1833, thirteen day-schools (one with 18 children, endowed,—one with 158 children, a national school), containing altogethor 485 children; and three Sunday-schools with 83 children.

Hemel Hempstead is in Dacorum hundred, 23½ miles from London, through Watford. The parish comprehends 7310 acres, with a population in 1831 of 4759: including the dependent chapelries of Bovingdon and Flaunden, it comprehends 12,440 acres, with a population of 6037. The town, which is on the side of a hill sloping down to the rich valley of the Gade, consists chiefly of one long street. The females of the town are much engaged in making the straw-plat, and there are corn and paper mills in the neighbourhood. The London and Birmingham railroad and the Grand Junction Canal pass near the town. The town-hall is a long narrow building with an open space under for the market, which is held on Thursday, and is one of the largest in the county for corn. The church, a large building, is partly of Norman architecture, of which the west door is one of the richest specimens in the county. The living is a vicarage with the dependent chapelries mentioned above, in the deanery of Berkhamsted, the archdeaconry of Huntingdon, and diocese of Lincoln, of the yearly value of 709*l.* There were in 1833, in the parish and two chapelries, two infant-schools with 56 children, two national schools with 98 children, two schools of industry with 67 girls; ten other day-schools and four boarding-schools with 374 children, and five Sunday-schools with 280 children; there were also twenty-four schools in which about 247 children were taught to plat straw and read. The town of Hemel Hempstead was incorporated under Henry VIII.; but the corporation is not noticed either in the Commissioners' Reports or in the Municipal Corporation Reform Act.

In the year 1837 several curious Roman relics were discovered by the Rev. J. F. Girton in the burial-ground of Box Lane Chapel near Hemel Hempstead. They consist of two glass vases (one globular and thin, the other square and of thick glass with a handle), an earthern pitcher and some nails. The square vase, which is entire except a slight chip off the handle, is three times as thick as the globular vase, and is a good specimen of glass. This square vase was filled with human bones; the globular one was only partially filled. For these facts and a drawing of the different objects we are indebted to a communication from the Rev. J. F. Girton.

Hitchin is in Hitchin and Pirton hundred, 34 miles from London, on the little river Hiz. The parish comprehends 6150 acres, and had in 1831 a population of 5211, about one-third agricultural. The town, which consists of several streets, is irregularly laid out. It was formerly the seat of a woollen manufacture: the principal trade is now in corn and malt, of which latter a considerable quantity is made. Much straw-plat is made; there are some breweries, and also a silk-mill. The church is a handsome edifice near the centre of the town, built upon the foundations of a more antient structure. The south porch is a remarkably fine specimen of Gothic architecture in the perpendicular style, and there is a font of the same character; also numerous sepulchral monuments and brasses. There are meeting-houses for Independents, Baptists, and Quakers; and several sets of almshouses. The town is divided into three wards, for each of which constables and other officers are elected at a court-leet. There was formerly a small priory for Carmelite monks, and one for Gilbertine nuns. The market is on Tuesday, and there are three yearly fairs. The living is a vicarage in the deanery of Hitchin, the archdeaconry of Huntingdon, and the diocese of Lincoln, of the yearly value of 650*l.* with a glebe-house. There are the ruins of a chapel at Langley, in the parish of Hitchin, three miles from the town. There were in 1833 one infant school with 50 children, two endowed day-schools with 36 boys and as many girls, two Lancasterian schools with 171 boys and 100 girls, a school partly supported by subscription with 25 children, and five day or boarding and day-schools with 127 children, and four Sunday-schools with 581 children.

Hoddesdon is a hamlet chiefly in the parish of Broxbourn, in the hundred of Hertford, 17 miles from London, on the North road, through Ware and Royston. The population in 1831 was 1990; the area is 2650 acres. The town consists chiefly of two long streets. The antient market-house, a wooden edifice supported on arches and pillars curiously carved, is in the middle of the town, and near it is a conduit by which the town's people are supplied with water. There is a chapel, a square brick building. The site of a more antient chapel is marked by a building called the clock-house. There are two Dissenting meeting-houses. The market, which is on Thursday, has much declined; there is one yearly fair.

The chief business of the town is malting: there is a cotton-mill in the neighbourhood. There are some almshouses. The living of Broxbourn, of which the chapelry is a dependency, is in the deanery of Braughing, the archdeaconry of Middlesex, and the diocese of London, of the yearly value of 361*l.*, with a glebe-house: the yearly value of the chapelry of Hoddesdon is 54*l.* The church is a large church of perpendicular character, with some elegant chapels, and antient monuments and font. There were in that part of Hoddesdon hamlet which is in Broxbourn parish, in 1833, seven day-schools with 117 children, two national schools with 142 children, and one Sunday-school with 90 children.

Royston is in the hundred of Odsey, on the North road through Huntingdon, 37½ miles from London. The parish extends into Armingford hundred, Cambridgeshire, and the town extends beyond the parish boundaries. The area of the parish is 320 acres: the population in 1831 was 1757, about one-tenth agricultural. The town is situated in a bottom surrounded by chalk downs, and consists of four principal streets. The principal business is malting; a large corn trade is also carried on. The market is on Wednesday; the market-house is quite a modern building. The church was formerly the conventual church of a priory of the regular canons of St. Augustine; the yearly revenues of this priory at the dissolution were 106*l.* 3*s.* 1*d.* gross, or 89*l.* 16*s.* clear. The living is a vicarage in the deanery of Braughing, archdeaconry of Middlesex, and diocese of London, of the yearly value of 107*l.* There are three or four meeting-houses for different classes of dissenters. A brick building in the northern part of the town was once the occasional residence of James I., who came here to hunt and shoot dotterels, which then abounded on the neighbouring downs. In the town there was discovered, in A.D. 1742, a curious bell-shaped subterraneous cavern, 30 feet high, and nearly 20 feet in diameter, cut out in the solid chalk, and ornamented with rude carvings of sacred subjects, supposed to have been a hermitage. The downs round the town are frequented by 'the hooded-crow,' a species not found in other parts of England, and popularly called the Royston crow: it is a migratory bird, and passes the winter here. There were in Royston parish, in 1833, one infant school with 53 children, a Lancasterian school with 53 girls, eleven day or boarding and day-schools with 194 children, and three Sunday-schools with 259 children.

Tring is in Dacorum hundred, 33 miles from London on the road to Aylesbury. The parish comprehends 7390 acres, and had in 1831 a population of 3488, nearly one-third agricultural. The town is neat, and contains several good houses. The church is an antient building, with a massive tower, and contains some antient monuments. There is a weekly market on Friday, and two yearly fairs. There are several dissenting meeting-houses. The living is a perpetual curacy united with the chapelry of Long Marston; the joint annual value is 157*l.*, with a glebe-house, in the deanery of Berkhamsted, the archdeaconry of Huntingdon, and the diocese of Lincoln. There were in the parish, in 1833, six day-schools with 240 children, and five Sunday-schools with 659 children.

Ware is in Braughing hundred, on the east bank of the Lea, 20 miles from London on the road to Cambridge. The parish comprehends 4430 acres, and had in 1831 a population of 4214, including the population of Amwell End; of the population, about one-eighth or one-tenth is agricultural. Up to this place the Danes, in the reign of Alfred, brought their vessels, and protected them by a dam or wear across the river, from which wear the town is said to have obtained its name; but this is disputed. Ware consists of one long street and several smaller ones. The church consists of a chancel, with a chapel on each side; a nave with two side aisles, and two projections resembling transepts; with a square embattled tower: the font is of perpendicular architecture, with considerable enrichments. There is considerable trade at Ware; the market, which is on Tuesday, is one of the greatest in the county for corn, and there are two yearly fairs. At one of the inns in this town (the Saracen's Head) is a large bedstead, twelve feet square, elaborately carved in oak, and probably of the age of Queen Elizabeth. It is alluded to by Shakspeare (*Twelfth Night*, act iii., scene ii.), and is popularly known as the Bed of Ware. The living of Ware is a vicarage united with that of Thundridge, of the yearly value of 333*l.*, in the deanery of Braughing, the archdeaconry of Middlesex, and the diocese of London. There were in the parish, in 1833, two infant or dame schools with 26 children, an endowed grammar school with 28 boys, a Lancasterian school with 120 boys, a national school with 75 boys, two charity schools with 94 girls, ten day or boarding and day-schools with 190 children, and a Sunday-school with 38 girls.

Watford is in Cashio hundred, 15 miles from London, on the road to Aylesbury, near the Coln. The parish comprehends 10,980 acres, and is divided into four hamlets: the population in 1831 was 5293, more than one-third agricultural. The town, which is neat, consists principally of one main street, about a mile in length, near the centre of which stands the church. There are considerable silk-mills, and also a paper-mill. The market is on Tuesday. The living is a vicarage in the archdeaconry of St. Alban's and diocese of London, of the clear yearly value of 730*l.*, with a glebe-house. There were in the parish, in 1833, an endowed school with 60 children, another endowed school with 11 boys, two schools with 70 boys and as many girls, supported by the earl of Essex, thirteen other day-schools with 279 children, and five Sunday-schools with 419 children.

Buntingford and Rickmansworth are still frequently spoken of as market-towns.

Buntingford is in Edwinstree hundred, in the parish of Layston, on the road to Cambridge, 31 miles from London. It has a brick chapel built above two hundred years ago. There are also some almshouses, forming three sides of a quadrangle. The population of the parish in 1831 was 1093, two-fifths agricultural. The market was on Monday, but has been discontinued. The living of Layston is a vicarage in the deanery of Braughing, the archdeaconry of Middlesex, and the diocese of London, of the yearly value 149*l.* There is an Independent congregation. There were in Layston parish in 1833, one grammar-school with 3 boys, one charity-school with 36 girls, and one Sunday-school of 70 children.

Rickmansworth, or Rickmersworth, is 18 miles from London, in Cashio hundred, in a low and flat situation near the confluence of the Coln, the Chesham or Chess, and the Gade. The parish comprehends 9740 acres, and had in 1831 a population of 4574, more than one-third agricultural. The town is irregularly laid out. The church has been lately rebuilt: the former church was a large antient building; the tower, which is in the perpendicular style, is yet standing. There are several paper and flour mills near the town; and some straw-platting and horse-hair weaving is carried on. The Grand Junction Canal passes through the town. The living is a vicarage in the archdeaconry of St. Alban's and diocese of London, of the yearly value of 510*l.*, with a glebe-house. There are two dissenting places of worship. There were in 1833 three infant or dame schools with 20 children, an endowed national school with 86 children, a Lancasterian school with about 80 boys (since, we believe, discontinued), eighteen day or boarding and day-schools with 312 children, one day and Sunday Lancasterian school with 40 to 60 children, and two Sunday-schools with 81 children. Near Rickmansworth is Moor Park, which was the residence of Cardinal Wolsey, of the unfortunate James, duke of Monmouth, and of Lord Anson.

Cheshunt, though only a village, has some claims to notice. The parish comprehends an area of 8430 acres, and had in 1831 a population of 5021, from one-fourth to one-third agricultural. It is divided into three wards, Cheshunt Street, Waltham Cross, and Woodside. The name is written in Domesday 'Cestrehunt,' from which it has been conjectured that it was a Roman station. Waltham Cross takes its name from one of the crosses erected by Edward I., to mark the resting-places of the corpse of his wife Eleanor, when conveyed to Westminster for interment. This beautiful cross, which had become much mutilated, has been lately restored by Mr. W. B. Clarke. In Cheshunt parish was Theobalds Park, a favourite residence of James I. Richard Cromwell retired to this village upon his abdication.

Divisions for Ecclesiastical and Legal Purposes.—Hertfordshire is comprehended in the dioceses of London and Lincoln, which are here conterminous. That part which is in the diocese of London constitutes the deanery of Braughing, in the archdeaconry of Middlesex, containing 37 benefices; and the deanery and archdeaconry of St. Alban's, containing 22 benefices. That part which is in the diocese of Lincoln constitutes the deaneries of Baldock, containing 24 benefices; Berkhamsted, 21 benefices; Hertford, 18 benefices; and Hitchin, 15 benefices: all in the archdeaconry of Huntingdon. Of the whole 137 benefices, 65 are rectories, 52 vicarages, 4 donatives, 14 chapelries, and 2 curacies. The number of parishes is only 130; some of the benefices not being distinct parishes.

Hertfordshire is included in the Home circuit. The assizes and quarter-sessions are held at Hertford, except for the hundred of Cashio, the quarter-sessions for which are held at St. Alban's. The county returns three members to parliament. The place of election is Hertford: the polling-stations are Hertford, Stevenage, Buntingford, Bishop's Stortford, Hoddesdon, Hatfield, and Hemel Hempstead. Two members each are returned for the boroughs of Hertford and St. Alban's.

History and Antiquities.—At the time of Cæsar's invasion, Hertfordshire seems to have belonged to the Catyeuchlani (Καττευχλανοι, Ptol.) or Catuellani (Κατουελλανοι, Dion), of whom we have elsewhere supposed Cassivellaunus, the antagonist of Cæsar (B.C. 54), to have been the chief. [BRITANNIA.] Whether the Trinobantes, who occupied Essex and perhaps Middlesex, possessed any portion of Hertfordshire is not clear. Camden would place the Cassii, a tribe which submitted to Cæsar before the final defeat of Cassivellaunus, in the hundred of Cashio: but as the narrative of Cæsar would rather lead to the conclusion that the stronghold of Cassivellaunus, which he stormed, and which is commonly supposed to have been on the site of the Roman Verolamium, was not in the country of the Cassii, though it is in Cashio hundred, the conjecture is hardly probable. Hertfordshire was probably the scene of contest in the struggle of the Britons under Togodumnus and Cataratacus or Caractacus (A.D. 43—51), but we cannot identify any locality in it with the events of that struggle. In the revolt under Boadicea (A.D. 61), Verolamium was taken and the inhabitants massacred. The martyrdom of Alban occurred during the persecution in the reign of Diocletian. [ALBAN'S, ST.]

Several of the antient British roads or trackways crossed this county: Watling Street crossed it in a north-west direction not varying much from that of the present road from London by Edgware and St. Alban's to Dunstable; Ermin Street nearly coincided with the present road from London by Enfield, Hoddesdon, Ware, and Buntingford, to Royston (it was divided near Ware into two branches which reunited near Buntingford); Icknield Street ran along the downs from Dunstable toward Royston. The traces of the British Watling Street are obliterated by the Roman road afterwards carried along the same line. Traces of Ermin Street and still more of Icknield Street may yet be recognised. There were probably some smaller British roads branching from these. The Verolamium of the Romans has been mentioned as having been probably a British town: it has been conjectured that there were British towns or posts at Royston, at Braughing a few miles beyond Ware on the Ermin Street, in the neighbourhood of Berkhamsted at Ravensburg, on the border of the county, near the Icknield Street, and perhaps at other places. The Romans included Hertfordshire in the province of Flavia Cæsariensis. They fortified the town Verolamium, near St. Alban's [ALBAN'S, ST.], on which they conferred the rank of a municipium; and made military roads along Watling and Ermin Streets, and in other directions. A Roman post or town, Ad Fines, on the Ermin Street between Londinium (London) and Durolipons (Godmanchester), was most likely at Braughing, where are the remains of a vallum of a regular shape, and where a tesselated pavement, many silver coins, and other Roman antiquities have been found. It has been supposed that there were posts at or near Bishop's Stortford, at Royston (where some have proposed to fix the station Ad Fines), and at Cheshunt, but the evidence on which the supposition rests is not decisive.

At Wilbury Hill, three miles west of Baldock, is an antient camp on the Icknield Way, enclosing about seven acres; the rampart (four or five feet high) and ditch remain on the west side. Between Caldecot and Hinxworth, four or five miles north of Baldock, various Roman funeral and other antiquities have been dug up, including large urns full of burnt bones and ashes, pateræ of fine red earth with names impressed on the bottoms, glass lacrymatories, rings, beads, and fibulæ. Roman coins have been found at Ashwell in the same part of the county. A brass figure of Mars, and some thin plates with figures and inscriptions engraven upon them, were dug up in Rockley Wood, near Barley, not far from Royston; two Roman vessels of pale earth at Westmill, not far from Braughing, and coins at Bishop's Stortford and Cheshunt. Salmon proposed to fix the Roman station Durolitum at this last place. The Roman antiquities dug up near Hemel Hemstead have been noticed before.

When the Saxons subjugated Britain, Hertfordshire appears to have been included in the two kingdoms of Essex and Mercia: possibly the boundary of the dioceses of London and Lincoln may be nearly coincident with the boundary of the kingdoms. St. Alban's abbey, which was founded by Offa, king of Mercia, is indeed in the diocese of London; but Offa appears to have held the kingdom of Essex at this time in subjection, and therefore would not hesitate to found a religious house in it. Offley, not far from Hitchin, where Offa had a palace, and Bennington and Berkhamsted, also residences of the kings of Mercia, are in the diocese of Lincoln.

In the invasions of the Northmen which troubled the close of the reign of Alfred (A.D. 896), they brought their vessels up the Lea to the neighbourhood probably of Hertford or Ware. But Alfred, who pursued them, diverted the waters of the Lea into another channel, and obliged the Northmen to abandon their vessels and march across the island to the

Severn. Edward the Elder, son of Alfred, built Hertford Castle, probably with the view of checking the incursions of the Northmen who had been allowed to settle in East Anglia. An antient castle at Bishop's Stortford was probably built with the same design.

When William the Conqueror, after the battle of Hastings (A.D. 1066), advanced into the interior of the kingdom, his march was impeded near Berkhamsted by the bold conduct of Fretheric, abbot of St. Alban's, who caused the trees that grew by the road-side to be cut down. The same spirited ecclesiastic placed himself at the head of a confederacy, with which the Conqueror found it necessary to come to terms, by swearing, in a grand assembly of the clergy and nobles at Berkhamsted, to govern according to the antient laws of the realm, and especially those of St. Edward the Confessor: but when he thought himself strong enough, he scrupled not to break his oath.

In the civil broils of the reign of John, Hertford castle was defended for the king by Walter de Godarvil, a retainer of Fulk de Brent, against the revolted barons and the dauphin Louis of France; and in the troubles in the reign of Edward II. the barons confederated against Gaveston, the king's favourite, assembled their troops at Whethamsted, a few miles from St. Alban's, A.D. 1312. After the general rising of the peasantry under Wat Tyler and Jack Straw, many of the ringleaders were tried and executed at St. Alban's, the king being there at the time with a guard of 1000 men.

In the war of the Roses this county was repeatedly the scene of contest. In tho year 1455 three thousand men from the north, under Richard duke of York and the earls of Salisbury and Warwick, advanced towards London in order to seize and bring to trial the duke of Somerset, who had been impeached of treason by the House of Commons, but released by the influence of the queen, Margaret of Anjou. The insurgent nobles reached the neighbourhood of St. Alban's, which was occupied by the king, who had advanced from London with a body of two thousand men to impede their progress. After a vain attempt at negotiation the town was stormed by the Yorkists; the duke of Somerset and several other nobles and gentlemen of the royalist side fell in the battle, and the king himself was wounded and taken prisoner. In the year 1461 a second battle was fought at St. Alban's. The queen, who had just vanquished and slain the duke of York at Wakefield in Yorkshire, was advancing to London when she was met near St. Alban's by the Yorkists under the earl of Warwick, having the king with them. The battle was bloody, but the Lancastrians prevailed, and the king was restored to the keeping and use of his own faction. The battle of Barnet, A.D. 1468, in which Warwick fell in battle against Edward IV., whom he had been mainly instrumental in seating on the throne, was fought in Middlesex just beyond the boundary of Hertfordshire.

Of the monastic or castellated buildings of the middle ages Hertfordshire possesses but few remains. St. Alban's Abbey [ALBAN'S, ST.] is the chief; to which may be added Royston church, formerly conventual, and some remains of the priories at Hitchin and Ware. There are castles at Hertford and Berkhamsted [BERKHAMSTED]; some slight remains of a castle at Bishop's Stortford, and the earthworks of Austey or Anstic Castle, between Royston and Bishop's Stortford. Waltham Cross and Hatfield Palace have been noticed; there are some remains of a palace built by king Henry III. at King's Langley, between Watford and Berkhamsted.

In the breaking out of the war between Charles I. and the Parliament, this county was the scene of one of Cromwell's earliest exploits. While yet a captain of a troop of horse which he had raised, he arrested the high-sheriff of Hertfordshire as he was proceeding to St. Alban's to publish the king's proclamation declaring all the parliamentary commanders traitors. There has been no public event since of any moment connected with the county; but a circumstance which occurred in April of the year 1751 deserves notice as marking the extent of popular ignorance and barbarity at that period. A publican near Tring being troubled with fits, conceived that he was bewitched by an old woman named Osborne. Notice was given by the crier that two witches were to be tried by ducking; and in consequence a vast mob assembled at the time appointed. The old woman and her husband, who had been in Tring workhouse, were removed into the church for safety; but the mob obtained possession of the old man and old woman, whom they then dragged two miles to a muddy stream, ducked them, and otherwise so maltreated them that the woman died on the spot, and the man with difficulty recovered. Thomas Colley, one of the perpetrators, was executed on the spot; but so strong was the infatuation of the populace that it was thought necessary to have a guard of more than 100 troopers to escort the cavalcade to the place of execution.

STATISTICS.

Population.—Hertfordshire is principally an agricultural county; of 34,910 males twenty years of age and upwards, only 290 are employed in manufactures or in making manufacturing machinery, while 16,617 are occupied in agricultural pursuits; of those engaged in manufactures, 180 are employed at Tring, Watford, St. Alban's, and Tittenhanger (collectively) in spinning and winding silk and cotton, and in making ribbons; there are 49 machine-makers at Hemel Hempstead, and a few are employed at Royston in making wire-floors for malting. This county ranks the 13th in the list of agricultural counties.

The population of Hertfordshire at each of the four following periods was—

	Males.	Females.	Total.	Increase per cent.
1801	48,063	49,514	97,577	..
1811	55,023	56,631	111,654	14·42
1821	64,121	65,593	129,714	16·17
1831	71,395	71,946	143,341	10·50

showing an increase between the first and last periods of 45,764, or not quite 48 per cent., on the whole population; being 9 per cent. below the whole rate of increase throughout England.

The following table contains a summary of the population, &c., of every hundred, as taken in 1831:—

Summary of the County of Hertford.

HUNDREDS, CITIES, OR BOROUGHS.	HOUSES.				OCCUPATIONS.			PERSONS.			
	Inhabited.	Families.	Building.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in trade, manufactures and handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.	Males, twenty years of age.
Braughing, Hundred	3,307	3,641	15	136	1,272	1,120	1,249	8,971	8,856	17,827	4,436
Broadwater	3,103	3,303	8	51	1,931	782	590	8,607	8,436	17,043	4,138
Cashio	5,225	5,820	22	132	2,667	1,786	1,367	14,164	14,355	28,519	7,123
Dacorum	5,542	5,950	25	140	2,863	1,761	1,326	14,183	14,689	28,872	6,833
Edwinstree	1,782	1,991	2	49	1,164	396	431	4,707	4,530	9,237	2,262
Hertford	2,650	2,826	23	94	1,064	798	964	6,842	7,128	13,970	3,483
Hitchin and Pirton	1,991	2,179	6	41	1,189	643	347	5,244	5,467	10,711	2,518
Odsey	1,308	1,522	13	14	990	316	216	3,675	3,468	7,143	1,756
Hertford, Borough	841	913	2	9	36	390	487	2,757	2,490	5,247	1,266
Alban's, St.	800	1,105	3	33	92	560	453	2,245	2,527	4,772	1,095
Totals	26,549	29,250	119	699	13,268	8,552	7,430	71,395	71,946	143,341	34,910

County Expenses, Crime, &c.—The sums expended for the relief of the poor at the four dates of—

		£.		s.	d.	
1801	were	56,380,	being	11	6	for each inhabitant.
1811	„	76,701	„	13	8	„
1821	„	89,129	„	13	9	„
1831	„	94,336	„	13	1	„

The sum expended for the same purpose for the year ending March, 1837, was 49,670*l.*; and assuming that the population had increased at the same rate of progression as in the ten preceding years, the above sum gives an average of 6*s.* 6*d.* for each inhabitant. These averages are above those for the whole of England and Wales.

The sum raised in Hertfordshire for poor-rate, county-rate, and other local purposes, in the year ending the 25th of March, 1833, was 111,934*l.* 19*s.* and was levied upon the various descriptions of property as follows —

On land	£79,473	19
Dwelling-houses	26,124	12
Mills, factories, &c.	5,215	5
Manorial profits, navigation, &c.	1,121	3

The amount expended was—

For the relief of the poor	£91,323	17
In suits of law, removal of paupers, &c.	2,952	14
For other purposes	19,963	13
	£114,240	4

In the returns made up for subsequent years, the descriptions of property assessed are not specified. In the years 1834, 1835, 1836, and 1837, there were raised 108,189*l.* 16*s.*, 95,190*l.* 12*s.*, 77,749*l.* 12*s.*, and 59,369*l.* respectively; and the expenditure of each year was as follows:—

	1834. £.	s.	1835. £.	s.	1836. £.	s.	1837. £.
For the relief of the poor	85,799	13	70,997	17	59,368	17	49,670
In suits of law, removals, &c.	2,056	19	1,949	3	1,402	8	756
Payment towards the county-rate	19,720	12	9.465	13	8,053	19	5,230
For all other purposes			12,187	2	7,558	18	3,628
Total money expended	£107,577	4	94,599	15	76,384	2	59,284

The saving effected on the whole sum expended in 1837, as compared with that expended in 1834, was therefore about 45 per cent.; and the saving effected on the sum expended for the relief of the poor was rather more than 44 per cent. in 1837, as compared with the expenditure in 1834

The number of turnpike trusts in Hertfordshire, as ascertained in 1835, is 11; the number of miles of road under their charge is 170; the annual income in 1835, arising from the tolls and parish composition, was 28,336*l.* 6*s.* 10*d.*, and the annual expenditure 26,753*l.* 19*s.* 9*d.*

The county expenditure in 1834, exclusive of that for the relief of the poor, was 5500*l.* 11*s.* 6*d.*, disbursed as follows:—

	£.	s.	d.
Bridges, building, and repairs, &c	68	3	6
Gaols, houses of correction, &c., and maintaining prisoners, &c.	2832	9	6
Shire halls and courts of justice, building, repairing, &c.	72	13	0
Prosecutions	768	17	8
Clerk of the peace	385	5	6
Conveyance of prisoners before trial	536	1	11
Conveyance of transports	70	1	6
Vagrants, apprehending and conveying	73	19	8
Constables, high and special	198	7	0
Coroner	131	19	6
Debt, payment of, principal and interest	106	13	4
Miscellaneous	255	19	0

The number of persons charged with criminal offences in the three septennial periods ending with 1820, 1827, and 1834, were 747, 1047, and 1730, respectively; making an average of 107 annually in the first period, of 149 in the second period, and of 247 in the third period.

The number of persons tried at quarter-sessions in each of the years 1831, 1832, and 1333, in respect to which any costs were paid out of the county-rates, were 64, 76, and 106 respectively. Among the persons charged with offences, there were committed for—

	1831.	1832.	1833.
Felonies	49	49	88
Misdemeanors	15	21	18

The total number of committals in each of the same years was 95, 101, and 167 respectively.

	1831.	1832.	1833.
The number convicted was	59	71	109
„ acquitted	12	15	29
Discharged by proclamation	24	15	29

In 1837 there were 335 persons charged with crimes at the assizes and sessions in Hertfordshire. Of these, 9 were charged with offences against the person, 6 of which were for common assaults; 21 for offences against property committed with violence; 283 for offences against property, committed without violence; 1 for killing and maiming cattle; 8 for uttering counterfeit coin; 10 for poaching; and 2 for other misdemeanors. Of the whole number committed, 243 were convicted, 68 were acquitted, 6 were not prosecuted, and no bill was found against 18. Of those convicted, 4 were sentenced to death, the sentence of 3 of whom was commuted to transportation for life, and of 1 for 7 years; 17 others were transported for life, 1 for 15 years, 4 for 14, 11 for 10, 29 for 7 years, and 1 for some other period; 2 were imprisoned for three years or above 2 years, 7 for two years or above 1 year, 8 for 1 year or above 6 months, and 154 for 6 months or under; and 5 were fined. Of the whole number of offenders, 306 were males, and 29 females; 194 could neither read nor write, 91 could read and write imperfectly, 45 could read and write well, and the degree of the remaining 5 could not be ascertained.

The number of persons qualified to vote for the county members of Hertfordshire is 5098, being about 1 in 28 of the whole population, and about 1 in 7 of the male population twenty years of age and upwards, as taken in 1831. The expenses of the last election of county members to parliament were to the inhabitants of the county 496*l.* 14*s.* 10*d.*, and were paid out of the general county-rate.

There are 5 savings' banks in this county. The number of depositors and amount of deposits on the 20th November in each of the following years were—

	1832.	1833.	1834.	1835.	1836.
Number of depositors	3,055	3,209	3,320	2,485	2,073
Amount of deposits	£130,449	£134,415	£137,120	£92,395	£72,044

The various sums placed in the savings' banks in 1835 and 1836 were distributed as under:—

		1835. Depositors	1835. Deposits.	1836. Depositors.	1836. Deposits.
Not exceeding	£20	1,224	£9,166	1,009	£7,984
„	50	699	21,541	621	19,128
„	100	320	22,125	267	18,290
„	150	120	14,290	92	10.886
„	200	82	14,127	70	11,861
Above	200	40	11,.46	14	3,895
		2,485	92,395	2,073	72,044

Education.—The following summary is taken from the Parliamentary Returns on Education made in the session of 1835:—

	Schools.	Scholars.	Total.
Infant schools	55		
Number of infants at such schools; ages from 2 to 7 years:—			
Males		310	
Females		378	
Sex not specified		269	
			957
Daily schools	451		
Number of children at such schools; ages from 4 to 14 years:—			
Males		6,110	
Females		5,555	
Sex not specified		2,130	
			13,795
Total number of schools	506		
Total of children under daily instruction			14,752
Sunday schools	191		
Number of children at such schools; ages from 4 to 15 years:—			
Males		5,067	
Females		5,879	
Sex not specified		2,173	
			13,119

Assuming that the population between the ages of 2 and 15 is in the same proportion to the whole population as it was in 1821, and that it has increased in the same ratio since 1831 as the whole population did in the ten years preceding that date, we find by approximation that there were 49,214 children between the ages of 2 and 15 in the county of Hertfordshire, in 1834, the time the Educational Inquiry was made. Sixteen Sunday-schools are returned from places where no other school exists, and the children, 924 in number, who are instructed therein, cannot be supposed to attend any other school: at all other places Sunday-school children have opportunity of resorting to other schools also; but in what number, or in what proportion, duplicate entry of the same children is thus produced, must remain uncertain. Forty schools (containing 2291 chidren), which are both daily and Sunday schools, are returned from various places, and duplicate entry is therefore known to be thus far created. Making allowance from this cause for a number of children having been entered twice as under instruction, we may perhaps fairly conclude that about half of the children between the ages of 2 and 15 are receiving instruction in this county.

Maintenance of Schools.

Description of Schools.	By endowment.		By subscription.		By payments from scholars.		Subscrip. and payment from scholars.	
	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.
Infant Schools	..	..	9	262	39	448	7	247
Daily Schools	46	1,691	65	2,977	302	6,899	38	2,228
Sunday Schools	11	660	162	11,219	1	56	17	1,184
Total....	57	2,351	236	14,458	342	7,403	62	3,659

The schools established by Dissenters, included in the above statement, are—

	Schools.		Scholars.
Infant schools . .	—		—
Daily schools . .	12,	containing	433
Sunday schools . .	51	„	4,824

The schools established since 1818 are—

			Scholars.
Infant and other daily schools	240,	containing	7,574
Sunday schools . .	110	„	8,587

Forty-six boarding-schools are included in the number of daily-schools given above. No school in this county appears to be confined to the children of parents of the Established Church, or of any other religious denomination, such exclusion being disclaimed in almost every instance, especially in schools established by Dissenters, with whom are here included Wesleyan Methodists, together with schools for children of Roman Catholic parents.

Lending libraries of books are attached to 32 schools in Hertfordshire.

HERTHA, or HERTHUS, the Goddess of Earth among the antient Germans. Tacitus (*Mor. German.*, c. 40) says that she was worshipped by the Suevi, and that her sanctuary was in a grove in an island of the ocean, and was served by a single priest. A cart, covered by a cloth to conceal the goddess, was taken out of the sanctuary on certain occasions, and was drawn by cows about the country with great solemnity. This was a time of general rejoicing, especially for those places which were honoured by the visit of the goddess. During that time a cessation of war took place, arms were laid aside, and peace reigned over the land, until the priest thought proper to restore the goddess to her sanctuary, where the cart and the clothing, and the goddess herself, or her image, it was said, were washed in a secret pond, and the attendants who assisted at these ablutions were immediately after swallowed up by the flood. The report of these mysterious circumstances served to inspire the ignorant people with a dread of the power of the goddess, whom no mortal could behold with impunity.

HERVEY, JAMES, born in 1714, was educated at Lincoln College, Oxford, where he became acquainted with the first Methodists, whose views and society, though he did not enter into their connexion, influenced his course through life. He took orders in the Established church, devoted his whole life to acts of piety and beneficence, and the sedulous discharge of his clerical duties, and died early, of a decline brought on by labouring beyond his strength, in 1758. For some years preceding he had been rector of Weston-Favell in Northamptonshire. His works are numerous, and all religious: his style is metaphorical, flowery, diffuse, abounding in turgid declamation and strained fancies. Faulty as it is, it enjoyed its season of extensive popularity; and probably has won the notice of many who would have been less attracted by a purer writer. In doctrine he leaned towards the Calvinistic school. The most popular of his works were, 'Meditations among the Tombs,' 'Contemplations in a Flower-Garden, 'On the Night,' &c., 1746-7; and 'Theron and Aspasia; or, a series of Dialogues and Letters on the most important Subjects,' 1753. (Watt, *Bibl. Britann.*)

HESIOD (in Greek, Hésiodos) was a native of Ascra, a village at the foot of Helicon, whither his father had migrated from Cuma in Æolis. From thence he went to Orchomenos, according to his editor Goettling, who thinks that by the line 'Ascra, foul in the cold, oppressive in heat, bad at all times,' he expresses resentment at the iniquitous conduct of the Ascræan judges with respect to the division of his patrimony. Thirlwall doubts the truth of the interpretation, although Goettling quotes a passage of Paterculus (i. 7), which might by possibility refer to it. These facts are collected from the 'Works and Days,' a poem which there is no reason not to ascribe partially, although only partially, to Hesiod. Plutarch tells us that he met his death in consequence of the suspicions of some young men regarding their sister's honour, and we learn from Pausanias that he was revered in later times as a hero.

The only works that remain under the name of Hesiod are, 'The Theogony,' 'The Shield of Hercules,' and the 'Works and Days.'

The Bœotians themselves are said to have considered the last as Hesiod's, although they doubted the authenticity of the other works ascribed to him; but the ingenuity of modern times professes to discover interpolations even in this poem, which consists of advice given by Hesiod to his brother Perses, on subjects relating for the most part to agriculture and the general conduct of life. Whatever may be the decision which is arrived at regarding the authorship, we think one thing must be very evident to all who read the poem, that in its present state it shows want of purpose and of unity, too great to be accounted for otherwise than on the supposition of its fragmentary nature. Ulrici considers the moral and the agricultural instruction as genuine, the story of Prometheus and that of the Five Ages as much altered from their original Hesiodic form, and the description of Winter as latest of all.

The 'Theogony' is perhaps the work which, whether genuine or not, most emphatically expresses the feeling which is supposed to have given rise to the Hieratic school.* It consists, as its name expresses, of an account of the origin of the world, including the birth of the gods, and making use of numerous personifications. This has given rise to a theory that the old histories of creation, from which Hesiod drew without understanding them, were in fact philosophical and not mythological speculations; so that the names which in after-times were applied to persons, had originally belonged only to qualities, attributes, &c.; and that their inventor had carefully excluded all personal agency from his system. Thus much we may safely assert respecting the 'Theogony,' that it points out one important feature in the Greek character, and one which, when that character arrived at maturity, produced results of which the 'Theogony' is at best but a feeble promise; we mean that speculative tendency which lies at the root of Greek philosophy.

The 'Shield of Hercules' is a fragment, or rather a cluster of fragments; some of them by very late Rhapsodists who copied, according to Aristophanes the grammarian, from Homer's description of the shield of Achilles.

Those who are desirous to pursue the subject of the 'Theogony,' will do well to consult Ulrici, *Geschichte der Hellen. Dichtkunst*, 1, 360, 199; Hermann and Creuzer's *Briefe über Homer und Hesiod;* Creuzer's *Symbolik;* and especially Mr. Thirlwall's *History of Greece*, and Müller's *Prolegomena.*

The best modern editions of Hesiod are Goettling's (in 1 vol. 8vo., published in the *Bibliotheca Græca*), and Dindorf's, Leipzig, 1825, 8vo.

HE'SIONE (Zoology), the name of a genus of *Dorsibranchiate Annelids* [DORSIBRANCHIATA, vol. ix.], with a short but rather stout body, composed of a few ill-defined rings. A very long cirrhus, which probably executes the

* We use the word Hieratic with reluctance, but we are not aware what other single word would express what we mean, namely, that school of epic poetry which is connected with the religious life of the Greeks in the same way as Homer and the heroic poets were with the political.

function of branchiæ, occupies the upper part of each foot, which has also another lower one and a packet of fine bristles. The proboscis of *Hesione* is large, and without either jaws or tentacles. The reader will find, in the great work on Egypt, figures and descriptions of *Hesione splendida*, Sav., and *H. festiva*, Sav.

HESPE'RIDES, in Greek mythology, a family of Nymphs, of the same parentage, and apparently the same with the Atlantides, though there are differences between them, especially in number (the Atlantides being usually reckoned seven, and the Hesperides three in number), which we must leave to be accounted for by the general uncertainty of mythological story. They are named Ægle, Arethusa, and Hesperethusa, and were the daughters of Atlas, by Hesperis, the daughter of Hesperus. They dwelt in a beautiful garden in the western parts of the earth, in which grew the celebrated tree which bore golden apples. These apples were guarded by a fierce dragon named Ladon, which never slept. Hercules killed the dragon and carried off the precious fruit. Some authors make the treasure to consist of sheep instead of apples, both being called by the same Greek word, *mela*. Some think them citrons or oranges. The Gardens of the Hesperides are variously placed, in an oasis of the African desert, in Cyrenaica, at the foot of Mount Atlas, and in the Happy Islands of the Atlantic.

HESPERI'IDÆ (Stephens), a family of Lepidopterous insects of the section *Lepidoptera Diurna* of Latreille. Distinguishing characters:—Antennæ terminated by a distinct club, generally with a minute hook at its extremity; tibiæ with two pairs of spurs, one at the apex, and the other near the middle; claws very small, bifid, body thick, wings small, the posterior pair with a groove to receive the abdomen. The larvæ are pubescent, or naked, and have a large head; pupa smooth, enclosed in a web.

These little butterflies have a large head, and a thicker body and smaller wings than the more typical species; they are moreover at once distinguished from them by their possessing two pairs of spurs, or spines, to the legs; their flight is short and in frequent jerks, hence they have received the name of *skippers*.

Hesperia Sylvanus is about one inch and a quarter in width; the wings are of a rich brownish yellow above, with the outer margins deep brown; the anterior wings are spotted towards the apex with yellow, and have an oblong black dash near the base; the posterior wings have some indistinct spots.

This butterfly, which is very common in various parts of England, and is chiefly found on the borders of woods, will afford an example of the tribe of which we are treating.

There are several other species of the family Hesperiidæ found in this country, of which the *Thymele alveolus* may be noticed. This is a little black butterfly with numerous silver-like spots, and is known by the English entomologists by the name of the *Grizzled Skipper*.

HESPERIDIUM, one of those fruits which, in common botanical language, is confounded with the word Bacca [BACCA], but which indicates a different structure. It has a tough separable rind, the seeds hardly lose their attachment when ripe, and the cells readily separate through the dissepiments. Of this nature is the fruit of the orange, which is the type of the Hesperidium.

HESSE, an extensive country of Germany, which, in antient times, was inhabited by the Catti, part of whom however emigrated before the Christian æra to the Low Countries, where they were called Batavi. The Catti are mentioned under the emperors Augustus and Tiberius. Germanicus burnt their chief seat, Mattium (probably Marburg), A.D. 15. [CATTI.] In the sequel they belonged to the great empire of the Franks, losing their name in the third or fourth century. The Christian religion was introduced even before Charlemagne's reign by Boniface, the apostle of the Germans, archbishop of Mainz (Mayence), who preached here; and Christian churches and convents flourished in the seventh century at Hersfeld, Fulda, Frizlar, Amöneberg, &c. Till about the middle of the thirteenth century the history of Hesse was blended with that of Thüringen; but Henry Raspe, landgrave of Thüringen, dying without children, in 1247, a war for the succession took place, which was terminated in 1263 by a compact, by which Hesse was separated from Thüringen, and assigned to Henry, son of Sophia, duchess of Brabant, daughter of the late landgrave's brother, who was the common ancestor of all the succeeding landgraves of Hesse. It is beside our purpose to detail the various changes that occurred in consequence of the alternate partitions of the territory among the sons of the sovereigns, and the re-unions on the extinction of collateral lines. Philip I., surnamed the Generous, who succeeded his father William II. in the sovereignty of the whole country in 1509 (the other line becoming extinct in the person of William III.), and who introduced the Reformation, divided his dominions among his four sons: William IV., the eldest, obtained one-half, with Cassel, the capital; Louis IV. a fourth part, with Marburg; Philip II. an eighth, with Rheinfels; and George I. an eighth, with Darmstadt. But Philip II. dying in 1583, and Louis IV. in 1604, without issue, there remained only the two still flourishing main branches of Hesse-Cassel and Hesse-Darmstadt.

HESSE-CASSEL, from the time of William IV., 1592, suffered, in the successive wars which desolated Germany, but did not sustain any loss of territory; on the contrary, it made several acquisitions. After the Thirty Years' War Hessian mercenaries in the service of other Continental powers were employed in almost all the European and Turkish wars; a system which indeed enriched the princes of Hesse, but did not tend to promote the prosperity of the country. Frederick II., who succeeded to the government in 1760, though he embraced the Roman Catholic religion, signed an engagement to his family and the Estates, under the guarantee of England, Denmark, Sweden, Prussia, and Holland, not to change the constitution in church and state, and he also had his children educated in the Protestant religion. He kept a splendid court, beautified his capital, Cassel, and liberally promoted the arts and sciences. All this he was enabled to do by increasing his military force, of which he let out several thousand men to England in the American war, and received for them, from 1776 to 1784, above three millions sterling. He died in 1785, and was succeeded by the landgrave William IX., who in the war of the French revolution not only furnished his contingent as a prince of the empire, but had also a body of troops in the pay of England. In 1796 he joined in the treaty of Basel, and allied himself with Prussia. For the loss of his territories beyond the Rhine he received ample indemnities, and on the 25th February, 1803, obtained the dignity of elector, on which he took the title of William I. When war broke out between Prussia and France in 1806, both parties recognised the neutrality of Hesse; but within less than a month afterwards Napoleon, pretending that the elector was partial to the Prussians, seized on Cassel; and by the peace of Tilsit the greater part of the electorate was incorporated with the new kingdom of Westphalia. A secret article reserved to the elector, as an indemnity for the loss of his dominions, an annuity to be paid by Westphalia, which he refused to accept, and retired first to Holstein, and then to Prague, where he lived as a private individual. After the battle of Leipzig, 1813, he returned to his capital, where he was enthusiastically received by his subjects. He concluded a treaty with the allied powers, and subsequently became a member of the German Confederation. Unfortunately he did not live on good terms with his subjects, to whom he thought of giving a new constitution, but could not agree about it with the antient Estates. He alienated the affections of the people by reviving old monopolies, by refusing to recognise the validity of any act of the late government, and by harassing those who had served under it. He died in 1821. His son and successor, William II., has embroiled himself still more seriously with his subjects; in the first instance, by the scandal of his connexion with the countess of Reichenbach, who took the title of countess of Lessonitz from an estate purchased for her in Moravia. A pseudonymous letter, threatening both with death, unless a constitution were given to the country and the influence of the countess in the government put an end to, gave occasion to arbitrary inquisitorial proceedings, which incensed the people, and caused dissension in the elector's own family. The fermentation increased, serious riots took place in 1830, the countess left Cassel, the elector consented to assemble the Estates, and the constitution being presented to them by the elector on the 9th January, 1831, general joy prevailed, which was interrupted by the return of the countess on the 11th. Fresh disturbances arose, and the countess left Cassel; but the elector was so angry that he also left Cassel, and could not be induced to return. He appointed his son, the electoral prince, regent, who entered on his functions October 1, 1831 Fresh discontents arose, and new troubles were caused by the accession of the electorate to the Prussian commercial league.

Situation; Extent; Boundaries.—The electorate of Hesse is situated between 50° 6′ and 52° 25′ N. lat. and 8° 25′ and 10° 45′ E. long. It consists of three distinct portions, of which the largest, extending only to 50° 40′ lat. and 10° 15′ long., is bounded on the north-east by Hanover and the Prussian province of Saxony, on the east by Weimar and Bavaria, on the south by Bavaria, on the west by Nassau and Hesse Darmstadt. The detached portions are the county of Schaumburg to the north, surrounded by Hanover and Lippe, and the lordship of Schmalkalden to the east, surrounded by the Saxon principalities and the Prussian circle of Schleusingen. The area of the whole is 4350 square miles.

Divisions.—The electorate is divided into four provinces, with a total population, at the end of 1835, of 700,583 inhabitants.

I. Lower Hesse (337,400 inhabitants), divided into ten circles, with 34 towns, 8 market-boroughs, and 519 villages. Chief towns, Cassel, the capital of the electorate [Cassel], with 29,931 inhabitants (garrison included); Eschwege, 5086 inhabitants. There is no other town with 5000 inhabitants. Among the principal are, Frizlar (2882 inh.), Hofgeismar (3195 inh.), Melsungen (3341 inh.), Rothenburg on the Fulda, with a palace, late the residence of the landgrave, and 4 churches (3461 inh.), Rinteln (3297 inh.), Witzenhausen (2490 inh.), Allendorf (2853 inh.), Wolfshagen (2761 inh.), Volkmarsen (2796 inh.), Homberg-on-the-Efze (3007 inh.).

II. Upper Hesse (114,769 inh.), divided into 4 circles, with 16 towns, 4 market-boroughs, and 206 villages; chief towns, Marburg, the capital (7640 inh.), and seat of the university; Frankenburg (2868 inh.)

III. Fulda (133,577 inh.), 5 towns, 7 market-boroughs, and 198 villages. It consists of, 1, the grand-duchy of Fulda (48,314 inh.), chief town Fulda (9571 inh.); 2, the circle of Hersfeld (31,414 inh.), chief town Hersfeld (6307 inh.); 3, the circle of Hünfeld (2896 inh.), chief town Hünfeld (2000 inh.); 4, the lordship of Schmalkalden (25,749 inh.), chief town Schmalkalden (4832 inh.).

IV. Hanau (114,797 inh.), 7 towns, 14 market-boroughs, 189 villages, divided into 4 circles; chief towns, Hanau, capital of the principality (Hanau, according to the most recent account, 14,834 inh.) [Hanau], Gelnhausen (2137 inh.), Steinau (2317 inh.).

Hesse-Cassel, as a member of the German Confederation, is the eighth in rank, has in the full council 3 votes, one in the minor council, furnishes a contingent of 5679 men, which forms part of the second division of the eighth corps of the army of the Confederation, and contributes 1500 florins annually to the treasury of the Confederation.

Face of the Country, Soil, Climate.—The country is in general hilly; but it contains numerous valleys, which in some places expand into more extensive plains. On the south-east and south the Thüringerwald, the Rhön, and the Spessart, extend their branches into the country from the Saxon duchies and Bavaria, and cover the province of Hanau, and the whole tract between the Werra and the Fulda. Schmalkalden is situated on the mountain called the Thüringerwald, on the northern frontier of which is the Inselberg (2932 feet high). The mountain is thickly-wooded, chiefly with red pine and fir. The other principal chains are the Hundsrück, the Wesergebirge, and the Vogelsgebirge. The soil of Hesse is not indeed distinguished in general by great fertility, but it can by no means be called sterile. The finest parts are the beautiful valleys of the Fulda, the Schwalm, the Edder, and the Werra. The climate is on the whole temperate, and everywhere healthy; mildest on the banks of the Main, and most severe in Fulda, on the summits of the Rhön. The principal rivers are the Maine, the Weser, the Werra, the Lahn, and the Fulda. The last, though not the largest, is the most important river of Hesse; rising in Bavaria, it traverses the circles of Fulda, Hersfeld, Rothenburg, Melsungen, and Cassel, becomes navigable at Fulda, and joins the Werra at Münden, in the kingdom of Hanover, both together forming the Weser. The Maine only just touches the south-west corner of the country, and being joined by the Kinzig near Hanau, flows into the Rhine. The Lahn, traversing the circle of Marburg, joins the Rhine below Coblenz. There are no lakes, but numerous large ponds, of which there are forty of various sizes in the district of Diemel alone.

Natural Productions.—Corn, maize, pulse, and potatoes in great abundance, especially in the mountainous parts, are cultivated. Flax and timber are staple articles: tobacco, hemp, madder, a few hops, and rapeseed, are also among the products. The vine is cultivated only in some parts of Hanau. The pasturage is in general good. Garden produce of excellent quality is raised about Cassel and Hanau; fruits are cultivated chiefly in Upper Hesse, Hanau, and Hersfeld, whence large quantities of dried fruits are exported. The breeding of cattle is pretty general, but much neglected in some parts; there are horses enough for the purposes of agriculture; and sheep chiefly in Lower Hesse, Hanau, and Fulda. Domestic poultry and game are very abundant. Hesse abounds in mineral wealth, producing silver, copper, lead, iron, quicksilver, cobalt, salt (from saline springs in great quantities), saltpetre, vitriol, and alum. There are also coals, marble, very fine white alabaster, porcelain, potter's, and pipe clay, &c.

Manufactures and Trade.—The manufactures, which are chiefly in Cassel, Hanau, and Fulda, are insufficient for home consumption. The principal are linen, mostly coarse, which is exported to the value of 300,000*l.* sterling annually fine linen is made in Cassel and Herzberg. Cotton spinning has been introduced of late years, and is become pretty general. Schmalkalden manufactures almost all the steel and iron of the country; Grossalmerode is celebrated for its crucibles, which are exported to all parts of the world. With respect to trade, there is properly no commercial town, and the two fairs at Cassel are of little importance. The exports are corn, dried fruits, timber, leaf tobacco, wrought iron, linen, earthenware, crucibles, salt, &c. The imports are colonial produce, wines, silk, cotton, and manufactured articles of all kinds, but not to a large amount, the inhabitants being very simple in their habits and mode of living. The proximity of Frankfort favours a profitable transit trade with the North of Germany, and the treaties lately concluded between Holland and the States on the Rhine will doubtless tend to promote the foreign commerce of Hesse.

The Revenue.—By the triennial budget for 1837—1839, the expenditure is estimated at 3,330,070 dollars, and the receipts at 3,314,810 dollars; leaving a deficiency of 15,260 dollars; but there is reason to expect that there will be a surplus. On the 1st of January, 1837, the public debt was 1,540,850 dollars, at 4 per cent. interest, of which however 900,000 dollars are in the hands of the government. The interest of the debt has been reduced to 3½ per cent.

The *army* consists of six regiments of infantry of the line, two battalions of foot guards, two battalions of light infantry, and two regiments of cavalry.

The *Constitution* of January, 1831, is one of the most liberal in Germany. The estates form only one chamber; the electoral dignity is hereditary, to the exclusion of females. Though there is no longer an emperor of Germany, and consequently no elector, the sovereign of Hesse-Cassel has thought fit to retain the title of elector. Since the introduction of the constitution, many good laws have been passed, and many material improvements introduced; but unhappily, there have been serious differences between the government and the states, some of which have been compromised, but one of much importance remains undecided. It arose on the extinction of the collateral branch of Hesse-Rotbenburg by the death of the landgrave Victor Amadeus, in Nov. 1834; the revenue of his domains (250,000 dollars) is claimed by the Estates as public property, whereas the elector affirms it to belong to the private property of his family.

Religious Education.—The great majority of the inhabitants are Protestants (for the most part, with the court, Calvinists), the Roman Catholics 102,000, the Jews about 9000. A law for the emancipation of the Jews was passed in 1833. The Protestant Church is under superintendants; and the Roman Catholic under the bishop of Fulda, which was erected into a see in 1822. Hesse has a university at Marburg; 1 lyceum, 6 gymnasia, 1 episcopal seminary, 3 seminaries for schoolmasters, 2 academies of drawing and painting, and 63 town schools, and elementary schools in all the villages.

HESSE-DARMSTADT, the grand-duchy of which is governed by the second main branch of the house of Hesse, was founded in 1567, as stated under Hesse-Cassel, by George I., youngest son of Philip the Generous, of whose dominion he obtained one-eighth with Darmstadt, and a small addition on the death of his brother Philip without issue. On the death of George his dominions were divided among his three sons. Louis V. succeeded him in the principal line; Philip obtained Butzbach, which reverted on his death to the main line; and Frederick, the youngest, was the founder of the junior line of Hesse-Darmstadt, namely, that of Hesse-Homburg. Excepting the ruinous effects of the Thirty Years' War, the reigns of the succeeding princes were on the whole prosperous, and various acquisitions of territory were made. Louis IX., who reigned from 1768 to 1790, was a friend of peace and a patron of the arts and sciences. He found the country burdened with a large debt, which he paid off, and left to his son, Louis X., an improved territory with 300,000 inhabitants. This prince, during his long reign of forty years, was a greater gainer than almost any other German sovereign by the consequences of the French revolution; that is to say, he acquired very large additions to the extent of his dominions and the number of his subjects. By the treaty of Luneville, 1801, and by the settlement of the affairs of the empire, in 1803, he lost territories containing above 100,000 inhabitants, and obtained instead, provinces more than double the extent, with 218,000 inhabitants. In 1806 he joined the Confederation of the Rhine, and obtained from Napoleon still further accessions of territory, with 112,000 inhabitants, and the dignity of grand-duke, on which he took the title of Louis I. In 1809 his troops acted against Austria, and the peace brought him new accessions of territory. In 1813 he was at first obliged to let his troops serve with the French; but after the battle of Leipzig he joined the allies, on their engaging to let him retain his newly-acquired provinces. In 1815 the grand-duke joined the German Confederation. By the decision of the congress at Vienna he indeed made large cessions on the right bank of the Rhine, with 185,000 inhabitants, to suit the convenience of Prussia and other states, but obtained on the left bank a part of the then late French department of Mont Tonnère, with Bingen, Mainz, and other towns, containing 203,854 inhabitants; so that he gained an addition of above 18,000 subjects. It is to be hoped that these continual changes, these transfers of entire provinces backwards and forwards, like so many bales of merchandise, are now at an end. They are but ill-calculated to ensure that affection of the people to their princes which is the firmest support of hereditary sovereignty; though they may perhaps have the effect of rendering the princes more solicitous to acquire, by good government, the affection of their new subjects. His son and successor Louis II. has been engaged in continual disputes with the Estates; and disturbances, in some instances attended with bloodshed, have broken out on different occasions. The Polish revolution caused a very great excitement in Hesse-Darmstadt; the deepest sympathy was felt for the Polish fugitives; associations of ladies were formed for their relief; addresses from Mainz and Darmstadt in their favour were presented to the German diet, but it did not accept them; the influence of the French propagandas was felt; and severe ordinances were issued by the government against popular festivals and meetings, distinctive badges, political associations, &c. Many changes made by the grand-duke in the internal administration were disapproved by the Estates; and though they acknowledged, in 1832, that there was on the whole a progressive improvement, a strong opposition was formed in the second chamber. Prosecutions for political offences were instituted; yet, in spite of many attempts to inflame the people's minds, the grand-duke's family received on several occasions, for instance on the marriage of the hereditary grand-duke in 1833, unequivocal marks of loyalty and attachment. Yet emigration to America has rather increased than diminished, and even families in good circumstances leave their native land to seek another home beyond the Atlantic.

The grand-duchy of Hesse-Darmstadt consists of two large portions, which are separated from each other by a long strip of land, extending from east to west, belonging to Hesse-Cassel and the city of Frankfort. Taking the town of Bingen for the most westerly and Schlitz for the most easterly point, Wimpfen (in a small detached portion in Würtemberg) as the most southerly, and the village of Eimelrod (in the lordship of Itter) as the most northerly point, the grand-duchy is situated between 7° 50′ and 9° 40′ E. long. of Greenwich, and between 49° 12′ and 51° 20′ N. lat. The northern portion is bounded on the west by Prussia and Nassau; and on the north, east, and south, by Hesse-Cassel. The southern portion is bounded on the north by Nassau, Frankfort, and Hesse-Cassel; and on the other sides, by Bavaria and Baden.

The area of the whole is about 5000 square miles.

Divisions.—The grand-duchy is divided into 3 provinces.

I. STARKENBURG (256,745 inhab.) contains 22 towns, 24 market-villages, and 382 other villages; chief towns, Darmstadt (24,500 inh.), the capital of the grand-duchy [DARMSTADT]; Pfungstadt (2800 inh.), Griesheim (2400 inh.), Bensheim (4000 inh.), Heppenheim (3600 inh.), Gernsheim (2900 inh.), Lorsch (2749 inh.), Lampertheim (2900 inh.), Dieburg (3000 inh.), Offenbach on the Main (8000 inh.), and Offenbach.

II. RHEINHESSEN, that is, RHENISH HESSE (190,000 inh.), contains 10 towns and 180 villages: Oppenheim (2200 inh.), Mainz (31,000 inh.), the greatest fortress of the German confederation [MAINZ]; Worms (8000 inh.) [WORMS], and Alzei (4200 inh.).

III. OBERHESSEN, or UPPER HESSE (271,642 inh.), with 34 towns, 10 market-villages, and 510 other villages; chief towns, Giessen, the provincial capital (8000 inh.) [GIESSEN], Friedberg (3200 inh.), Bübingen (2700 inh.), Alsfeld (3700 inh.), Lauterbach (3400 inh.), Schlitz (3200 inh.), Biedenkopf, on the Lahn (3200 inh.).

To the province of Upper Hesse belongs the entirely detached district of Wöhl, or Itter, the most northern part of the grand-duchy, a wild sterile country, surrounded by the territory of Waldeck.

The grand-duchy of Hesse, as a member of the German Confederation, is the ninth in rank, has three votes in the full council and one in the minor council, furnishes a contingent of 6195 men to the 2nd division of the 8th corps, and contributes 1500 florins annually to the treasury of the Confederation.

Face of the Country, Soil, Climate.—A large part of the surface of the country is mountainous. The banks of the Rhine, and the Wetterau, which contain about 400 square miles, are pretty level and very fertile: the remainder of the country is traversed by branches of the Vogelsgebirge, the Odenwald, Taunus, and the Westerwald; but of the two latter only small portions extend into the grand-duchy. The Vogelsgebirge, in Upper Hesse, is a volcanic mass, which with its branches occupies 400 square miles: it consists chiefly of basalt, and of various compact and porous lavas. The Odenwald, in Starkenburg, presents a pleasing and picturesque rather than a wild mountain character. Most of its summits are clothed with forests of oak, beech, and fir, while the broad well-watered valleys and middle declivities are covered with numerous habitations and carefully cultivated. Hesse-Darmstadt is on the whole an agricultural country. The chief productions are corn of all kinds, likewise maize and spelt; wheat and rye chiefly in Rhenish Hesse and the Wetterau; flax, hemp, hops, tobacco, pulse, potatoes, wines, both white and red, garden vegetables and fruit, and timber. Rhenish Hesse is nearly destitute of timber. The valleys of the Odenwald and Vogelsgebirge are well adapted to the breeding of cattle, of which there are about 250,000 horned cattle, and 200,000 sheep. Swine are kept chiefly in Upper Hesse and Starkenburg. The breeding of horses is much neglected. Domestic poultry is abundant; game is not scarce, but it is not plentiful. Mining is not carried on so extensively as might be expected: it is confined to copper, iron, coals, salt, and brown coal. Cobalt, basalt, lime, sandstone, marble, and slate, are found in different parts of the grand-duchy. The chief rivers are the Rhine (2500 feet broad at Mainz), and the Main, and next to these the Lahn, the Schwalm, the Nidder, the Ohm, and the Itter.

Manufactures and Trade.—Though the manufactures have greatly improved of late years, yet much still remains to be done. The chief manufactures are of woollens, cottons, and linen (of which latter 600,000 ells are annually made in Schlitz), leather, and hardware. Wine is produced chiefly in Rhenish Hesse. The most considerable manufacturing and trading town is Offenbach, which has two annual fairs. Mainz is the principal place for the transit-trade. The exports consist of the natural productions of the country and of some manufactures. Hesse-Darmstadt joined the Prussian commercial league in 1828.

The Revenue is estimated at 6,576,105 florins, and the expenditure at an equal sum, including the interest of the debt, which is above ten millions of florins. Provision is made for the gradual extinction of this debt.

The military establishment in time of peace is fixed at

6288 men, namely, 908 cavalry, artillery 308, infantry 4965, a company of sappers and miners 61, general staff 6. The war establishment is 9469 men.

Religion, Education.—Of the 718,000 inhabitants, 516,000 are Protestants (in 1822 the Lutherans and Calvinists in Rhenish Hesse united in one Evangelical church), 177,888 Roman Catholics, about 1300 Mennonites, and 22,174 Jews. In education Hesse is not so forward as some other German states; but considerable improvements have lately been made. There is one university (Giessen), a philological seminary, an episcopal seminary, 2 seminaries for schoolmasters, eight gymnasia, 4 schools of arts and sciences, one military school, one midwifery school, 16 schools of industry, and at least one elementary school in every commune.

HESSE-HOMBURG was formerly a part of the landgraviate of Hesse-Darmstadt, till it came, in 1596, into the possession of Frederick I., youngest son of George I., who was the founder of the still flourishing line of Hesse-Homburg. Frederick Charles Louis, who succeeded to the government in 1751, experienced various vicissitudes in his long reign. In 1806, on the foundation of the Rhenish Confederation, he was obliged to give up the sovereignty to Hesse-Darmstadt, on which he became dependent. The Congress of Vienna however, in 1815, not only restored to him the sovereignty of his antient principality of Hesse-Homburg, but added to it the lordship of Meisenheim, on the other side of the Rhine. The landgrave therefore is now a sovereign prince, and was unanimously received in 1817 as a member of the German Confederation, and as such has one vote in the full council, making the whole number 70. Frederick Joseph, his successor, was married in 1818 to the Princess Elizabeth of England, and dying without issue in 1829, was succeeded by the reigning landgrave, Louis William Frederick.

Divisions.—I. The lordship of Homburg, which contains about 58 square miles and 8800 inhabitants. The chief town, Homburg vor der Höhe, with 3600 inhabitants, is situated under an eminence, on which the palace of the landgrave is built, commanding an extensive prospect of extraordinary beauty. Homburg is divided into the old and the new towns, the latter of which is open, and regularly built.

II. The lordship of Meisenheim, which contains 126 square miles and 15,200 inhabitants. It lies between the Prussian province of the Lower Rhine, the Bavarian circle of the Rhine, and the principalities of Lichtenberg and Birkenfeld. The chief town is Meisenheim, with 1750 inhabitants. The territory of Hesse-Homburg contains a considerable proportion of arable land. Meisenheim, which is occupied by the offsets of the Hundsrück, has mines of coal, iron, stone-quarries, and considerable forests. The landgrave possesses also the bailiwicks of Winningen, Hötensleben, and Oebesfelde, in the Prussian province of Saxony, and some other private estates. The revenue, including 34,000 florins from the Prussian bailiwicks, and an appanage paid by Hesse-Darmstadt, is 180,000 florins (18,000*l.*). The public debt is 450,000 florins, for the gradual extinction of which provision is made. The military consists of a contingent of 200 men, furnished by Hesse-Darmstadt to the reserve of the army of the Confederation.

Religion.—14,000 Calvinists, 6000 Lutherans, 3000 Roman Catholics, 150 Jews. The supreme power is vested in an hereditary landgrave, and descends only in the male line. There is no assembly of estates.

HESSE-PHILIPPSTHAL, the younger collateral line of the house of Hesse-Cassel, was founded in 1685 by Philip, the sixth son of Landgrave William VI., and was divided by his sons into the two still flourishing branches of Hesse-Philippsthal and Hesse-Philippsthal Barchfeld: the residence of the former prince is at Kreuzberg or Philippsthal, that of the second at Barchfeld, both on the Werra. They are both of the Calvinist religion, and are neither of them sovereign princes.

HESSE-ROTHENBURG. This line was founded by Ernest, the youngest son of the Landgrave Ernest, born 1623, died 1693, who embraced the Roman Catholic religion. The line, as stated under HESSE-CASSEL, became extinct by the death of Landgrave Victor Amadeus without issue on the 12th November, 1834, when the revenue, about 250,000 dollars per annum, came to Hesse-Cassel.

(J. D. A. Höck, *Statistik und Topographie des Kurf. Hessen;* E. Wiegand, *Erdbeschr. des Kurf. Hessen;* A. F. W. Crome, *Statistik des Grossherzogthums Hessen;* P. A. Pauli, *Statist.-topogr. Beschreibung des Grossherz. Hessen;* G. W. J. Wagner, *Statist.-topogr.-histor. Beschreibung des Grossherz. Hessen*, 4 vols., 1829-31.)

HESSE, WILLIAM, LANDGRAVE OF, was born at Cassel about the middle of the sixteenth century, and died in the year 1597. He immortalized his name by the encouragement which he gave to all kinds of philosophical research, and more particularly by the zeal with which he endeavoured to advance the science of astronomy. With the assistance of Christopher Rothmann and Juste Byrge, he erected an observatory, and furnished it with the best instruments that were then obtainable. His observations, which are said to have been of a very curious nature (Hutton's *Dictionary*), were published at Leyden twenty-one years after his death, by Willebrord Snell, and are spoken of by Tycho Brahé, both in his Epistles, and in the second volume of 'Progymnasmata.' (Martin's *Biographia Philosophica*, Lond., 1764, p. 248.)

HESSE'NES, commonly called **ESSENES**, one of the three great sects into which the Jews were divided in the time of Christ. They are not mentioned in the New Testament; but it has been conjectured that they are alluded to in *Matt.* xix. 12, *Col.* ii. 18, 23. Many particulars concerning the customs and religious opinions of this sect are given by Josephus and Philo. Their statements differ in several points; but those of Josephus appear worthy of more credit, since he had in his youth passed some time among the Essenes. (*Life of Josephus*, c. 2.)

The Essenes generally lived at a distance from large towns, in communities which bore a great resemblance to the monkish societies of later times. They employed themselves in agriculture, and had no slaves. They had all things in common, ate at a common table, and were exceedingly abstemious, never partaking of food before sunset. They were clothed in white garments, abstained from wine, and generally led a life of celibacy. They sent gifts to the Temple, but never offered any sacrifices there. They were divided into four classes, according to the time of their initiation. They admitted no one to their society till after a probation of three years: those who were admitted had to take solemn oaths that they would worship and serve God, and be just towards their fellow-creatures; that they would love and speak the truth, and that they would never disclose the mysteries of the sect. The Essenes were exemplary in their religious duties, and were particularly distinguished by their rigid observance of the Sabbath-day. They believed in the immortality of the soul, but not in the resurrection of the body, and maintained the absolute predestination of all events: they held the Scriptures in the greatest reverence, but considered them as mystic writings, and explained them allegorically. They also appear to have possessed sacred books, which explained the peculiar doctrines and practices of their sect. (Philo, *De Vita Contempl.*, vol. ii., p. 475.)

The origin of this sect is uncertain. Some writers consider them the same as the Assidians, or Chasidim, who are mentioned in 1 *Macc.*, ii. 42; vii. 13. It would appear from the account of Pliny (*Nat. Hist.*, v. 17) that their principal society was on the western side of the Dead Sea; and that from this society other smaller ones afterwards proceeded, and spread themselves over Palestine, Syria, and Egypt. Their numbers were never considerable; according to Philo and Josephus, there were only 4000 in Palestine.

The Essenes of Egypt were divided into two sects: the practical Essenes, whose manner of life was the same as the Essenes of Palestine; and the contemplative Essenes, who were also called Therapeutæ. Both sects maintained the same doctrines, but the latter were distinguished by a more rigid mode of life.

From a passage in Eusebius (*Hist. Eccles.*, ii. 17), it has been argued by Bellarmine, Baronius, and other Roman Catholic writers, that the Therapeutæ were Christian monks formed into a society by St. Mark, who was the founder of the Christian church at Alexandria. But it is evident from the account of Philo, that the Therapeutæ were not Christians, but Jews.

It has been supposed, with considerable probability, that the early Christians derived many of their customs and opinions from the Essenes. Mr. Taylor, the editor of Calmet's 'Dictionary to the Bible,' gives many reasons for believing that John the Baptist belonged to this sect.

(Josephus, *Antiquities of the Jews*, xiii., c. 5; xv., c. 10

xviii., c. 1; *Jewish War*, ii., c. 8; Philo; Pliny, *Nat. Hist.*, v., c. 17; Prideaux's *Connection of the History of the Old and New Testament*, vol. ii., pp. 450-470; Jennings' *Jewish Antiquities*, i., c. 13.)

HESY'CHIUS. There is a valuable Greek Lexicon extant, bearing the name of this author, of whom however nothing except the name is certainly known; he is supposed to have lived in the fifth or sixth century after the Christian æra. That which has come down to us is said to be only an epitome of the original, but of this assertion no proof can be made. It has the appearance of rough notes put down in the course of reading, rather than of a finished work; and consists chiefly of short explanations of unusual Greek words, or forms of words, and technical terms. It was not known until the 16th century. But one MS., in the library of St. Mark at Venice, is said to be preserved, and that is full of abbreviations, and has many erasures; which accounts for the great corruption of the text, in spite of the labours of many able editors. The first edition was that of Aldus, 1513, fol.; the most complete, that of Alberti, 1746, 2 vols. fol., of which the second volume was published by Ruhnken in 1766. This edition has a copious body of Prolegomena, containing all that can be said concerning this author.

HESYCHIUS, named the Illustrious, of Miletus, lived in the sixth century, and wrote a universal history in six parts, from Belus down to his own age. Some extracts of it have been preserved; which, with an abridgment of the 'Lives of the Philosophers,' chiefly from Diogenes Laertius, are edited in one volume by Meursius, 1613; he also wrote the reign of Justinus. (Photius, *Bibl.*, 69.)

HESYCHIUS was a common name under the Greek empire: we find many ecclesiastics and martyrs so called. For a list of those concerning whom something is known, see Fabricius, *Bibl. Gr.*, lib. 5, c. 5, and the Prolegomena to Alberti's edition of the Lexicon.

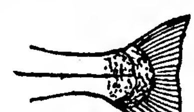
HETEROBRANCHIA'TA, M. De Blainville's name for the fourth order of his *Acephalophora*.

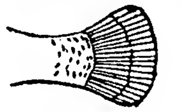
The 1st Family (*Ascidians*) is divided into two tribes: 1. *Simple Ascidians*, of which examples have been given under the heads of *Bipapillaria*, vol. iv.; and *Fodia*, vol. x.; 2. *Aggregated Ascidians*, an example of which has been given under the title of *Botryllus*, vol. v. [ASCIDIA, vol. ii.]

The 2nd Family consists of the *Salpaceans*, and is also divided into two tribes: 1. the *Simple*, (*Biphora*, *&c.*); 2. the Aggregate (*Pyrosoma*). [SALPA.]

HETERO'CERCAL, the term chosen by M. Agassiz to express a peculiar form of the tails of fishes, which affords a very obvious, and, as far as yet appears, a very correct indication of the geological age of formations. Among existing fishes the tail is either simple, as in the eel, bifurcate, as in the salmon, expanded to a round figure, as in the wrasse, or unequally bilobate, as in the shark. It is to this latter irregular form of tail that the term Heterocercal is applied: the others, by way of distinction, are called Homocercal.


Eel.


Salmon.


Wrasse.


Shark.

The peculiarity of the Heterocercal fishes is that the vertebral column runs along the upper caudal lobe: in the other forms of tail it is symmetrically placed with respect to the posterior finny expansion. M. Agassiz has found this peculiarity of the tail, which is least common among living fishes, and confined to particular groups, to belong to every species of fishes, of whatever group, and however differing in other respects, which occur in strata older than the oolitic system, while in and above that system Homocercal forms appear. It is therefore a characteristic of geological time; and among the conjectures as to the relations of this form to physical conditions of the surface, or laws of the animal economy, we prefer the opinion that it is one among several marks of the sauroid character of the fishes which lived in early geological periods. Some of the fishes of the oolitic rocks exhibit a slight inequality of the lobes of the tail, and some difference in the arrangement of the scales thereon, but without (we believe) the characteristic continuation of the vertebral column into the upper lobe. These may be thought to mark the gradual transition from the Heterocercal to the ordinary types of structure. Lepidosteus, with sharks, and other cartilaginous fishes of the existing creation, which were ranked by Linnæus as 'Amphibia Nantes,' thus appear the few surviving representatives of organic forms which, in earlier periods of the history of the globe, were exclusively predominant. (Agassiz, *Recherches sur les Poissons Fossiles*.)

HE'TERODON, M. De Blainville's name for a genus of Dolphins. [WHALES.] The term *Heterodon* had been applied by M De Beauvois to a genus of serpents placed by Cuvier under his great genus *Coluber*.

HETEROGANGLIA'TA. The *Heterogangliata* of Professor Owen comprise all the *Mollusca* of Cuvier, with the exception of the *Cirripeda*.

HETEROGENEOUS. [HOMOGENEOUS.]

HE'TEROMYS, a genus of Rodents, which, in M. Lesson's opinion, may be advantageously used, though M. Desmarest proposed it without adopting it. The genus is described as having the cheek-pouches of the Hamsters, the general form of the body and tail of the rats properly so called, and the dorsal flattened spines of *Echimys*, Geoff. (*Loncheres*, Illiger). Dental system unknown; feet with six callosities below, and five toes, the internal toe very small. (Lesson.) Example, *Heteromys Thompsonii*, Lesson (*Cricetus anomalus*, Desm.; *Mus anomalus*, Thompson) Habits and size of a rat. Locality, the Carib Island of Trinidad. (See 'Linn. Trans.,' vol. xi., p. 161, t. 10.)

HETERO'PODA. [GASTEROPODA, vol. xi., p. 92.]

HETERO'PORA, a genus of Polyparia, proposed by De Blainville to include species of the genus Ceriopora of Goldfuss, which have unequal cellules. From the chalk of Maestricht. (*Manuel d'Actinologie.*)

HETEROSCII (other-shadowed), an old astronomical term for persons living in such parts of the earth that their shadows at noon are always turned contrary ways. Thus the only heteroscii are those who are situated without the tropics, and in different hemispheres; since in the northern hemisphere those who are situated north of their tropic have the shadow at noon always turned northward, and those south of the southern tropic, southward.

HETEROSTEGI'NA. [FORAMINIFERA, vol. x., p. 348.]

HEVE'LIUS, JOANNES, or more properly JOANNES HEVEL, a Polish astronomer of great eminence, was born at Danzig, of a noble family, January 28, 1611. After visiting the principal countries of Europe (1630—1634), he returned to his native city, and was occupied in business or public affairs till 1639, when, by the advice of Cruger, whose pupil he had been, he applied himself almost exclusively to the study of astronomy. In 1641 he built an observatory in his own house, and furnished it with a quadrant and sextant of three and four feet diameter, together with large telescopes constructed by himself. His scientific pursuits did not however preclude his being elected consul in 1651, to which distinction his rank in society and philosophic character entitled him, and of which he continued to discharge the duties to the time of his death. In 1647 he published a description of the moon, under the name of 'Selenographia' (Gedani, fol.), to which was added a representation of the other planets as seen by the telescope. In 1654 appeared his treatise 'De motu Lunæ Libratorio' (Gedani, fol.), in the form of a letter to Riccioli, wherein he gave an explanation of the libration of the moon. (Montucla, *Hist. des Mathém.*, tome ii., p. 638.) To these succeeded an account of the eclipses of 1654; a treatise, 'De Natura Saturni Faciei ejusque Phasibus' (1656); 'Observations on the Transit of Mercury' in 1661, to which he added an account of the transit of Venus in 1639, as observed by Horrox (Gedani, 1661); 'Observations of the Comets of 1664 and 1665, published in 1665 and 1666; and in 1668 appeared his 'Cometographia.' In 1672 appeared an epistle to Oldenburg on the comet of that year, and in 1673 the first part of the 'Machina Cœlestis' was published. It was this last work which gave rise to public controversy between Hevelius and Dr. Hooke, who published *Animad. in Mach. Celest. Hevelii*, Lond. 1674, in 4to. Hevelius always imagined that better observations could be made with plain sights than with telescopes. Hooke recommended the use of the latter to Hevelius on the receipt of a copy of his 'Cometographia,' and some correspondence took place, which was increased into a quarrel by the dictatorial manner of Hooke in the work just cited. Halley was requested by the Royal Society of London to visit Hevelius at Danzig, and judge of the goodness of his observations. This voyage, which was made in 1679, produced a report from Halley highly favourable to Hevelius. In 1664 Hevelius was elected a member of the Royal Society of London. In 1679 he sustained considerable loss by the destruction of his house and observatory by fire. The whole of his instruments and library were destroyed, including most of the copies of the second part of his 'Machina Cœlestis,' which had only been published that year. This second part is now extremely rare. This accident appears only to have had the effect of increasing his ardour in the pursuit of astronomy, for he shortly after erected a new observatory, though on a less magnificent scale, and by 1685 he had another volume of observations ready for publication. He had now been occupied forty-nine years as an observer, and had attained sixty-three years, the climacteric, as it used to be called, of life, for which reason this volume (the last published during his lifetime) is entitled 'Annus Climactericus.' His posthumous works are 'Firmamentum Sobieskianum' (1690) and 'Prodromus Astronomiæ' (1691). He died at Danzig, universally respected, in 1687-8, and in his 76th year. During his lifetime he carried on an active correspondence with most of the learned men of Europe. The letters of his correspondents, and numerous observations, in seventeen folio volumes, were purchased of his family by M. Delille in 1725, and some of these were published by J. P. Kohlius in the supplement to the ninth volume of the 'Acta Eruditorum,' sect. viii., p. 359: the rest are at the Royal Observatory at Paris. His relation, J. E. Olhoff, published a considerable number of letters written to him in 1683.

Hevelius comes next to Flamsteed among the men of his day, as a diligent and accurate observer of the heavens. His 'Firmamentum Sobieskianum' is a standard catalogue of stars, containing the places of 950 stars known to the antients, 603 observed by himself, and 373 southern stars by Halley. For a full account of all his labours, see Delambre, *Hist. Astron. Mod.*, vol. ii., pp. 434-484; see also Weidler, *Hist. Astron.*, p. 485.

HEXACHORD (ἕξ, *six*, and χορδή, a *gut*, a *string*), a name given by the antient Greeks to a lyre of six strings; also to a scale of six sounds. In what is denominated the System of Guido, musical sounds are divided into three scales, named *Hexachords*. The first, from C to A, is called the *Natural* hexachord; the second, from G to E, the *Durum*; and the third, from F to D (the B flattened), the *Molle*. To the notes of each scale are assigned, as names, the syllables *ut, re, mi, fa, sol, la*. This most perplexing and irrational system, which has been well designated *Crux tenellorum ingeniorum*, is now utterly discarded.

HEXAGON, a figure of six sides. [REGULAR FIGURES.]

HEXAHEDRON, a solid of six faces. [CUBE; REGULAR SOLIDS.]

HEXA'METER (ἕξ, six, μέτρον, measure) is the most important form of dactylic verse. [DACTYLICS.] It consists of six feet, either dactyls or spondees, with no limit in their arrangements, except that the fifth is usually a dactyl, and the sixth invariably a spondee. Great part of the beauty of a long poem written in this measure depends on the varied cadences, which may be produced by varying the cæsura. [CÆSURA.] The most usual places are the middle of the third and the middle of the fourth foot: of these, the former is called by prosodians the *penthemimeral*; the latter, the *hephthemimeral cæsura*; as for example —

Vix e conspectu | Siculæ telluris in altum.
Non aliter quem qui adverso | vix flumine lembum.

That which is called the *bucolic* cæsura, at the end of the fourth foot, hardly seems to deserve special mention, being in no respect essential to the harmony of the verse, and invariably accompanied by one of the two before mentioned. These are essential; and one or other of them is always observed in well-constructed verse, except in rare cases where the omission is intentional, with a view to some special effect. For the niceties of the measure, see the treatise of Hermann, *De Metris*, lib. ii., 32.

HEXHAM. [NORTHUMBERLAND.]

HEYDEN, JOHN VAN DER, a very eminent Dutch painter, born at Gorcum in 1637 (some say 1640). He is one of the most admirable painters of external architecture of the Dutch, or indeed of any other school. His views of temples, palaces, churches, cities, and country-houses, are not only painted with incomparable precision and minuteness of detail, but this miniature-like finishing is combined with the most admirable keeping of the masses, the most striking effects of light and shade, and a clear and powerful tone. The value of his early works is enhanced by their being adorned with figures by A. Van der Velde, after whose death in 1672 Van der Heyden very successfully imitated his manner. His drawings, both in Indian ink and red chalk, are highly valued, as well as his admirable etchings. He died in 1712 at Amsterdam.

HEYLIN, PETER, born in 1600, at Burford, in Oxfordshire, studied at Oxford, where he took his degree of D.D. He gave lectures on history and cosmography in that university; and afterwards, in 1625, he published his 'Microcosmos,' or description of the globe, which met with great success, and was reprinted several times with alterations and additions. Heylin was appointed chaplain in ordinary to King Charles I., who presented him to several livings, of which he was afterwards deprived in the Rebellion, when his own property also was confiscated. On the restoration of Charles II. he was made sub-dean of Westminster, and he died in 1662. He wrote a number of works on the religious and political controversies of the times; among others a 'Defence of the Church of England;' a 'Life of Bishop Laud;' a 'History of the Tithes,' and a 'History of the Sabbath.'

HEYNE, CHR. GOTTLOB born at Chemnitz, in Saxony, in 1729, studied at Leipzig, and distinguished himself early as a classical scholar. The chair of eloquence and poetry in the university of Göttingen having become vacant by the death of J. M. Gesner, Heyne was appointed to it in 1763. From that time till his death Heyne was one of the most distinguished members of that learned institution, whose reputation he greatly contributed to uphold both by his lectures and by his publications. The department to which Heyne particularly applied himself was that of classical criticism and the illustration of the writings of the antients, by showing how they ought to be studied with reference to the manners and character of their respective ages. He published his ideas on these subjects in his notes to the 'Bibliotheca' of Apollodorus, and afterwards in numerous dissertations inserted in the Transactions of the University of Göttingen. His disciples M. Hermann, Voss, Manso, and others, have followed in the same path. Heyne's 'Opuscula Academica,' 6 vols. 8vo., Göttingen, 1785-1815, contain many learned and valuable disquisitions on antient history. Heyne published editions of Homer, Pindar, Diodorus Siculus, Epictetus, Virgil, Tibullus, &c., all enriched with ample commentaries. His 'Antiquärische Aufsätze,' in 2 vols., are essays on the history of antient art. As librarian to the university of Göttingen he introduced an excellent method of cataloguing the books of that extensive collection, which under his superintendence increased prodigiously both in number of works and value. (*Journal of Education*, vol ii.) Heyne died at Göttingen at a very advanced age, in July, 1814. His life, which has been written at some length by his son-in-law Heeren (Göttingen, 1813, 8vo.), contains an interesting account of the difficulties that this scholar had to encounter in early life.

HEYWOOD, THOMAS, was a well known dramatist who lived in the reigns of Elizabeth, James I., and Charles I., though, like many of his contemporaries, the dates of his birth and death are unknown. He has been compared to the Spaniard Lope de Vega for fertility, and in his preface to the 'English Travellers' has himself acknowledged that there are two hundred and twenty plays in which he had 'either an entire hand, or at least a main finger.' The practice of two or more authors uniting to form one play was very common among our old dramatists. Of all these pieces about twenty-four are left, of which 'A Woman killed with Kindness,' published in Dodsley's Collection, is much admired.

HIANS, Lacépède's name for the Grallatorial bird called the *open-beak* or *open-bill*, *Anastomus* of Illiger. [HERONS.]

HIATELLA. [PYLORIDEA.]

HIBERNIA. [IRELAND.]

HIBISCUS, a genus of plants of the natural family of Malvaceæ, so named from one of the Greek names (ἰβίσκος) of the Mallow. The species, upwards of 100 in number, of this genus, are chiefly herbaceous, though of a large size, but a few are perennial and arboreous. They abound in the hot parts of Asia and America, and also in Africa and the tropical islands; a few extend into Europe, North America, and to the Cape of Good Hope. *H. Trionum*, which occurs in Europe, is also found in Cashmere. The genus is characterized by having an exterior many-leaved calyx; carpels united into a five-celled capsule; valves with the partitions in their middle; cells many-seeded, or very rarely containing only a single seed. The species are remarkable, like the family to which they belong, for abounding in mucilage, and for the tenacity of the fibre of their bark, whence several are employed for many economical purposes in the different countries where they are indigenous.

The abundance of mucilage in some of the species renders them useful as articles of diet, as the unripe fruit of *H. esculentus*, the *okro* or *gombo* of the West Indies, which is employed both for thickening soup and as a vegetable; so in India *H. longifolius*, there called *ram turai*, is similarly employed, and much approved of by many Europeans, but objected to by others on account of its clamminess. The calyxes of *H. Sabdariffa* as they ripen become of a red colour and are pleasantly acid, whence in the West Indies the plant is called *red sorrel*. The calyxes are employed there, as well as in India, for making tarts; and a decoction of them, sweetened and fermented, is described in Browne's 'Jamaica' as a cool and refreshing drink, much used in many of the sugar islands. *H. syriacus* and *H. Rosa sinensis* are known as ornamental plants; the flowers of the latter are employed for blackening the eyebrows, as well as leather, both in India and China.

The species of Hibiscus are chiefly useful for the tenacity of their fibre, and hence several are employed in rope-making. Thus *H. cannabinus* is cultivated everywhere in India in the rainy season for this purpose; and its fibre is often imported into Europe as a substitute for hemp. It is known by the name *sun* in Northern India, *ambaree* in Western India, and *mesta pat* in Bengal. In the island of Otaheite rope and string are manufactured from the bark of *H. tiliaceus*, which is also made into matting of a white colour, and of different degrees of fineness. Forster states that the bark is also sucked as an article of diet, when the bread-fruit fails there: it is also so employed in New Caledonia. Indeed the mucilage which all these plants contain will no doubt afford some nourishment. In the West Indies, the whips with which the slaves are lashed are made from the fibres of *H. arboreus* (*mohoe* or *mohaul*). The bark of so many species of this genus being used for its tenacity, it is impossible to enumerate all. Dr. Roxburgh particularly recommends the cultivation in India of *H. strictus*, in consequence of its long, fine, and strong fibres, of a beautiful glossy white appearance, and as likely to be an advantageous substitute for such as are already cultivated for this purpose.

Hibiscus abelmoschus, so called from *hab-al-mooshk*, the Arabic name of its musk-scented seeds, is now often named *Abelmoschus moschatus*, and formed into a new genus. Its seeds are said to be added to coffee in Arabia, and are in India employed as a cordial medicine. The plant abounds in mucilage, and is employed in the process of clarifying.

HIBO'LITHUS, one of De Montfort's subdivisions of Belemnites.

HICKES, GEORGE, an eminent English divine and philologist, was born June 20th, 1642, at Newsham, in Yorkshire, where his parents were settled in a large farm. He was first sent to the grammar-school of North Allerton, and in 1659 to St. John's College, Oxford, whence he removed first to Magdalen College, afterwards to Magdalen Hall, and in 1664 was chosen Fellow of Lincoln College. In 1665 he became M.A., and was admitted into orders in 1666. In 1673 he travelled with Sir George Wheler in France. In 1676 he was made chaplain to the duke of Lauderdale, whom he accompanied in the following year to Edinburgh, when his grace was appointed high commissioner to the church of Scotland. In 1679 he was created D.D. at Oxford, having received the same degree the year previous from the University of Glasgow.

Between 1679 and 1683 he had several preferments, and in August of the latter year was made dean of Worcester. In 1688 he refused to take the oaths of allegiance, fell under suspension in 1689, and in the month of February following was deprived. He was subsequently consecrated suffragan bishop of Thetford by archbishop Sancroft. He died of the stone, Dec. 15, 1715.

Dr. Hickes was a man of general learning, deeply read in the fathers, and particularly skilful in the northern languages. His controversial pieces on politics and religion, especially those against popery, are very numerous, but for the most part forgotten. The work which goes by the name of his 'Thesaurus, or Treasure of the Northern Tongues,' in three volumes, folio, Oxford, 1705, is that which is most likely to sustain his literary reputation.

HI'ERAX. [FALCONIDÆ, vol. x., p. 180.]

HIE'RES. [HYERES.]

HIERO-FALCO, Cuvier's generic name for the Gyrfalcons.

HIE'ROCLES, the name of several Greeks:—

1. Hierocles, a rhetorician of Alabanda, in Caria, lived in the beginning of the first century before the Christian æra. He excelled in what Cicero termed the Asiatic stylo of eloquence. (*De Orat.*, ii. 23; *Brutus*, c. 95.)

2. Hierocles, a stoic philosopher, lived in the time of Hadrian, or perhaps later. (*Gell.*, ix. 5.)

3. Hierocles, a lawyer, wrote a work on veterinary medicine, addressed to Cassianus Bassus, of which three chapters are preserved in the 16th book of the 'Geoponica,' published by Needham, Camb., 1704, p. 424, 425.

4. Hierocles, who probably lived in the sixth century, was the author of a work entitled 'Synecdêmos' (συνέκδημος), that is, 'a travelling companion,' which gives an account of the provinces and towns of the Eastern empire. The 'Synecdêmos' is printed by Wesseling in his 'Vetera Romanorum Itinera,' Amst., 1735.

5. Hierocles, præfect of Bithynia, and afterwards of Alexandria, is said by Lactantius (*Inst. Divin.*, v. 2; *De Morte Persec*, c. 17), to have been the principal adviser of the persecution of the Christians in the reign of the emperor Diocletian. He also wrote two books against Christianity, entitled Λόγοι φιλαλήθεις πρὸς τοὺς χριστιανούς, 'truth-loving words to the Christians,' in which, according to Lactantius, 'he endeavoured to show that the sacred Scriptures overthrow themselves by the contradictions with which they abound; he particularly insisted upon several texts as inconsistent with each other; and indeed on so many, and so distinctly, that one might suspect he had sometime professed the religion which he now attempted to expose. He chiefly reviled Paul and Peter and the other disciples as propagators of falsehood. He said that Christ was banished by the Jews, and after that got together 900 men, and committed robbery. He endeavoured to overthrow Christ's miracles, though he did not deny the truth of them; and aimed to show that like things, or even greater, had been done by Apollonius.' (*Inst. Divin.*, v. 2, 3.)

6. Hierocles, a celebrated Alexandrine philosopher of the fifth century, wrote a Commentary upon the Golden Verses of Pythagoras, which is still extant; and also a Discourse on Foreknowledge and Fate, of which Photius has preserved large extracts. Stobæus has also preserved the fragments of several other works, which are ascribed to Hierocles. The Greek text of the Commentary on the Golden Verses of Pythagoras was first published by Curterius, Paris, 1583; reprinted at London, 1654; and has also been published at London, 1742, and Padua, 1744. The fragments of the Discourse on Foreknowledge and Fate, in which Hierocles attempts to reconcile the free-will of man with the foreknowledge of God, have been edited by Morell, Paris, 1593, 1597; and by Pearson, London, 1655, 1673; the latter edition contains the fragments of the other works of Hierocles. A complete edition of his works was published by Needham, Cambridge, 1709. The Discourse on Foreknowledge and Fate was translated into French by Regnaud (Lyon, 1560). Grotius translated part of this work into Latin in his 'Sententiæ Philosophorum de Fato,' Paris, 1624; Amst., 1648; reprinted in the 3rd vol. of his theological works, 1679. The Commentary on the Golden Verses has been translated into English by Hall, London, 1657; Norris, London, 1682; Rayner, Norw., 1797; and into French, by Dacier, Paris, 1706.

There is also another work, entitled Asteia (ἀστεῖα), which contains an account of the ridiculous actions and sayings of pedants, frequently printed with the editions of Hierocles; but it was probably written by another individual of the same name. This work is translated into English in the 'Gentleman's Magazine' for September, 1741.

HIEROGLYPHICS, a compound Greek word which means 'sacred engravings,' is the name given to the well-known figures of animals, plants, and other material objects sculptured on the Egyptian obelisks, temples, and other monuments, and which were used as a sort of ideographic writing among that people. The name 'hieroglyphics' has been also applied to other figures of a similar kind, used likewise for historical records on the monuments of the Mexicans and other nations. [AZTECS.] The earliest and simplest mode of recording events seems to have been that of picture-writing, that is to say, by a rude delineation of objects, such as that by which the Mexican scouts informed their master Montezuma of the arrival of Cortez and his band of followers, by sketching as faithfully as they could the appearance of the Spaniards, their ships, horses, and fire-arms. This however was only resorted to by the Mexicans on extraordinary occasions, in order to depict new objects. For ordinary purposes they had symbolical or conventional hieroglyphics to express historical events and other occurrences. As time passes on and events recur, and the relations of society increase, picture-writing becomes too cumbersome and inadequate a process for recording facts, and some method must be contrived for shortening and facilitating the task. This is effected at first perhaps by sketching only a part for the whole, such as a scaling-ladder for a siege, some flying arrows to indicate a battle, &c. The path of figurative imagery being once entered into, leads to symbols or tropical signs, in which one thing is put for another on account of some real or supposed resemblance between them: thus an eye with a sceptre underneath denotes the king or kingly power; a hawk's head surmounted by a disc represents the sun, &c. By a combination of such symbols an event may be recorded, and will present itself at once to the mind of the beholder who has the key of the system, without the assistance of words. In fact even to many of us Europeans who are in the constant habit of reading, the written or printed words often act upon our minds as hieroglyphics; the sight of a group of certain characters to which we have been long accustomed immediately conveys to our minds the idea expressed, without any reference to sound or alphabetical spelling. Herodotus and Diodorus say that the Egyptians had two kinds of written characters, Demotic and Sacred. The Rosetta inscription calls the common or vulgar character Enchorial. Clement of Alexandria, in a celebrated passage (*Stromata* v.) says that 'Those who are instructed among the Egyptians first of all learn that kind of Egyptian writing which is called epistolographic; next the hieratic, which the sacred registrars use, and last of all the hieroglyphic. Of the hieroglyphic there are two kinds, one of which expresses its meaning by the first elements, and the other is symbolic. Of the symbolic, one part expresses its meaning by imitation, a second part as it were tropically, and the third is purely allegorical, expressed by a kind of enigmas. Accordingly when they wish to represent the sun they make a circle; for the moon they make a crescent, the form of the object indicating the meaning. In the tropical mode of representation, following a certain analogy in the transfer and the change, they use the symbols, modifying some and in many ways altering others; consequently when they record the praises of their kings in sacred mythi, they express them in anaglyphs. Of the third or enigmatical mode of representation the following may serve as examples: they indicate the rest of the stars (planets), on account of the obliquity of their course, by serpents; but the sun is indicated by a beetle.' Clement gives no specimen of the first-mentioned sort of hieroglyphics, 'which expresses its meaning by the first element,' a phrase sufficiently obscure, but which is now generally supposed to refer to the phonetic use of the hieroglyphics. This phonetic system is a discovery of recent times. Zoega first suspected that some hieroglyphics might be expressive of sounds, and Dr. Young, having observed that certain groups of characters which were repeated in the enchorial text of the Rosetta inscription corresponded to the name of Ptolemaios in the Greek text, soon discovered corresponding groups of signs in the hieroglyphical text of the same inscription, enclosed in a kind of ring or cartouche. Dr. Young then endeavoured to fix the alphabetical or syllabic value of each sign, so as to produce the name of Ptolemaios. This was the beginning of the discovery of the phonetic use of hieroglyphics by the Egyptians, who, it was afterwards ascertained, wrote in this manner the names of foreign sovereigns, Persian, Greek, and Roman, who ruled over them in succession. It appears that they employed each hieroglyphic to express the initial letter of the spoken name by which the material object represented was known, and that by a series of such signs so employed they wrote the proper name which they wished to denote. The Chinese, whose characters are also ideographic, expressing objects and ideas, not sounds, use a somewhat similar contrivance when they wish to write a European proper name, but with them each character represents the entire syllable or sound which it expresses in ordinary use. Thus to write Maria or Maliya, as they pronounce it, the Chinese use three characters, the first of which means in their language 'jasper' and stands for *ma*, the second is the character which expresses profit, and it stands for *li*, and the third, which means 'second in rank,' stands for *ya*. For a further account of the phonetic hieroglyphics, and the respective merits of Dr. Young and Champollion in discovering them, and the extent and value of the actual discovery, see CHAMPOLLION and the authorities quoted there. Various hieroglyphics appear to have been used in different instances to express the same letter, a circumstance which increases the difficulty of deciphering the names written phonetically. There are, according to Champollion, 864 distinct hieroglyphical signs; Zoega reckons 958: of these the phonetic value of 134 only has been fixed, and one half of the 134 have only a conjectural value which has not been tried by a sufficient test. Besides this, the arrangement of the signs themselves is very capricious; sometimes they are ranged from right to left, sometimes up and down, at other-times they seem to be thrown pell-mell together. And then it must be remembered that in many instances we do not know the antient Egyptian name of the object which the hieroglyphic represents, and we cannot trust much to the word in the modern Coptic, which is a corrupt dialect mixed up with many foreign words. Still something has been done, and proper names of Persian, Ethiopian, Greek, and Roman rulers, besides those of native kings, have been traced on the monuments of Egypt by means of the phonetic interpretation. Whether the discovery will extend much further is a matter of doubt. We do not know (at least, we do not consider it proved) whether the Egyptians wrote other words phonetically besides proper names, and their language being in great measure lost, it is not very likely that we shall be able to solve the question.

The hieratic or sacerdotal character appears to have been a tachygraphy, or abridged form of the hieroglyphic signs, adopted for the sake of convenience and expedition, and used by the priests in their records.

The enchorial, or demotic, or epistolographic, appears to be a further abridgment of the hieratic. The signs, having lost nearly all trace of their original hieroglyphical form, have the appearance of a running alphabetical writing, and are written from right to left. The distinct characters of the enchorial writing appear hardly to exceed forty. Akerblad and Dr. Young have composed alphabets of them ('Rudiments of an Egyptian Dictionary, in the antient Enchorial character,' London, 1831, and article 'Hieroglyphics' in the last edition of the 'Encyclopædia Britannica.') Whether the enchorial was used entirely alphabetically is perhaps a question. We are told however by Plato, that Thoth, an Egyptian, invented the alphabet, and this may refer either to the phonetic use of the hieroglyphics, or to the enchorial characters which may have been derived from the hieroglyphics themselves. The writer of an article on the enchorial language of Egypt, in No. 3 of the 'Dublin University Review,' contends that the enchorial was a distinct language from that expressed by the hieroglyphics, and that both are different from the Coptic. (See varieties of hieratic and enchorial characters in *Hieroglyphics, collected by the Egyptian Society and arranged by Dr. Young*, fol., London, 1823, where, by comparing the enchorial writing found on fragments of earthenware at Elephantine, plates 53, 54, and 55, with the enchorial inscriptions from Sakkara, plates 74, 75, and 76, we perceive the gradations through which the enchorial character dwindled into a running and almost indistinct hand. See Robiano, *Etudes sur l'Ecriture, les Hiéroglyphes, et la Langue de l'Egypte*, Paris, 1834; and Young, *Account of some recent Discoveries in Hieroglyphical Literature and Egyptian Antiquities*, London, 1823, containing translations of corresponding Greek and Enchorial MSS. on papyrus.)

HI'ERON I., succeeded his brother Gelon, as tyrant or ruler of Syracuse, 478 B.C. He committed many acts of violence, encouraged spies, and kept a mercenary guard about his person. He was ambitious of extending his dominion, and his attempts proved successful. After the death of Theron, prince of Agrigentum, Hieron defeated his son Thrasydæus, who was soon after expelled by his countrymen. Hieron took Naxus and Catana, and having driven away the inhabitants from both towns, he replaced them by Syracusan and Peloponnesian colonists. He changed the name of Catana into that of Ætna, and he himself assumed the name of Ætnæus. Having joined his fleet to that of the people of Cumæ, he succeeded in clearing the Tyrrhenian sea of the Etruscan and other pirates which infested it. His chariots repeatedly won the prize at the Olympic games, and his success on those occasions formed the theme of some of the odes of Pindar, who was his guest and friend. Æschylus, Simonides, Bacchylides, and Epicharmus, were also well received at the court of Hieron, who was fond of the society of learned men. Hieron died at Catana, 467 B.C., and was succeeded by his brother Thrasybulus, who had all his faults, without any of his good qualities, and was at last driven away by the Syracusans, who restored the government of the Commonwealth. (Diodorus, xi. 48-66.) Ælianus (ix. 1) gives Hieron credit for a much better character than Diodorus; probably the latter part of his reign, after he had firmly established his authority, was better than the beginning.

Coin of Hieron I.

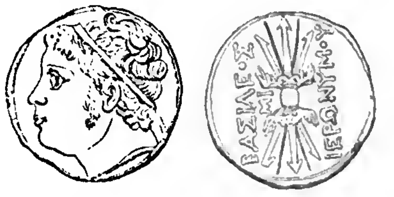
British Museum. Actual Size. Silver. Weight, 428¼ grains.

HIERON II., son of Hierocles, a wealthy citizen of Syracuse, and a descendant of Gelon, distinguished himself in early youth by his brilliant qualities; and he served with distinction under Pyrrhus in his Sicilian campaigns. After Pyrrhus had suddenly abandoned Sicily, the Syracusans found themselves threatened on one side by the Carthaginians, and on the other by the Mamertines, a band of Campanian mercenaries, who had treacherously taken possession of Messana. The Syracusan troops, being in want of a trusty leader, chose Hieron by acclamation, and the senate and citizens, after some demur, ratified the choice, 275 B.C. By marrying the daughter of Leptines, a man of influence among the aristocratic party, he secured their support. Having led the army against the Mamertines, he divided it into two bodies, in the foremost of which he placed the mercenaries in the pay of Syracuse, who had of late shown a mutinous disposition, and ordered them to begin the attack. They did so, but were overpowered by superior numbers; and Hieron, instead of supporting them with his Syracusan soldiers, withdrew, and left them to be slaughtered by the Mamertines. He then recruited his army among his own countrymen, and having deceived the Mamertines, who were waiting for him at the pass of Tauromenium, he marched round the western base of Ætna, attacked and took Tyndaris, Abacænum, Mylæ, and other towns, before the main body of the enemy could come to their relief, and lastly defeated the main body itself in a pitched battle on the banks of the river Longanus. He was on the point of attacking Messana, when the Carthaginian commander in Sicily, who was then in the island of Lipara, came to offer his mediation, but in fact for the purpose of introducing a Carthaginian garrison into Messana. In this object he succeeded, having deceived both parties; and Hieron, unwilling to bring on himself the whole might of Carthage, returned to Syracuse, where, through the influence of Leptines, he was proclaimed king, B.C. 270. Shortly after, the Mamertines at Messana quarrelled with the Carthaginians and drove them out of the citadel, upon which the Carthaginians invited Hieron to join his forces to theirs, in order to drive the Mamertines out of Sicily. Hieron having assented, encamped himself under the walls of Messana on one side, and the Carthaginians fixed their camp on the other, whilst their squadron guarded the strait. The Mamertines meantime had applied to the Romans for assistance, claiming a common origin with them as being descended from Mars, called Mamertus in the Oscan language; and Rome eagerly seized this opportunity of obtaining a footing in Sicily. The consul Appius Claudius marched to Rhegium, and having contrived to pass the strait in the night, unobserved by the Carthaginian cruisers, he surprised Hieron's camp, routed the soldiers, and obliged Hieron to seek for safety in flight. The consul next attacked the Carthaginian camp with the same success, and this was the beginning of the first Punic war, 264 or 265 B.C. In the following year the Romans took Tauromenium and Catana, and advanced to the walls of Syracuse, when Hieron sued for peace, which he obtained on condition of paying 100 talents of silver and supplying the Roman army with provisions. He punctually fulfilled his engagement, remaining faithful to Rome during the whole of the war, and by his supplies was of great service to the Roman armies, especially during the long sieges of Agrigentum and Lilybœum. Hiero was included in the peace between Rome and Carthage, by which his territories were secured to him, and he remained in friendship with both states. He even assisted Carthage at a very critical moment by sending her supplies of provisions during the war which she had to sustain against the disbanded mercenaries. The period of peace which elapsed between the end of the first and the beginning of the second Punic wars, from 241 to 218 B.C., was most glorious for Hieron and most prosperous for Syracuse. Commerce and agriculture flourished, and wealth and population increased to an extraordinary degree. Hieron paid particular attention to the administration of the finances, and issued wise regulations for the collection of the tithe or tax upon land, which remained in force throughout Sicily long after this time, and are mentioned with praise as the Lex Hieronica by Cicero (ii. and iii. *in Verrem*). Hieron introduced the custom of letting the tax to farm every year by auction. He embellished and strengthened Syracuse, and built large ships, one of which, if we are to trust the account given of it by Athenæus, (v. 40,) was of most extraordinary dimensions and magnificence. This ship he sent as a present to Ptolemæus Philadelphus. Archimedes lived under Hieron's reign. When the second Punic war broke out, Hieron continued true to his Roman alliance, and after the Trasymenian defeat he sent a fleet to Ostia with provisions and other gifts, and a body of light troops to the assistance of Rome. He lived to see the battle of Cannæ, after which his own son Gelon embraced the part of the Carthaginians. Gelon however died, not without suspicion of violence, and Hieron himself, being past 90 years of age, died shortly after, 216 B.C., leaving the crown to his grandson Hieronymus. With Hieron the prosperity and independence of Syracuse may be said to have expired. (Livy, xxii. and xxiii.; Polybius, vii.)

Coin of Hieron II.

British Museum. Actual Size. Copper. Weight, 282¼ grains.

HIERO'NYMUS, grandson of Hieron II., king of Syracuse, succeeded him on the throne at the age of fifteen (B.C. 216), and under the guardianship of several tutors, among whom was Andronorus, his aunt's husband, who, seconded by other courtiers, and in order to monopolize the confidence of the young king, indulged him in all his caprices and follies. The court of Syracuse, which under Hieron was orderly and respectable, soon became as profligate as it had been under the younger Dionysius. Andronorus persuaded Hieronymus, against the dying injunctions of his grandfather, to forsake tho Roman alliance for that of Carthage, and messengers for that purpose were sent to Hannibal in Italy, and also to the senate of Carthage, which gladly agreed to an alliance with Syracuse, in order to effect a diversion against the Romans. The Prætor Appius Claudius, who governed that part of Sicily which the Romans had taken from the Carthaginians, sent messengers to Hieronymus to exhort him not to forget the old friendship existing between Rome and Syracuse. The messengers were received contemptuously, and the young king sneeringly asked them for some details concerning the battle of Cannæ, which had occurred not long before. War being at last declared by Rome, Hieronymus took the field with 15,000 men: but a conspiracy broke out among his soldiers, and he was murdered, after a reign of only thirteen months. On this news a popular insurrection took place at Syracuse, the daughters and grand-daughters of Hieron were murdered, and royalty was abolished. But the people were distracted by factions and by the mercenaries in their pay, and revolution succeeded revolution until two adventurers of Syracusan extraction, but natives of Carthage, who had been sent by Hannibal to keep in countenance the Carthaginian party in Syracuse, became possessed of the chiof power, and so provoked tho Roman Consul Marcellus, that ho laid siege to Syracuse.



Coin of Hieronymus.
British Museum. Actual Size. Silver. Weight, 125½ grains.

HIERO'NYMUS, a native of Cardia, or Cardiapolis, a town in the Chersonese of Thrace, lived in the times of the immediate successors of Alexander. He wrote a work entitled 'Historical Memoirs' concerning the successors of Alexander the Great and the wars which followed the death of that conqueror, which is mentioned by Suidas, and also by Dionysius of Halicarnassus in the preface to his history. The work of Hieronymus is unfortunately lost. Diodorus appears to have made use of it in several parts of his work. Gerrard Vossius (*De Historicis Græcis*, b. 1, ch. xi.) distinguishes Hieronymus of Cardia both from Hieronymus of Rhodes, a disciple of Aristotle, and from Hieronymus the Egyptian, who was governor of Syria under Antiochus Soter, and who wrote a history of Phœnicia, quoted by Josephus, *Antiqu. Jud.*, b. 1. (See also *Recherches sur la Vie et les Ouvrages de Jerôme de Cardie*, par l'Abbé Sevin, in the *Mémoires de l'Académie des Inscriptions et Belles-Lettres*, vol. xiii.)

HIGDEN, RANULPH, or RALPH, author of the Polychronicon,' was a Benedictine monk of St. Werburgh's monastery in Chester, where he died at a great age, after having lived in the convent sixty-four years; according to Bale, in 1367; according to Pits, in 1373. Dibdin, in his edition of Herbert's 'Ames,' and Chalmers, in his Biographical Dictionary,' say Higden died about 1360. Gale published a portion of Higden's original work in the 'Scriptores,' xv., fol., Oxford, 1691. John de Trevisa's translation of the 'Polychronicon' was printed by Caxton in folio, in 1482, in seven books, to which Caxton added an eighth. The Chester Mysteries, exhibited in that city in 1328, at the expense of the several trading corporations, have been ascribed to Higden. That a monk of the name of Randle, or Ranulph, contemporary with Higden, had some concern in them, there seems no doubt. It is not quite so clear that Higden was himself the person. (See Tanner, *Bibl. Brit. Hib.*, p. 403; *Pref.* to Markland's *Chester Mysteries.*)

HIGGINS, or HIGINS, JOHN, was born about 1544, according to the author of a note in a late edition of 'The Mirror for Magistrates.' He was educated at Oxford, but whether he took a degree is uncertain. He was one of the contributors to the book above mentioned, to which he supplied forty legends, relating mostly to the mythical history of England. In one of the 'envoys' he tell us that he did not 'take the pain to learn tho tongues and write' until he was twenty; that French and Latin were his chief studies, and that he published his part of the 'Mirror for Magistrates' when thirty. One stanza from the introduction will give a fair specimen of his manner, and at the same time supply information on the nature of the poem. He tells us that he bought the hook to which he was then employed in making additions, and goes on to enumerate those who were celebrated therein:

> ——Some perdy were kings of high estate,
> And some were dukes and came of regal race;
> Some princes, lords, and judges great, that sate
> In council still, decreeing every case.
> Some other, knights, that vices did embrace;
> Some gentlemen; some poor exalted high;
> Yet every one had played his tragedy.'

The 'Mirror for Magistrates' went through many editions from its first appearance as Lidgate's 'Fall of Princes' to its latest shape in the impression of 1610. Its importance has, we think, been little seen; but the very evident application of many of the stories (such, for instance, as that of James I. of Scotland) must have had its effect in the sixteenth and seventeenth centuries. (Wood's *Ath. Oxon.*; *Mirror for Magistrates*, edition of 1815.)

HIGHGATE. [MIDDLESEX.]

HIGHWAY. [WAY.]

HILA'RION, SAINT, the founder of monastic institutions in Palestine, was born at Tabatha, near Gaza, about A.D. 291. His parents, who were heathens, sent him at an early age to Alexandria to pursue his studies, where he made great progress in philosophy and literature. Having been converted to the Christian religion, he resolved, in imitation of Antonius, with whom he had spent two months in the deserts of Egypt, to retire from the world. Accordingly, on his return to Palestine, he divided among his relatives the property which his parents had left him, and retreated at the age of fifteen to the desert country south of Gaza. After remaining in this place for twenty-two years, during which time he practised the greatest austerities, his reputation for sanctity became so great, that numbers of people resorted to him in order to be cured of their diseases. According to Jeromo, Hilarion performed the greatest miracles, and 'was so full of the power of the Holy Ghost as to be able to discover from the smell of the bodies and the clothes of men, or of anything else they had but touched, to what particular dæmon or to what vice they were severally subject.' Hilarion afterwards went to Egypt, and successively visited Sicily, Dalmatia, and Cyprus, where he died about the year 371. We are informed by Jerome, that 'by the influence of Hilarion's example innumerable monasteries began to be founded through all Palestine.'

The life of Hilarion has been written by Jerome, and is printed in vol. iv., part ii., pp. 74-90, of the Benedictine edition of his works.

HILA'RIUS, a native of Sardinia, was made deacon of Romo about A.D. 354. He is frequently mentioned by Jerome (*Adv. Lucif.*) as a rigid Luciferian, a sect which derived its namo from Lucifer, bishop of Cagliari, in Sardinia, who separated from the church on account of the absolution that had been granted to those Catholics who had become Arians during the reign of Constantius. Hilarius wrote several works in favour of the opinions of Lucifer; in which he maintained, among other things, that Arians and all other heretics ought to be baptized again when they were converted to the orthodox faith.

Hilarius is generally supposed to have been the author of a Commentary on thirteen of St. Paul's Epistles, which is usually printed with the works of St. Ambrose; and also, though this is more doubtful, of 'Quæstiones in Vetus et Novum Testamentum,' usually joined with St. Augustine's works. The Benedictine editors of St. Ambrose inform us that the MSS. of the Commentary on St. Paul's Epistles differ considerably, and that in some parts there appear to be interpolations of long passages. This commentary is said by Du Pin to be 'clear, plain, and literal, and to give the meaning of the text of St. Paul well enough; but it gives very different explanations from St. Augustine in those places which concern predestination, provocation, grace, and free-will.'

(Lardner's *Credibility, Works*, vol. iv., p. 381-385; Du Pin's *Ecclesiastical History*, vol. ii., p. 189-190, Engl. Trans.)

HILA'RIUS, SAINT, was born at Poitiers, of which place he was afterwards made bishop about A.D. 354. He is distinguished in ecclesiastical history by the active part which he took against the Arians during the reign of Constantius. He was banished by this emperor to Phrygia, shortly after he had been elected bishop of Poitiers, on account of his defence of Athanasius, in the council of Béziers, against Saturninus, bishop of Arles. In the East he continued his exertions in favour of the Catholic faith. In 359 he attended the council of Seleucia in Isauria, which had been summoned by order of Constantius, and boldly defended the doctrine of the Trinity against the Arian bishops, who formed the majority of the council. He afterwards followed the deputies of the council to the emperor's court, and presented a petition to Constantius, in which he desired permission to dispute publicly with the Arians in the emperor's presence. In order to get rid of so formidable an opponent, the Arians, it is said, induced the emperor to send him away from the court. But previous to his departure, Hilarius wrote an invective against Constantius, in which he denounced him as Anti-Christ, and described him as a person who had only professed Christianity in order that he might deny Christ. After the Catholic bishops had recovered their liberty under Julian, Hilarius assembled several councils in Gaul for the re-establishment of the Catholic faith and the condemnation of Arian bishops. He also travelled into Italy for the same purpose, and used every exertion to purify the churches of that country from all Arian heresies. When Auxentius was appointed bishop of Milan by the Emperor Valentinian, in 364, Hilarius presented a petition to the emperor, in which he denounced Auxentius as a heretic. Though this charge was denied by Auxentius, Hilarius still continued his attacks upon his orthodoxy, and created so much confusion in the city that he was at length ordered to retire to his own diocese, where he died shortly afterwards, in the year 367.

The most important of Hilarius's works are:—1, 'Twelve Books concerning the Trinity;' 2, 'A Treatise on Synods,' addressed to the bishops of France and Britain, in which he gives an account of the creeds which had been adopted by the Eastern churches since the council of Nice; 3, 'Three Discourses addressed to Constantins,' on the Arian Controversy; 4, 'A Commentary on St. Matthew;' 5, 'A Commentary on the Psalms.' These commentaries are entirely taken from the commentaries of St. Augustin. 6, 'A Book of Fragments,' which contains extracts from several of the last works of Hilarius.

The writings of Hilarius are very obscure, and often unintelligible, which is principally owing to his fondness for antithesis and metaphorical expressions, and to the length and intricacy of his periods. Though he was very severe in condemning the erroneous opinions of others, he differed in many particulars from the doctrines of the Catholic church. He maintained, among other things, that Christ experienced no pain at his crucifixion, and that the souls of men are material.

The works of Hilarius have been published by Miræus, Paris, 1544; Erasmus, Bas., 1523, reprinted 1526, 1535, 1550, 1570; Gillot, Paris, 1572; reprinted with several improvements, 1605, 1631, 1652; by the Benedictines, Paris, 1693; the Marquis de Maffei, Verona, 1730; and Oberthür, 4 vols. 8vo., 1781-88.

(Du Pin's *Ecclesiastical History*, vol. ii., p. 64-79, Eng. Transl.; Lardner's *Credibility, Works*, vol. iv., p. 178, 179.)

HILA'RIUS, SAINT, was born A.D. 401, and became bishop of Arelate (Arles) in 429, on the death of Honoratus, who had been the means of converting him to Christianity. Hilarius was distinguished by the holiness of his life and his zeal for monastic institutions; but he is more known in ecclesiastical history on account of his controversy with Leo, bishop of Rome. Celidonius, bishop of Vesontio (Besançon), who had been deposed from his office by a council, at which Hilarius had presided, appealed to Leo against this decision. Leo gladly availed himself of this opportunity of extending the power of the Roman see, and accordingly reinstated Celidonius in his bishopric. Hilarius strongly opposed the decision of Leo; but his opposition only drew upon him the enmity of the Roman bishop, who soon found an opportunity of depriving Hilarius of the bishopric of Arelate. Several of the Gallic bishops, whom he had offended by the severity with which he had enforced the discipline of the church, accused him of various ecclesiastical offences; and Leo accordingly, supported by a rescript of the Emperor Valentinian III., deposed Hilarius from the exercise of his episcopal duties. Hilarius however still continued to possess great influence in his diocese, in which he died in 449.

Hilarius was highly esteemed by all his contemporaries; even Leo, after his death, declared that he was an upright and pious man. (*Epistles of Leo*, 106.) The writings of Hilarius are lost, with the exception of a life of Honoratus, a letter to Eucherius, and a poem upon the beginning of Genesis; which are published by Quesnel at the end of Leo's works, Paris, 1675. His life of Honoratus has also been published by Genebrard, Paris, 1578.

HILARIUS, a native of Sardinia, succeeded Leo I., or the Great, as bishop of Rome in the year 462. He had been employed by Leo in important affairs; among others he was sent as legate to the council of Ephesus, A.D. 449, against the Eutychians, and was well versed in matters concerning the discipline of the church, which he displayed great zeal in enforcing. He interfered in the election and consecration of bishops by their metropolitans in France and Spain, and he justified his interference by alleging the preeminence of the see of Rome over all the sees of the West, a preeminence which he however acknowledged, in one of his letters, to be derived from the Emperor's favour. He also forbade bishops nominating their successors, a practice which was then frequent. He however did not declare elections or nominations to be illegal merely from his own authority, but assembled a council to decide on those questions. Hilarius died at Rome, A.D. 467, and was succeeded by Simplicius.

HILDBURGHAUSEN. [SAXE MEININGEN.]

HILDESHEIM, a principality in the kingdom of Hanover, forming part of the province of the same name. It lies between 51° 44′ and 52° 25′ N. lat., and is bounded on the north by Calenberg and Lüneburg, on the east by Brunswick, on the south by Göttingen and Brunswick, and on the west by Calenberg. Its area is about 680 square miles, and its population, which in 1812 was 128,938, is now 155,014, of whom 30,000 are Roman Catholics, 167 Calvinists, and 1000 Jews: the remainder are Lutherans. In the south the surface is traversed by branches of the Harz. The soil is stony and not generally fertile. In the centre and north the surface is undulating, and the soil rich and fertile. The principal rivers are the Innerste, Leine, Ocker, Ecker, and Fuse. The climate is healthy. The agricultural products are corn, garden vegetables, fruit, flax, hops, and timber: the mineral products are iron, coal, and salt. The trade is very considerable. The exports consist of the natural productions, and of some manufactures, chiefly linen, which is the principal manufacture of the principality. The exports amount to about four millions of dollars annually; the imports to three millions.

Hildesheim was formerly a bishopric, founded in 822 by Louis the Pious. The diocese was enlarged by several successive bishops; but in 1519 the bishop engaging in an unsuccessful contest with the duke of Brunswick was placed under the ban of the empire, and stripped of a great part of his territories; and it was not till 1643 that a considerable portion of them was restored. As all the towns and most of the nobles had embraced the Protestant religion, and the bishopric remained Roman Catholic, the religious liberty of the subjects was guaranteed by several compacts. After the treaty of Luneville, the king of Prussia took possession of Hildesheim and Goslar in 1802, giving a pension to the bishop. In 1807 the principality was incorporated with the kingdom of Westphalia, and in 1813, by a convention with Prussia, was annexed to Hanover, to which it was confirmed by the congress of Vienna, 1815. The principality has 660 schools, in which 46,211 children are educated.

HILDESHEIM, the capital of the principality, situated in 52° 9′ 31″ N. lat. and 9° 55′ 38″ E. long., is a place of considerable extent, and, like most of the antient German cities, very irregularly built. It is divided into the old and the new towns. There are seven gates; but the antient ramparts have been levelled and converted into public walks. The city is situated at the foot of the Gallaberg, near the Innerste, in which river there is a beautiful island converted into gardens. The inhabitants, 13,100 in number, are mostly Lutherans; but many, with the bishop, are Roman Catholics. The principal public buildings and institutions are, a palace, 4 Roman Catholic and 8 Lutheran churches, 12 Roman Catholic and 8 Protestant hospitals, 3 orphan houses, a convent (7 others have been secularized), a synagogue, a

Roman Catholic and a Protestant consistory, a Lutheran gymnasium, with a good library, schools of industry, and an admirably-regulated poorhouse, where nearly 600 children receive gratuitous education, beggars are employed, the sick nursed, &c. The cathedral, founded in 818 by Louis tho Pious, has 10 altars, very fine paintings on glass, magnificent iron doors covered with bas-reliefs, and numerous antiquities, among which is the celebrated pillar, erroneously called the Irmensäule, a hollow cylindrical pillar of greenish marble sixteen feet high, which now bears an image of the Virgin Mary.

HILL, AARON, was born at Beaufort Buildings, in the Strand, 1684-5, and having been deprived of an extensive family estate by his father's imprudence, was left dependent on his mother and grandmother. He was educated at Westminster school, and in his sixteenth year went to Constantinople with the design of visiting the English ambassador, Lord Paget, who was a relation of his mother's. The nobleman received him kindly, and provided him with a tutor, with whom he travelled through a great part of the East. Having subsequently lost his kinsman's favour, he was engaged by Sir William Wentworth, of Yorkshire, as his travelling companion through Europe. On his return he wrote in 1709 a History of the Ottoman Empire, compiled from materials collected at the Turkish court, and about the same time was made 'master' of Drury Lane Theatre. At this time he wrote his first tragedy of 'Elfrida.' He started several commercial projects with indifferent success, and in 1738 withdrew to Plaistow, in Essex, where he devoted himself to study. Here he translated Voltaire's tragedy of 'Merope,' and lived just long enough to see it produced. He died in 1749-50.

Aaron Hill wrote about fifteen pieces, of which only two are now remembered, 'Alzira,' and 'Zara,' both of which are adaptations from Voltaire. The English national feeling is so entirely averse to tragedies on the French model, that although such attempts may obtain a transient reputation from adventitious circumstances, there is little chance, when they are once forgotten, of their ever being recalled from oblivion.

HILL, SIR JOHN, was born about 1716, and began life as apprentice to an apothecary in London, in which capacity he gained that knowledge of botany which is his only claim to honourable notice: though being possessed of lively parts, industry, and impudence, he managed to obtain in his lifetime no little notoriety. He pushed his way into fashionable life; published a fashionable and scandalous newspaper called the 'Inspector;' made, puffed, and sold quack medicines; and yet found time to compose a great number of works, many very voluminous, principally on botanical subjects. He was very desirous to obtain admission into the Royal Society; but being rejected, on account of his equivocal character, he published in revenge a 'Review of the Works of the Royal Society,' 4to. 1751, in ridicule of that body, which sealed his exclusion from it for ever. No doubt subjects enough for satire might be found in their voluminous Transactions; but the Review is said to have shown as much unfairness as ingenuity, and no little of both. Hill obtained a Scotch diploma of medicine, and assumed the titlo of Sir John in virtue of a Swedish order of knighthood presented to him by the king of Sweden in exchange for a present of his botanical publications. He died in 1775. The following are some of his most considerable works:—'History of the Materia Medica,' 4to., 1751; 'General Natural History,' 1748-52, 3 vols. fol.; 'British Herbal,' 1756, fol.; 'Vegetable System,' 1759-75, 26 vols. fol., a magnificent book, containing 1600 plates, published at 38 guineas plain, and 160 coloured; 'Constitution of Timber from its Early Growth,' fol., 1770, a work highly praised by Haller. (Watt, *Bibl. Britann.*; and a *Short Account of the Life, &c., of Sir J. Hill*, Edinb., 1779.)

HILLAH. [BABYLON.]

HILLEL, one of the most celebrated of the Jewish Rabbis, was descended on his mother's side from king David; but his father belonged to tho tribe of Benjamin. His birth is placed by Bartolocci (*Biblioth. Rabinic.*, vol. ii., p. 784) in A.M. 3648 (B.C. 112), which agrees with tho account of Jerome, who says that he lived shortly before the birth of Christ. According to Jewish tradition he was born in Babylon. At the age of forty he came to Jerusalem, where he applied himself to the study of the law, and became so eminent for his sanctity and knowledge that he was appointed president of the Sanhedrim at the age of eighty. He continued to discharge his duties as president for forty years; and died at the advanced age of 120.

Hillel is not mentioned by Josephus; but it has been supposed that he must have been the same as Pollio, or the high-priest Hananeel.

The disciples of Hillel were very numerous, amounting, according to tradition, to a thousand, of whom one of the most eminent was Jonathan Ben Uzziel, the author of the Chaldee paraphrase upon the prophets. The decisions of Hillel on several points in the Jewish law differed from those of Shammai, vice-president of the Sanhedrim; and the disciples of each frequently disturbed the peace of Jerusalem by their divisions and quarrels. Hillel's party at length prevailed, in consequence it is said of a *bath kol*, that is, a voice pretended to come from heaven. The decisions of Hillel are supposed to have been the ground-work of the Mishna.

Another rabbi of the name of Hillel, the son of Rabbi Juda Nasi, and a descendant of Hillel, of whom we have spoken above, who lived in the fourth century of the Christian æra, is said to have established the present calendar of tho Jewish year.

HIMA'LAYA, or HIMMA'LEH MOUNTAINS, extend along the north-eastern boundary of Hindustan and constitute likewise the northern boundary of the valley of Asam. They are situated between 27° and 35° N. lat. and 73° and 98° E. long. The most western portion (between 73° and 88° E. long.) lies in a general direction from north-west to south-east, forming a slightly curved line, so that the north-western extremity runs north-north-west and the south-eastern nearly due east. The eastern portion (between 88° and 98° E. long.) runs west and east. In the first direction the range extends more than 900 miles, and in the last about 600; its whole length is 1500 miles. Its breadth, as far as it is known, varies between 80 and 120 miles. The whole range may therefore occupy a surface of 150,000 square miles and upwards.

This extensive mountain-range lies between two plains, a low and level one, which is drained by the Ganges and the Brahmapootra, and extends along its south-western and southern declivity, and the elevated and partly hilly table-land of Tibet, which lies to the north-east and north of the range. The plain of the Ganges and Brahmapootra, at its southern extremity, is little elevated above the sea, and where it is farthest from the shore its elevation does not much exceed 1000 feet. The table-land of Tibet, as far as it is known, rises to the elevation of 10,000 feet and more. The Himalaya Mountains may therefore be considered as an extensive slope, by which the elevated table-land of Tibet descends to the low plain of the Ganges. But as in most cases where two plains of different elevations lie near one another, the descent by which the higher sinks down to the level of the lower is partly occupied by a mountain-range running along the border of the more elevated plain, so the Himalaya Mountains rise far above the level of the table-land of Tibet, and where they are contiguous to it they constitute an uninterrupted range, covered with snow in its whole extent, with the exception of a few mountain-passes, which are partly free from snow during the hottest months. They terminate on the plain of the Ganges, in a wall-like range from 4000 to 5000 feet high, which however is frequently broken by gaps through which the rivers escape that carry off the water collected in the interior of the mountain-region. This interior tract between the two border-ranges varies considerably in the form of its surface in different parts.

The most north-western extremity of the Himalaya is separated from the extensive mountain-region of Eastern Persia, which from its highest mountain-range has obtained the name of Hindu Coosh, by the narrow valley of the Indus. This valley has not been visited by Europeans, and nothing is known of the course of the Indus through it, except that it is probably more than 60 miles in length. We know however that a high snow-topped rango protrudes into the most northern bend of the river, and skirts its banks as far south as the neighbourhood of Attock. This range, called the Gosseie Mountains, constitutes therefore the most north-western extremity of the Himalaya.

The river Sutlej, an affluent of the Indus, originates on the table-land of Tibet, and traverses the Himalaya between 31° and 32° N. lat. in its winding course from east to west. That portion of the mountains which lies between the val leys of the Indus and Sutlej forms towards the table-land of Tibet, so far as is known, one uninterrupted range; its northern portion, which encloses the valley of Cashmire on the north-east, is called by the natives of that country Tibet Panjahl; the southern, between the upper course of the Chinab and the Sechoo, bears the name of the Paralasa Mountains. At the point of junction of these two ranges (between 33° 30′ and 33° 40′ N. lat.) are its highest summits, the Mer and Ser, which rise considerably above the snow-covered range, but their elevation has not been determined. From this elevated range, the mountain-region spreads south-west about 80 miles, and is formed of several ranges parallel to the principal range, but at unequal distances from one another, so that the valleys which are enclosed by them are of different widths. Though the ranges themselves are not covered with snow in all their extent, they contain several summits which rise far above the snow-line. These ranges are not continuous, but several breaks of considerable extent occur between them. The valleys which lie between the ranges are probably between 5000 and 7000 feet above the sea. The best known is the valley of Cashmire, which is nearly enclosed by snow-covered mountains, on the north-east by the Tibet Panjahl range, and on the south-west by the Peer Panjahl Mountains.

Twelve mountain-passes connect the valley of Cashmire with the adjacent countries, among which the four following are the most frequented:—1, the Kandrihall Pass over the Tibet Panjahl range (near 34° 20′ N. lat.) to Leh, or Ladak, on the table-land of Tibet; 2, the Sagam Pass, from Islamabad in Cashmire to Kishtewar and Jummû on the Chinab; 3, the Barramulla Pass, traversing the Peer Panjahl range by Canhorn to Prunch; and 4, the Barramulla Pass, running along the course of the river Jhilum to Mozufferabad and Attock. The passes which traverse the Paralasa Mountains are little known, except the Para Laha Pass, which traverses the mountains between 32° and 33° N. lat., and leads from the valley of the Upper Chinab to Leh.

We know very little of the mineral wealth of this range, except that at its western extremity, where the offsets of the Gosseie Mountains approach the Indus south of Attock, extensive layers of rock-salt occur, which are worked to a great extent. As to the other natural riches of this portion of the Himalaya, Cashmire may perhaps be considered as offering the most favourable specimen. [Cashmire.] The whole of this part of the range is now subject to Maharaja Runjit Sing, the raja of Lahore.

We pass to the central part of the Himalaya, or that which extends between the valley of the Sutlej and Bootan (from 77° to 88° E. long.). Here the mountain region is about 100 miles across, and is not composed of parallel ranges, but enormous mountain-masses protrude from the principal range nearly to the middle of the mountain-region. These masses, which are of great extent and elevation, contain between them only a few transverse narrow valleys, which, when compared with the height and extent of the surrounding mountains, may appropriately be called ravines. Such protruding masses are the Moral-ka-kanda Mountains between the valley of the Sutlej and the upper branches of the Jumna, which exhibit numerous peaks rising to between 18,000 and 20,000 feet above the sea; the Mandjri Mountains, with their extensive snow-field, between the Supin, a tributary of the Jumna, and the last mentioned river; the Uncha-ka-Dunda Mountains between the Jumna and the Bhaghiratee, the principal branch of the Ganges. Farther east lie the mountain-masses of Jaunli and of the Panch-Kedar, which with their extensive snow-fields and numerous peaks, several of which rise to more than 20,000 feet, fill up the country between the two principal branches of the Ganges, the Bhaghirateo and the Alakananda. Between the last mentioned river and the upper branches of the Kali and Gogra, the most southern elevated mass is called the Tri Sula Mountains. It is overtopped by several peaks rising to more than 20,000 and 21,000 feet, and contiguous to it on the north is the great mass of the Jawahir, which in its most elevated summit rises to 24,238 feet, and is surrounded by other peaks not much inferior in elevation. To the east of the upper branches of the Gogra River lies an extensive mountain-region, called Mallebum, of which we hardly know anything else than that it is covered with very high mountains and partly with snow. It extends to the Dhawalaghiri range, the highest mountain-mass in the whole region, which occupies the space between 28° 30′ and 29° N. lat., and 83° and 84° E. long., and is traversed by the Gandaki Ganga or Gun duck. Its highest summit, called Ghosa Cotee, attains an elevation of 28,000 feet above the sea, and is the highest known land on the surface of the globe. Contiguous to the Dhawhalaghiri Mountains on the east is the great mass of the Dhayabung Mountains, whose highest pinnacle rises to 24,560 feet. These extensive masses fill up the space between the Gandaki Ganga and the Bori Gadaki, and terminate north-west of Khatmandu on the banks of that river. The space between the Bori Gandaki and the Arun, an affluent of the Coosy, is mainly occupied by the Salpoo range, which contains two summits exceeding 24,000 feet in height, and many others nearly as high. The elevation and extent of the mountains between the Arun river and the boundary of Bootan are imperfectly known.

The enormous mountain-masses are separated from one another by long but very narrow valleys, which descend towards the south and south-west with rather steep slopes, especially in their higher parts. During the summer these upper valleys are covered with a vigorous vegetation, and are used by the inhabitants of the lower valleys as pasture-ground; but during the greater part of the year they are buried in snow, and uninhabited. Through these valleys lie the few roads by which the plain of the Ganges communicates with the countries on the table-land of Tibet. The most northern of these roads follows the valley of the Sutlej. At Puari, where the great mountain-masses of the Moral-ka-kanda Mountains begin, the road is 6160 feet above the sea-level; and at Shipkee, where it issues on the table-land, 10,484 feet. North of the Moral-ka-kanda Mountains the principal range of the Himalaya bears the name of the Kailas range, and the Charung Ghaut leads over it from the valley of the Buspa to that of the Todang Ghad; this pass attains the height of 17,400 feet above the sea. Out of the valley of the Bhaghiratee, or rather from that of its upper branches, the Jahneree river, the Gangtang Ghaut leads from Nilung to Chaprung, which is built on the banks of the upper Sutlej. It attains only the height of 10,150 feet, and is practicable for horses. The Manah Ghaut leads from the Vishnu Ganga, one of the upper branches of the Alakananda, to Chaprung, and rises to 18,080 feet. The road from the valley of the Douli, an affluent of the Alakananda, leads to Dumpo, on the banks of the upper Sutlej over the Necætee Ghaut, which rises to 16,620 feet. The Oola Dhoora Ghaut (30° 35′ N. lat.) rises to 17,790 feet, and contains the road which connects the valley of the Gori, an affluent of the Kali, with Dumpo. This seems to be the most frequented of all the roads traversing the Himalaya Mountains, as far as they are within the British dominions. The Neo Dhoora Ghaut, whose elevation has not been determined, is traversed by the road which leads from the valley of the Douli, an affluent of the Gogra, to the sacred lakes of Rhawan Hrad and Manas Sarowar: it is only frequented by Hindu pilgrims. The Taklakot Ghaut, which attains an elevation of 17,600 feet, is traversed by the road which connects the upper valley of the Kali, an affluent of the Gogra, with Taklakot, a place built 16,700 feet above the sea, near the sources of the Gogra, and on the table-land of Tibet. From Taklahot the road runs through another mountain-pass to the sacred lakes. We have only a very imperfect knowledge of the passes by which a communication is maintained between Nepaul and Tibet. From the Alpine province of Mallebum a long pass leads along the Gandaki Ganga over Mastang, where it attains its summit-level, to the plains extending along the river Sanpoo. The road by which the Chinese army in 1792 invaded Nepaul, begins on the side of Tibet at Kheru, attains its highest level at Siapi, and thence descends to Dhayabung, Noyakote, and Khatmandu. It seems to offer greater advantages than the other roads. Another road leads from Khatmandu along the Bhootya Coosy to Cuti, and thence over the Langur Pass to Tingri, on the table-land. Farther east a road leads to Tibet along the river Coosy and its affluent the Arun, beginning at Vijayapoor and passing through Seksura and Manigumbah to the table-land. The most eastern of these passes is the Phakali Ghaut, which leads from Sikim north-east to Tangchim, and thence over the mountains to Tibet; a part of this road runs through the territories of the raja of Bootan. Nearly all these passes are too steep and high for any beasts of burden, except sheep, which in the Himalaya mountains are used for the transport of merchandise.

The high mountain-masses advance so far from the principal range into the interior of the mountain-region, as to occupy more than one-third of it, when they descend with a rapid declivity. The other two-thirds of it are of a very different character. The general elevation of this lower portion may be between 4000 and 5000 feet above the sea. Almorah, the capital of Kumaon, on the river Kosila, and only 15 miles in a straight line from the lower edge of the mountain-region, is 5485 feet above the sea-level. Only the valleys, which are drained by the Bhaghiratee and Alakananda, the two principal branches of the Ganges, sink considerably below this level; Tiri, on the Bhaghiratee, being 2272 feet, and Sireenuggur, on the Alakananda, 1800 feet above the sea. Though the surface of this portion of the mountain-region is extremely uneven, and consists of continual elevations and slopes, with narrow spots of level ground between them, the summits which rise above it are not numerous; they are also considerably below the snow-line, as they generally do not rise above 8000 or 9000 feet. They are either isolated, or united by lower ridges, above which they rise 1000 feet and more. But these ridges do not run parallel to the mountain-region, except towards its lower border. This description however does not apply to the tract between the upper branches of the Jumna and the Sutlej river, which is much more mountainous. Here the mountain-ranges are higher, more continuous, and occupy a greater space, and several of the summits attain the snow-line. The Chur-Peak (30° 50′ N. lat., and 77° 30′ E. long.), which is hardly 20 miles from the lower edge of the mountain-region, is 12,160 feet above the sea. The difficulty which the great unevenness of this tract presents to an easy communication between the inhabited places, explains the circumstance of there being in it a great number of sovereigns whose dominion frequently extends only over a few villages. The remainder of this lower portion of the Himalaya range contains more cultivable land than is generally found in mountain-regions, and is also pretty well inhabited, though the villages are mostly very small.

The mineral wealth of that portion which belongs to the British, or is under their protection, is unknown; but Nepaul contains, according to Sir Francis Hamilton, rich mines of copper, iron, lead, and sulphur. Corundum is very common. In such a mountainous country the climate must of course vary extremely. We shall confine ourselves on this point to observing that the snow-line rises much higher on the north-eastern than on the south-western declivity: on the former it occurs at about 16,600 feet, and on the latter at 12,500 feet above the sea-level. It follows that the vegetation also must be different at the same elevation on the two sides. [ASIA, vol. ii., p. 467.]

The portion of the Himalaya between the Sutlej and Bootan is partly immediately subject to the British, or under their protection, and partly subject to the independent raja of Nepaul. The British dominions comprehend the countries between the Sutlej and the Kali Gogra. About one half of the country between the Sutlej and Kali Gogra is governed by rajas under British protection, and the other half constitutes the British province of Kumaon. The mountainous country along the banks of the Sutlej river is occupied by thirty-two petty rajas, among whom the raja of Indur, who resides at Ramgur, and the raja of Kuhlur, who resides at Bulaspur, on the Sutlej, are the most powerful. But the territories of these rajas do not extend to the table-land of Tibet. The higher mountain-region is possessed by the raja of Bissahir, whose territories extend along both sides of the Sutlej river and beyond the Kailas Mountains, over a mountainous tract which ought to be considered as a part of the table-land of Tibet, and approach the town of Shipkee on the Sutlej. He resides in Rampur on the Sutlej. The raja of Sirmur governs the countries situated in the middle of the lower region west of the Jumna river. His residence is at Nahun, a town built not far from the edge of the mountains towards the plain extending between the Ganges and Indus. The territories of these princes occupy about half of the countries which are under British protection; the other half belongs to the raja of Gurwal, whose territories stretch over the whole breadth of the Himalaya range, comprehending all the countries drained by the Bhaghirattee, and by the upper course of the Jumna and Supin. He resides in the town of Tiri, on the banks of the Bhaghirattee; but the most important place is Dhera, a large town not far from the lower edge of the mountain-region, in a low and warm valley. North of this place, on the mountains of Massura-ke-kanta, an establishment has been made for Europeans who have lost their health in the sultry climate of the plains on the Ganges, at Lundur, 7000 feet above the sea-level (30° 26′ 30″ N. lat., and 78° 4′ E. long.). The British province of Kumaon is annexed to the presidency of Allahabad; its capital is Almorah. [ALMORAH.] The countries within the Himalaya range, extending from the eastern banks of the Kali Gogra to the boundary of Bootan, are subject to the independent raja of Nepaul, with the exception of a very small portion contiguous to Bootan, which is possessed by the raja of Sikim, an ally of the British, who resides in the town of Sikim. Within his territory also a sanatory is established for the presidency of Calcutta, at Dargiling, near the Teesta river, an affluent of the Ganges. Its mean temperature is about 36° lower than that of Calcutta.

The eastern portion of the Himalaya range, extending from the western boundary of Bootan to the very sources of the Brahmapootra river, is almost entirely unknown. We are only acquainted with it as far as it is contiguous to the road which leads from the plain of the Ganges through Tassisudon, the capital of Bootan, to the table-land of Tibet. [BOOTAN.] Farther east the range has never been visited by Europeans. When seen from the valley of Asam it does not appear to rise to the snow-line west of 92° E. long.; but probably the lower ranges which are visible cover much higher mountains which lie north of them. Between 92° and 98° E. long. however, extensive ranges are visible, which rise above the snow-line, and they appear to attain a very great elevation near the sources of the Brahmapootra. [ASAM.]

The word Himâlaya is a Sanscrit word, compounded of *hima*, 'cold, or frost, or snow,' and *alaya*, 'abode.' (Wilson's *Sanscrit Dict.*) The resemblance of the first part of the compound to the name of the Hæmus (Balkan), to the Greek *cheima* (χεῖμα), and the Latin *hiems*, is obvious. The Greek and Roman geographers were acquainted with this enormous mountain-range under the general name of Imaus or Emodus, though their limited geographical knowledge does not allow us to assume that their term Imaus comprehended so much as the word Himalaya. It was known to Pliny that the word 'Imaus' signified, 'in the language of the natives, snowy' (vi., c. 17).

(Hodgson, Webb, Herbert, Wilcox, and Traill, in *Asiatic Researches*; Colebrooke, and Rodney Blane, in *Trans. Asiatic Society*; Webb and Hügel, in *London Geogr. Journal*; Fraser's *Journal of a Tour through Part of the Snowy Range of the Himala Mountains*; Gerard's *Journal of Part of a Journey in the Himalaya Mountains*; Mundy's *Journal of a Tour in India*; Skinner's *Excursions in India*; Johnson's *Journal through the Himaleh Mountains*; Archer's *Tour in Upper India*, Ritter's *Erdkunde II. and III.*; Berghaus, *Karte von Assam und Spezialkarte vom Himalaya in Kumaon, Gurhwal, Sirmur, &c.*)

Botany.—The vegetation of the Himalaya Mountains is particularly interesting, whether we consider it in a special or in a general point of view.

These mountains have their south-west or Indian base clothed with a dense and almost impenetrable jungle, which separates them from the plains of India. This belt diminishes in breadth as we proceed northwards, until it altogether disappears to the north of the Jumna, where, in the country of the Sikhs, cultivation is carried on close to the foot of the mountains. From the proximity of water to the surface of the soil, this tract of country is usually called the Tarai, or Wet-land; but between the Ganges and Jumna rivers, Khadir-lands. The moisture is maintained by the want of free evaporation from the surface of the soil, and is increased by the great quantities of watery fluid transpired by the multitudinous leaves of this dense forest; its dispersion being prevented by the want of free ventilation. With this uniformity of moisture we have also greater equability of temperature than in the open plains; for as less solar heat is absorbed during the day, so is radiation less free during the night under this umbrageous covering, as is the case in the open plains in cloudy weather. Accordingly we have the characteristics of tropical climate, and with it tropical or Indian vegetation, which therefore extends much farther north along this tropic-girt base, emphatically called by Bishop Heber the belt of death, than in the open plains, where great heats alternate with great cold. In the south-east parts, as in Silhet, Chittagong, and Lower Asam, the forests are composed of gigantic trees, with extensive climbers reaching to their tops, epiphytes covering their branches, and tall grass concealing their trunks, as well as the elephants, which are found there of the finest description. The trees are composed of Artocarpeæ, Terebinthaceæ, Euphorbiaceæ, arboreous Leguminosæ and Malvaceæ, Combretaceæ, Ebenaceæ, Aurantiaceæ, Cinchonaceæ, Guttiferæ, &c. Ficus elastica, the Caoutchouc-tree of Silhet, occurs in great abundance and of gigantic size, as well as the Theetsee, or Varnish-tree, of the Burmese (Melanorrhœa usitata of Dr. Wallich). Hiptage madablota, Bauhinia corymbosa, and Robinia macrophylla, form the climbers, with species of Cathartocarpus, Erythvina, Butea, Bombax, Hibiscus, and Cochlospermum Gossypium, with large and showy flowers. Here splendid tree-ferns are found, and numerous scitamineous plants, with the plantain and peppers. Great uniformity extends along the whole of this tract, as many of the species of southern parts are found in the northern as far as 30°, as the Dipterocarpeæ, Shorea robusta, Ebenaceæ, Diospyros glutinifera, Lauraceæ, Cinnamomum albiflorum, Piperaceæ, Piper longum; a dwarfish Phœnix, P. humilis, and a trailing Calamus, represent the Palms.

In the tract of forest between the Ganges and Jumna are found many species which occur also beyond the limits of India, as Cassia elata, at the mouth of the Irrawady, in the Birman empire, Marlea begonifolia in Java, and Deeringia celosioides in New Holland. In the most northern parts Nerium odorum, or Oleander, is found along the banks of rivulets, as it is on those of watercourses in the north of Africa.

In this tropic-like forest the elephant reaches his most northern distribution on the banks of the Jumna, where a Paradoxurus is common: the rhinoceros does not extend beyond the eastern bank of the Ganges. Many tropical birds travel even farther north in the rainy season. A huge Python is found in the lower hills, as well as a Monitor of large size. Most of the insects also are those of hot and moist climates: Papilio Parakekte, found by Dr. Horsfield in Java, is also common at the foot of the hills in 30° N. lat.

The decrease of temperature being gradual as we ascend mountains, so is the disappearance of tropical forms in the Himalayas; and we continue for some time to meet with plants like Nyctanthes arbor tristis, which are common in the plains of India. But Indian trees and shrubs soon disappear. On reaching the region of Rhododendron arboreum and Quercus lanata, at about 5000 feet, scarcely any but European forms are visible. But as a few species of tropical genera travel into northern latitudes, so we find some such among the European-like vegetation met with at 6000 and 7000 feet of elevation, in 30° N. lat., as a few laurels and some Acanthaceæ, with species of Loranthus, even on an oak. But annuals which require only a few months to grow and ripen their seed indicate the temperature of the season, and not that of the year. Thus many tropical plants may be cultivated in the summer of European countries, and European plants and cultivation may be seen in the plains of India from November to March, or in what is the winter, as of more northern latitudes. In the same way we may see annuals characteristic of Indian or tropical vegetation at a much higher elevation in the Himalayas in the summer months than appears compatible with the prevalence of snow and great cold in winter. This anomaly presents itself at much greater elevations than would be expected, or indeed possible, were it not that the whole of the southern face of the Himalayas is under the influence of the tropical rains, during which they are inundated like the plains, and at the same time enveloped in clouds. The air, as it rises from the heated plains loaded with moisture, deposits it on reaching the point of saturation in these mountains. Hence continual moisture is preserved, and also equable temperature; for the cloudy covering prevents much absorption of heat during day, as it does radiation during night. The cooling besides of a ridge or a peak has but small influence on the mass of the atmosphere by which it is surrounded. Hence we observe but little change in the thermometer from night to morning, or from day to day, or week to week, and the temperature does not vary 10° of Fahr. for three months, or from the middle of June to the end of September. During this season therefore we see many plants in luxuriant growth which could not exist here for even a single day if either the moisture was less or the cold greater, as balsams, Begonias, some Melastomaceæ, numerous Cyrtandraceæ, tropical Orchideæ and Scitamineæ. The branches of the trees become covered with mosses and ferns, as well as epiphytes, such as Dendrobium alpestre and Cœlogyne precox: even Thalictrum radiatum and Arum viviparum are found on trees at this season of the year. A small bamboo even may be seen at 9000 and 10,000 feet, as well as Roscoea alpina at the former height, both having their roots protected by the earth and the covering of snow during winter.

It is in those months that rice is cultivated in these mountains, as well as other tropical grains, together with a species of arum, which is one of the principal articles of the chiefly vegetable diet of the hill-people.

The climate however of these mountains at about 7000 and 8000 feet of elevation being temperate, with greater uniformity however, and a less range of the thermometer, or from about 25° to 80°, supports a European-like vegetation, as has already been mentioned in Asia, *Botany of Himalayan region*, to which the reader is referred. Instead however of all the species being Indian, but of European form, as there stated, many species are identical with those found in the plains of European countries. Of such there are several instances in the families of Cruciferous and Labiate plants, also among the Compositæ and Leguminosæ. We may mention as instances, Ranunculus arvensis, common thyme, marjoram, and some of the mints; shepherd's purse, Prunella vulgaris, and the widely diffused Samolus valerandi, though nowhere met with in the plains of India. This identity of species is not confined to herbaceous plants, as we have the yew and the walnut, with the ivy and Rubus fruticosus. The apricot and pomegranate may be supposed to have been introduced, but the latter is undoubtedly wild. Pyrus baccata is a small Siberian tree found also in these mountains. Several of the Caucasian genera are also met with; and there is great similarity between the vegetation of the Hindu Coosh and that of the Himalayas in genera, and probably also in species.

It is curious to find among the above many which have hitherto been thought the peculiar genera of China and Japan, as Stauntonia, Abelia, Deutzia, Eurya, and Camellia. Thea itself has now been found in Upper Asam, but probably escaped from cultivated places; even some of the same species occur in the Himalayas and these countries; as Cleyera ochnacea, Hovenia dulcis, Kadsura and Lonicera Japonica, Houttuynia cordata, Ophiopogon spicatus, Pardanthus chinensis, and many others. Hence inferences were drawn that many parts of these mountains were fitted for the cultivation of the tea, long before it was known that it already was so in Asam. It is still more interesting to find here some North American genera and species; as Triosteum, Osmorrhiza, and Phryma; and even identical species, as O. brevistylis and P. leptostachya, with Desmodium nudiflorum, and a species of Panax closely allied to the Chinese P. Ginseng and American P. quinquefolium, which Dr. Wallich has named P. pseudo-Ginseng.

The vegetation of the upper belt has also been noticed vol. ii., p. 479), as well within as beyond the limit of forest. Here the climate bears some resemblance to that of polar regions in the same season, as the peaks are covered with snow for nine months in the year, which only melts when the sun has great power and the light is bright in the rarified atmosphere of these elevated regions. Junipers, dwarf-willows, and Rhododendrons, with Andromeda fastigiata, closely allied to the Siberian A. tetragona, reach the highest limits. Along with showy Primulas may be seen plants which are very similar to those of Arctic regions, as Ranunculus polypetalus to the Siberian R. glacialis of Fischer; a species of saxifrage, S. stenophylla, hardly to be distinguished from S. stolinifera, brought from Melville Island. This similarity in form to the plants of very distant regions is not however confined to genera containing numerous species, but is observable in others where two or three only constitute the genus, and of which one is found in these mountains; as of Sieversia which occurs also in Melville Island and Kamtchatka, and Dalibarda in North America and the Straits of Magalhaens, where many of the same genera are found as on these lofty peaks. The genera Oxyria, Gymnandra, Wulfenia, Dictamnus, Coriaria, and Staphylea, afford other instances, though some are found at a lower elevation. Ourisia is found in these mountains as well as in Van Diemen's Land and the Straits of Magalhaens.

The snowy passes exhibit many of the phenomena characterising these lofty peaks. The resemblance in form however is not confined to the vegetable kingdom. The Himalayan fox can scarcely be distinguished from the European species. Many birds are identical in species with those found in Europe: the woodcock may be adduced as an instance. Many insects also do not differ from those found in Europe. At still greater elevations the Alpine hare, or Lagomys, is found, which hardly differs from the Siberian Pika. A jay (Garrula bispecularis) is of an American form, as is the genus Paussus among insects, which, until brought from the Himalayas by Mr. Downes, was thought to be confined entirely to North America.

In crossing the snowy mountains by the passes, which are flanked by snowy peaks usually 3000 or 4000 feet more elevated, and which prevent the passage across of the air loaded with moisture, we have a very different set of phenomena presented. The district of Kunawur may be considered a portion of Tartary, or Tibet, instead of India, though some Indian forms still show themselves in the bed of the Sutlej, in Lower Kunawur. The climate is extremely dry, and evaporation very rapid. Very little rain falls at any time. The country is covered with snow from the end of October until April, but the layer is never very thick, from the great dryness of the climate. The cold is intense during winter, but the thermometer in July and August ranges from 55° to 58° in the morning, and rises even as high as 80° or even 85° during the day, in villages elevated 10,000 feet. 'When the snow is melted, these elevated tracts, surrounded and confined by towering mountains, absorb heat as readily during the presence of the sun, as they radiate it freely during his absence; and becoming, like the surface of the earth at ordinary levels, the source whence the heat received from the sun is diffused to surrounding objects, they cause the line of perpetual congelation (and consequently of vegetation) to rise higher and higher in proportion to their own elevation. Peaks and pinnacles, on the contrary, projected into the air like promontories into the ocean, partake rather of the equability of the media into which they intrude, than impress on them, like plains and table-lands, their own extremes of heat and cold.' (Royle, *Illust.*, p. 39.)

Kunawur is everywhere intersected by elevated ridges which are crossed by passes varying in elevation from 12,000 to 18,000 feet: on some of those to the eastward, even at the latter height, little snow is seen in summer, and that only in streaks. Vegetation extends to 16,600 or even 17,000 feet. Junipers are found at 14,500 feet, Rhododendron lepidotum below them, but above the birch, which is found at 14,000 feet. Pines do not extend beyond 12,300 feet. The highest cultivation was seen by Dr. Gerard near Dabliug, at 13,600 feet, consisting of barley, buckwheat, and turnips.

The Tartar province of Hungarung lies north of Kunawur, but separated by a lofty range which is crossed by a pass at an elevation of 14,800 feet, coinciding here with the limit of snow. The mountains have rounded outlines with gentle declivities. The country is destitute of trees, and presents everywhere a picture of arid barrenness. The villages are at elevations of 10,000 to 12,000 feet. Nako is at the latter height, on the western face of lofty mountains, yet there are produced luxuriant crops of wheat, barley, buckwheat, and turnips 700 feet higher, rising by steps or terraces, enclosed by hedges of gooseberry, barbary, and juniper. Caragana Gerardiana and versicolo extend to 13,000 feet, and are the plants called Tartarian Furze by travellers. Dr. Gerard also found this at a village at a height of 14,700 feet, where the barometer gave 14,900 feet as the elevation of the highest field of cultivation.

The vegetation of the northern face of the Himalaya has been noticed (vol. ii., p. 478), under the head of *Tartaric region*. The cultivation has been indicated above; the fruit trees consist of species of Pyrus and Persica, with the apricot, of which the fruit is dried, and the grape-vine, from which wine is manufactured. The families and genera of plants which prevail here are strikingly similar to those occurring in the Altai Mountains, as described by Ledebour in his 'Flora Altaica,' also in the south of Siberia and on the Caucasus, as among them we not only find such genera as are common to these countries and other parts of the world, but several which are remarkable and peculiar, as well genera as species. Among the latter we find Lithospermum amplexicaule, Cuminum Cyminum, and Hyoscyamus niger (the last found both in Caucasus and in Europe); Biebersteinia odora, in Persia and on the Altai range; Crambe cordifolia and Tauscheria desertorum of the Caucasian Flora, the latter also found on the deserts of the Kirghis and the banks of the Irtisch. Many others might be enumerated, but the above are sufficient as examples, and it is impossible within our limits to attempt a complete view of so extensive a subject. Notwithstanding the apparent barrenness of much of the country on the northern face of the Himalaya, nowhere are the flocks of cattle more conspicuous for number and variety. The cold and dry atmosphere is particularly favourable to the shawl-goat. The sheep and goat are both used as beasts of burden, and the dog is of large size, and, like the others, furnished with fine wool under the upper shaggy hair. The Bhural (Asiatic Argali), the Yak (Bos grunniens), the wild horse, the Yuckur, or wild ass, and the Dziggtai, or Equus Hemionus of Pallas, are all found here, and obtain nourishing food from the grasses of European genera, and the Leguminous Astragali and Caraganas. Among birds, Gypaëtus barbatus and the chough, or red-legged crow, are common, with three species of pheasants, and the Chukor, which is most frequently seen on the most barren hills. (Dr. Royle's *Illustrations of the Botany and other branches of the Natural History of the Himalayan Mountains.*)

HIMA'NTOPUS, the generic name for the *Long-legged Plover*, *Longshanks* or *Stilt*. [PLOVERS.] The term is also applied by Müller to a genus of *Microzoaria*.

HI'MERA, a city in the interior of Sicily, which took its name from the river Himeras, was founded by the Zanclæans of Mylæ in Sicily (Strab., vi. 272), and after existing as a flourishing town for 240 years, was destroyed by the Carthaginians, and its ornaments carried off. The inhabitants who survived this calamity established themselves at Thermæ, near the site of the antient town (Cic., *In Verr.*, ii. 35), and enriched their new abode with such works of art as they had saved from the wreck. Upon the capture of Carthage, Scipio restored to the people of Thermæ, of Gela, and other Sicilian towns, those monuments of art of which they had respectively been plundered in their wars with Carthage. (*In Verr.*, iv. 33.)

Coin of Himera.

British Museum. Actual Size. Silver. Weight, 265¼ grains.

HIMMEL, FRIEDRICH-HEINRICH, a German composer of celebrity, the reputed son of Frederic William II., of Prussia, was born in the duchy of Brandenburg in 1765. He was intended for the church, and studied theology in the university of Halle, but devoted all his spare time to music, in which he became so skilful that the king, his supposed father, encouraged him to pursue the art as a profession, and settled on him a pension to enable him to study it under proper instruction. He chose Naumann as his guide, with whom he made such progress that in two years he produced the oratorio of *Isacco*. He then travelled into Italy, and at Venice brought out a pastoral opera, *Il Primo Navigatore*. In 1794 he succeeded Reichardt as kapellmeister at Berlin, and in the following year produced his *Semiramide*. The operas on which his fame chiefly rests, are *Fanchon das Leiermädchen* (*Fanchon, the Lyre-maiden*), and *Die Sylphen* (*the Sylphs*). His best compositions are a *Funeral Cantata* on the death of Frederic William in 1799, and a *Te Deum* for the coronation of his successor.

Himmel wrote many good sonatas for the piano-forte, and his romances, songs, &c., which are very numerous, abound in sweet and original melody. He visited London in 1801, but made only a short stay. His death took place at Berlin in 1804.

HIMILCON, the name of several Carthaginians.

1. Himilcon, who is said by Pliny (*N. H.*, ii. 67) to have been contemporary with Hanno, was sent by the Carthaginian government to explore the north-western coast of Europe. A few fragments of this voyage are preserved by

Festus Avienus (*Ora Maritima*, l. 90), in which the Hiberni and Albioni are mentioned, and a promontory, Œstrymnis, and islands, Œstrymnides, which are usually considered to be Cornwall and the Scilly Islands. (Gosselin's *Recherches sur la Géographie des Anciens*, vol. iv., pp. 162, 163.)

2. Himilcon, who commanded the Carthaginians in their wars with Dionysius I., tyrant of Syracuse, B.C. 405-368. Himilcon was an able and successful general. He took Gela, Messana, and many other cities in Sicily, and at length besieged Syracuse by sea and land; but he was defeated by Dionysius, who burnt most of the Carthaginian ships. (*Diodor. Sic.*, b. xiii. xiv.)

3. Himilcon, a supporter of the Barcine party at Carthage (*Liv.*, xiii. 12), was sent by the Carthaginian government to oppose Marcellus in Sicily. (*Livy*, xxiv. 35-39; xxv. 23-36.)

HINDUSTAN, that is, the country of the Hindus, in the Persian language: this term has been adopted by geographers to designate that part of India, or the East Indies, which was formerly called the Peninsula within the Ganges, and which extends from Cape Comorin, its most southern extremity, to the foot of the Himalaya range and the mountain-chains which separate the high table-land of Iran (Persia) from the low plain traversed by the Indus, or Sinde, after this river has issued from the Himalaya mountains. As the long declivity of the last-mentioned extensive mountain-chain slopes towards the plains of Hindustan, which extend along its base, and as the rivers originating within this range descend towards these plains, the Himalaya mountains are commonly and properly included in Hindustan. The seas which surround Hindustan on the south-east, south, and west, and the mountains which enclose it on the north-west and north-east, mark distinctly its boundary on these sides. On the east, where the valleys traversed by the Brahmapootra and the Soormah open into the plains of Bengal, the boundary-line is uncertain; but we may fix it at 92° 30′ E. long., to which meridian the possessions of the East India Company now extend, if the coast of Aracan, which properly does not belong to Hindustan, is excluded. Within these boundaries Hindustan extends from Cape Comorin, 8° 4′ N. lat., to Attock on the Indus, 34° N. lat., and from Cape Monze, west of the delta of the Indus, 67° 30′, E. long. to the meridian of 92° 30′. Its length, in round numbers, is about 1800 miles, and its greatest breadth between Cape Monze and Silhet, on the Soormah river, along the parallel of 25° N. lat., about 1500 miles. Its surface is stated to be 1,200,000 square miles, or three times the extent of France and Austria taken together; but this statement is exaggerated; and it probably does not exceed 1,000,000 square miles.

The coast-line of Hindustan amounts, according to a rough calculation, to about 3280 miles, of which 1830 miles are washed by the Indian Ocean, and 1290 by the Bay of Bengal; about 160 miles, or somewhat more, extend along the Gulf of Manaar and the Palk Strait. Beginning with the innermost corner of the Bay of Bengal, at Chittagong, or Islamabad, the coast for about 320 miles is traversed by the numerous mouths of the Ganges, all of which admit small vessels; the Hoogly branch admits vessels of good size, and the Horigottah branch vessels of any size. Contiguous to the Hoogly is the open Bay of Balasore, with a coast of 120 miles, terminating at Cape Palmyras. From this point the coast stretches in a south-west direction to the mouth of the Kistna for about 420 miles, and is without harbours, except that of Coringa, near the mouth of the Godavery. From the mouth of the Kistna to Cape Calymere, an extent of about 430 miles, no harbour occurs, even for vessels of moderate size. Between Cape Calymere and Cape Comorin, about 160 miles, there is only the small and shallow harbour of Tuticorin. The coast, which stretches north-north-west, and afterwards nearly north, between Cape Comorin and the innermost corner of the Gulf of Cambay, a distance of about 1150 miles, contains a great number of small and several very good and safe harbours. The coast-line of the peninsula of Gujerat, which, exclusive of the Lesser Runn, is about 380 miles in extent, has several harbours for vessels of moderate size. The coast-line of the island of Cutch, exclusive of the Runn, but inclusive of the Koree, or eastern mouth of the Indus, extends about 150 miles. The coast intersected by the several mouths of the Indus extends as far as Cape Monze, about 150 miles, but it cannot be approached by vessels of more than 50 tons burden, except at the harbour of Currachee, which admits vessels of moderate size.

The surface of Hindustan is characterized by very marked features on a large scale. From the mouths of its two great rivers, the Ganges and the Indus, two low and level plains extend in a converging direction along both sides of these rivers till they meet between 28° and 31° N. lat., and 76° and 77° E. long. Near 28° N. lat. the country begins to rise rather abruptly, constituting between the two plains, and afterwards between the two seas (the Indian Ocean and the Bay of Bengal), a series of table-lands in the form of terraces, which rise higher and higher as they advance southward, until they attain their greatest elevation in the table-land of Mysore, at the foot of the Nilgherry mountains (between 11° and 12° N. lat.). South of this range a low plain, in some parts less than 20 miles in width, extends across the peninsula. This narrow portion of the plain is called the Gap of Coimbatore; and south of it is a mountain region which occupies about half the breadth of the peninsula in this part, but as it advances southwards grows narrower till it terminates at Cape Comorin in a narrow ridge. The table-lands do not extend to the shores of the sea, but are divided from it by flat tracts varying in breadth. The table-lands themselves are divided into two unequal portions by two deep valleys which traverse them obliquely, beginning on the west near 22° and terminating on the east near 25° N. lat. In these valleys run the rivers Nerbudda and Sone, the former of which falls into the Gulf of Cambay, and the latter joins the Ganges north of 25° N. lat.

Following this natural division we shall give a general description of the surface, soil, rivers, climate, and principal products of Hindustan under five heads:—1, Southern Region, comprehending the southern extremity as far north as the Gap of Coimbatore; 2, Deccan, which extends to the river Nerbudda, and includes the maritime countries of Malabar, Canara, and Concan, on the Indian Ocean, and the Carnatic and the Circars on the Gulf of Bengal; 3, Mountain-region of North Hindustan, comprehending the terraces north of the Nerbudda, together with the peninsulas of Gujerat and Cutch; 4, the Plain of the Ganges; and, 5, the Plain of the Indus. To these may be added, as a sixth natural division, the Himalaya Mountains. [HIMALAYA MOUNTAINS.]

I. *The Southern Region.*—The narrow sea which separates Hindustan from the island of Ceylon is traversed by a chain of islands and sand-banks called Adam's Bridge. [ADAM'S BRIDGE.] The island of Rameserum is low, sandy, and not cultivated, but celebrated for its great pagoda, the extent and splendour of which have called forth the admiration of many travellers; it is still visited by pilgrims from all parts of Hindustan. At the western extremity of the island is a small place called Paumben, where travellers cross the Paumben Passage to the continent. It is about a mile wide, and has six feet of water at high tide. The adjacent coast is low and sandy, but at a short distance from the sea some sand-hills occur, between and behind which are numerous salt swamps and lagoons, whose exhalations render these tracts unhealthy. These swamps often extend several miles inland. Behind them the country rises but very slowly to the foot of the mountains on the west, a distance of from 40 to 60 miles. This tract is very well supplied with water, numerous small rivers descending from the mountains, and supplying plentiful means of irrigation. It is accordingly well cultivated and presents a succession of rice-fields and palm-groves. Among its rivers is the Vaygaroo, which passes near the town of Madura, which formerly contained a population of 40,000 inhabitants, but now has hardly half that number. Farther south is the town of Tinnevelly, in a very well cultivated country not far from the mountains. The harbours are shallow, with the exception of that of Tuticorin, which however is small; in its neighbourhood pearls are fished.

At the foot of the mountains the plain may be about 300 feet or less above the sea. The mountain-regions which border on it on the west are very little known, except that between 9° 10′ and 10° 20′ N. lat. they occupy a considerable surface. Their elevation seems to be considerable. Mount Permaul, north-west of Dindigul, which appears to be the most north-eastern offset of the range, was found by Colonel Lambton to be 7364 feet high, and it is conjectured that much higher summits may occur farther west. According to a native account they even attain the snow-line. This isolated mountain-region therefore may be considered as the highest land in Hindustan south of the Himalaya range. The Aligherry Mountains, south-west of Madura, another offset of the same stock, rise to 4219 feet. South of 9° 10′ the mountain-mass runs out southwards in one single range, which is lower, but continues at a considerable elevation to a distance of about 20 miles from Cape Comorin, where it suddenly lowers about 2000 feet. The remainder is a low ridge of granite overgrown with thick forests of a vigorous vegetation, in which are numerous large boulders of granite. As these mountains are exposed to the immediate effects of both monsoons, they are everywhere covered with trees, among which the teak is abundant, and forms one of the chief sources of wealth to the country. In these forests pepper-vines and cardamom-plants frequently occur, but most of their vegetable productions are yet undescribed. Two passes are at present known to exist across these mountains. The northern, called the Ariangawal Ghaut occurs near 9° N. lat., and leads from Tinnevelly on the east to Quilon on the west, through Cotallum. The southern, the Amboli Ghaut, lies about 20 miles from Cape Comorin, near the place where the mountain-range suddenly lowers.

The country which lies to the west of the mountains exhibits a much more diversified surface than that to the east of them. Numerous offsets consisting only of low hills advance towards the coast and leave a level tract along the sea some miles broad. Between Quilon and Anjengo the hills reach even to the shores, which are sandy and mostly covered with cocoa-palms. At a short distance from the coast are lakes, among which that is particularly remarkable which extends with its branches from Cochin on the north, to Quilon on the south, and offers very advantageous means for the transport of goods. The low country, which extends east of the lakes some miles inland, is in many places swampy, and used as pasture-ground in the dry season, or covered with jungle and forest trees; but the higher tracts produce rice and other grain in abundance. These tracts are mostly uninhabited. The villages are built farther inland on the low ranges of the hills, where they are surrounded by extensive plantations of palms, jack, plantains, and mangos. Still farther inland the mountains rise with a steep ascent, and are covered with forests, especially of teak. The navigation along this coast is safe and very pleasant from November to March, but during the south-west monsoon no vessel ventures to approach it. A very heavy surf always runs along this coast, and renders landing difficult.

This tract is subject to two native princes, allies of the English. The king of Travancore possesses the southern portion, which is about seven-eighths of the whole; and the raja of Cochin is in possession of the most northern districts. The English and Dutch have some settlements. Tivandrum, the capital of Travancore, a few miles distant from the sea, is a large and well-peopled place with a castle. Anjengo is a small harbour, where the English had a factory up to 1813, when it was abandoned. Between it and Quilon is the Dutch factory of Eddava. Quilon was formerly in possession of the Portuguese, and afterwards of the Dutch, but it has been abandoned. It has a small harbour, but a considerable population. Cochin, which was first possessed by the Portuguese, and afterwards by the Dutch, is now in possession of the English; it has a good harbour, and a considerable commerce with Bombay, Surat, Arabia, the Sunda Islands, and China. It exports pepper, cardamoms, teak, and sandal-wood, cocoa-nuts, coir, cassia, and the produce of its fisheries, a branch of industry much attended to along this coast. No place is better adapted for the exportation of teak than Cochin, as the timber is floated down the various small rivers which fall into the lake, and then easily conveyed to Cochin. Cochin has 30,000 inhabitants. North of it is Cranganore, where a Catholic bishop resides.

The Gap of Ponany or Coimbatore, which extends between 10° 40′ and 11° N. lat., is a long valley which unites the wide plains of the lower Cavery with the level coast of Malabar. It takes its name from the town of Coimbatore, which lies near its eastern extremity, but without it, or from the river Ponany, which drains it in all its length. The most elevated part near the sources of the river is only about 400 feet above the sea, and not sufficiently high to hinder the north-east monsoon from penetrating through the Gap. Rennell observed that vessels sailing in the fine season along the coast of Malabar always experience a stronger eastern wind when they approach the mouth of the river Ponany. It is also stated that Coimbatore participates in both monsoons. Between the last-mentioned town and the fortress of Palighat is the narrowest part of the valley, which is only from 12 to 15 miles across. Its surface is encumbered with a great number of boulders of granite, but is everywhere overgrown with high forests, and during the south-west monsoon the greater part of it is converted into a swamp. It is not cultivated, and almost exclusively frequented by immense herds of wild elephants and other beasts. Cultivation begins at the strong fortress of Palighat, where the Ponany river becomes navigable for canoes, and the culture of rice and other productions increases on the banks of the river as it advances towards its mouth, where the town of Ponany is built, which has a good harbour and a population of about 10,000 souls. It carries on a considerable commerce with the towns along the Malabar coast, Arabia, and Bengal. Its rich merchants are mostly Mohammedans.

II. *Deccan.*—This term, which is derived from the Sanscrit Dakshina (the south), was originally applied to the whole peninsula south of the river Nerbudda, including also the country south of the Gap of Coimbatore. It was afterwards used to indicate that portion of the peninsula which had become subject to the Mongol emperors. We have however applied it, in a geographical view, to the peninsula north of the Gap of Coimbatore, and we fix its northern boundary at the valley of the Nerbudda, the elevated table-land of Omercuntuc, and the range of mountains which, branching off from the table-land to the east, terminates in the Nelligreen mountains, in the neighbourhood of Balasore, on the Gulf of Bengal. This boundary-line runs across the whole peninsula between 21° and 23° N. lat.

The interior and by far the greater part of this extensive region is an elevated table-land, which is enclosed on all sides by low plains extending to the sea-shore. The edges of the table-land are here, as in every other part of the world, raised above the surface of the table-land itself, and appear in the form of mountains or high hills, and the descent from them to the low plains on the sea-shore is steep, and full of impediments to easy communication.

The *Table-land* extends from south of 12° to 21° N. lat. Between 12° and 16° its average breadth probably does not exceed 150 miles, but north of 16° it widens gradually to 400 miles. Its boundary will be determined by a survey of the ranges which surround it. By the natives it is called Bala-Ghaut, or the country above the Ghauts; and the low plains of the coast are named Payan-Ghaut, or the country below the Ghauts. The name Ghaut signifies the narrow passes by which the mountains which divide the Payan-Ghaut from the Bala-Ghaut are traversed. The resemblance of the word in form and meaning to our word *gate* is obvious, and it appears to be a form of the Sanscrit 'gati,' a way or path.

The elevation of this table-land varies to a certain extent. The country south of 15° N. lat., which is called the table-land of Mysore, is the highest part, and it is higher towards the east than towards the west. Bangalore is 3026 feet, and Colar 2900 feet above the sea; but Seringapatam is only 2412 feet, being built in a deep depression on the river Cavery. North of 15° N. lat. the table-land grows lower, and the greatest depression seems to occur between 15° and 17° in the region drained by the Kistna and its tributaries. In this part the country slopes slowly from west to east. Dharwar, near the western edge, is 2352 feet above the sea; Bellary, nearly 77° E. lat., 1488 feet; and Gooty, between the rivers Penn-air and Kistna, 1182 feet. Farther north it again rises higher, and the western and higher districts, as far east as 77°, may vary between 2000 and 2500 feet. But east of 77° its slope, which is mostly directed to the south-east or south, is more rapid. Hydrabad is 1696 feet, and Nagpoor only 900 feet above the sea.

The surface of this table-land is a level plain, on which hills rise here and there in a conical form, and in a few places ridges of sandstone appear, but these ridges are not continuous; they are frequently interrupted by depressions, which sink to the level of the plain. These eminences rise from 300 to 900 feet above their base. Towards the mountains which constitute the western edge of the table-land the surface is much more uneven; numerous short spurs branching off from the mountains and advancing about 30 or 35 miles into the plain. The isolated hills, as well as these spurs, are of very steep ascent, and on them are built the numerous strong fortresses called droogs or durgas,* which served for a long time as places of retreat to those who laid waste the table-land with their hostile incursions. They are now mostly in the hands of the English, and are going rapidly to decay.

Here, as in other countries between the tropics, the year is divided into two parts, a rainy and a dry season. The rainy season does not occur, as on the eastern coast, during the north-east monsoon, but during the south-west monsoon, as on the western coast. It begins however not immediately with the change of the monsoons, but in May, in which month only small showers fall. In June or July they become more regular and continuous, and they last till October. But the quantity of rain is not great, being estimated to amount only to 20 or 26 inches annually, whilst on the western coast it is 116 inches, and on the eastern 45 inches. It is further observed that more rain falls in the districts which skirt the Western Ghauts than farther east; and likewise that the quantity of rain also decreases towards the north. The last circumstance is ascribed to the direction of the Western Ghauts, which do not run exactly south and north, but decline some points to the north-west. In the districts which skirt this mountain-range a cool westerly wind blows during the night, even in the season of the north-east monsoon. The mean annual temperature of the higher districts of the table-land seems to be nearly 10° less than at Madras; it is stated to be at Darwar 75°, and at Madras 84° of Fahrenheit.

The table-land here also, as in other parts of the world, is destitute of trees so far as the plain extends. On the low spurs of the Western Ghauts and in the valleys between them the country is wooded, and this is also the case with the most southern corner along the river Cavery. All the remainder contains only a comparatively small number of bushes, but is generally covered with grass. It is however rather fertile. On the whole surface of the table-land a black soil prevails, which, from being favourable to the growth of cotton, has been called the black cotton ground, or *regur;* this soil is never manured nor does it ever lie fallow, and yet it produces rich crops every year when skilfully managed. The hills which rise on the table-land are bare and sterile, like most of the small valleys between them, some of which however exhibit a great deal of fertility. The northern districts of the table-land are less fertile, probably on account of the deficient quantity of moisture. Vast tracts without cultivation frequently occur here. During the rainy season and the cool months which immediately follow, this country, especially in the southern districts, presents a pleasant view, being covered with a fine sward of grass, and mostly cultivated or planted. But towards the spring the plains lose their verdure, and their surface becomes a brown level, intersected by numerous deep rents. Clouds of dust are raised by the dry hot winds, and when a calm suddenly occurs they remain for some time stationary in the air. The excessive heat produced by the vertical rays of the sun extinguishes every trace of life; even the smallest insects disappear. The rivers flow slowly in their deep beds, and their bare black banks descend abruptly 20 or 30 feet to their channels, and thus have the appearance rather of artificial cuts than of rivers. All the smaller streams dry up, and the larger, which during the rainy season rise from 20 to 30 feet, and even inundate a few tracts along their course, are during the dry season so deep below the surface of the adjacent fields that the water cannot be used for irrigation, as in the plains of the Ganges, and in some of the tracts along the Bay of Bengal.

The cultivation of rice is only carried on where there are artificial means of irrigation; tanks for this purpose are numerous in some places. But the number of other grains, plants, and fruits is very great.

By far the greatest portion of this table-land is still under the sway either of Hindu or of Mohammedan princes. The districts immediately subject to the British government comprehend only about 40,000 square miles, whilst the territories belonging to the princes under the protection of the British extend over an area exceeding 200,000 square miles.

1. The most southern part is the kingdom of Mysore, governed by a Hindu prince, now Maharaja Krishna Adiaver. It comprehends more than 30,000 square miles, or an area 4000 square miles larger than Scotland. Its capital is Seringapatam. The ancient capital, Mysore, south of Seringapatam, is said still to contain 10,000 inhabitants. Besides, there are two large towns, which carry on a considerable commerce, Bangalore and Bednore. [BANGALORE; BEDNORE.]

2. The territories of the Nizam, or raja of Hydrabad, a Mohammedan prince, occupy the centre of the northern portion of the table-land, and comprehend an area of about 110,000 square miles, or little less than the British islands, and are inhabited by more than ten millions of souls. The capital, Hydrabad, is a large town, whose population by some is stated to amount to 120,000 souls, by others even to 200,000; it is noted for its extensive traffic in diamonds. In its neighbourhood is Golconda, a fortress on a high hill, from which the whole country once received the name of the kingdom of Golconda. Other remarkable places are Beder, a commercial town, situated on one of the great thoroughfares of the table-land, Aurungabad [AURUNGABAD], Dowletabad [DOWLETABAD], and Elora with its famous ruins [ELORA].

3. The possessions of the raja of Berar, called Boonslah, extend to the east of Golconda over a surface of about 65,000 square miles, or an extent of country greater than England and Wales together. The population is estimated at about three millions. The capital, Nagpoor, situated towards the northern boundary of the table-land, is a large town, with a population of 100,000 and a circuit of seven miles. The prince is a Hindu of a Mahratta family.

4. The raja of Satara governs a country containing about 9000 square miles, or nearly the extent of the island of Sicily, and inhabited by more than half a million of souls. It extends along the Western Ghauts, but reaches far into the table-land. The prince is a Hindu, and resides in the town and fortress of Satara, which is situated in a very fertile and well cultivated country. In his territories are the ancient town of Bejapore [BEJAPORE], and Punderpore on the Beema river, a commercial town and noted place of pilgrimage.

5. The raja of Colapore possesses a territory of about 3000 square miles, nearly equal to the county of Devonshire. It extends likewise along the Western Ghauts, south of the territories of the raja of Satara. The prince is a Hindu, and his capital is Colapore.

6. The English possessions are partly annexed to the government of Madras and partly to that of Bombay. Only the ceded districts, or Balaghauts, belong to Madras. [BALAGHAUTS.] They contain the fortresses of Gootydroog and Bellary. Two districts are annexed to the presidency of Bombay; Darwar, or the South Mahratta country [DARWAR], and Deccan [DECCAN], the first lying south of the territories of the rajas of Colapore and Satara, and the second lying north of it. In Darwar is the town of Darwar [DARWAR] or Dharwar, and in Deccan are the towns of Poonah, Ahmednuggur, a considerable and thriving commercial town, situated on one of the great thoroughfares of the table-land, with more than 20,000 inhabitants, and Nassuck, with 27,000 inhabitants. Near Nassuck are the excavated temples of Pandu Lena; and not far from Poonah those of Carli.

In surveying the higher lands, which encircle the table-land, we begin with the most northern portion, the elevated table-land of Omercuntuc, which lies between 22° and 23° N. lat. and 80° 30′ and 82° 30′ E. long. It rises considerably above the surrounding tracts; but as it has not been visited by Europeans, its elevation is not known. On its eastern declivity rises the Sone river, and the Nerbudda traverses it in its length from east to west, until it leaves it near Mundlah. Near the source of the Nerbudda is a Hindu temple, which is a place of pilgrimage. The table-land of Omercuntuc is the central link by which the higher lands of the Deccan are united to those which extend to the north of the Nerbudda. Below Mundlah the high lands contiguous to the table-land extend westward on both sides of the narrow valley of the Nerbudda in extensive masses, which, near 79° E. long., take the form of three distinct ranges. The ridges diverge between 78° and 79° E. long., but farther west they run nearly parallel. The most northern range is the Vindhya Mountains, the middle range is called the Sautpoora Mountains, and the southern, which is less distinct in its features, being only the northern declivity of the table-land of the Deccan, has no general name, but may perhaps with propriety be called the Northern Ghauts. Between these three ranges lie the two parallel valleys of the Nerbudda and Tapty

* 'Difficult of access or approach,' &c.; 'a fort, a stronghold, a *Droog*, or hill-fort.' Wilson's 'Sanscrit Dict.'

The Northern Ghauts may be said to begin in 22° N. lat., between 78° and 79° E. long., with the high lands, on whose eastern declivity the upper branches of the Whurdah, an affluent of the Godavery, and on whose western declivity those of the Tapty rise. These mountain-masses, which extend from north to south, have probably an elevation of 4000 feet above the sea, and send off a very distinct and elevated range westward between the two upper branches of the Tapty. This last-mentioned range, called Mahadeo Phar (the mountain of the great god), rises to the height of 4000 feet near the fortress of Gawulgur. The remainder of the Northern Ghauts, from the neighbourhood of Oomrawutty (20° 55′ N. lat. and 77° 45′ E. long), lies in a general westerly direction along the southern side of the valley of the Tapty, and joins the Western Ghauts between Chandore and Soolgana, west of 74° E. long. It rises with a very steep ascent from the valley of the Tapty, where it presents the appearance of a mountain-range, between 2000 and 3000 feet high, but its descent on the south is short and easy, the table-land of the Deccan being on an average perhaps only 500 feet lower than the range. The mountain-passes are very difficult, especially those leading from the valley of the Tapty to the table-land. The most frequented is the mountain-pass of Ajunteh, through which the road runs which leads from Boorhampoor on the Tapty to Dowletabad and Aurungabad. Near the mountain-pass are some temples excavated in the rock.

The Western Ghauts, which constitute the boundary of the table-land of the Deccan towards the Indian Ocean, begin about 10 miles from the southern bank of the Tapty and about 60 miles from the sea-shore. Between 21° and 19° N. lat. the highest portion of the range preserves the same distance from the sea, but somewhat north of the parallel of Bombay it approaches within about 30 miles. At about this distance it runs parallel to the shore to 15° N. lat., where it gradually approaches nearer, until the mountains come close up to the coast, at the mouth of the river Gangawally (14° 30′ N. lat.). They continue to constitute a high coast along the sea as far south as the town of Barcelore, or Barcoor (13° 30′). South of this place these mountains again recede farther inland, so that opposite Mangalore they are more than 30 miles from the sea. Farther south the distance is less, and between Chandergherry (12° 30′) and Mount Delli several elevated offsets come up to the sea. The Western Ghauts terminate a little south of the parallel of Calicut, about 11° N. lat., where they constitute the northern border of the Gap of Ponany.

This range varies considerably in elevation and width. North of Bombay it is stated not to exceed 3000 feet in height, and to be only about 1000 feet above the table-land on the east. But south of Bombay it rises higher, and the Mahabalipoora Mountains, nearly opposite Fort Victoria, about 18° N. lat., rise to the elevation of 5036 feet. A sanatory has been established on them for Bombay. It is not known how far south this elevation is continued, but opposite Goa (15° 30′) the mountains are traversed by a pass which is only 2477 feet high, and hardly more elevated than the contiguous plains of Darwar. The pass, which leads from Sadashevagur to Yellapoor and Soonda, seems to be still lower. The small difference observed in the temperature between the coast and the summit of the pass induced Dr. Fr. Buchanan to think that the difference of the elevation could not exceed 1000 feet, but probably it is much more. Opposite Bednore (south of 14° N. lat.) the mountains rise to 4000 feet, and they seem to continue with this elevation to the Hosso Angady Ghaut (13° 42′) south of which they rise to between 5000 and 6000 feet in the Alpine region of Coorg, and at their termination they probably are not much lower. The width of the Western Ghauts is inconsiderable, and perhaps nowhere except towards its southern extremity exceeds 12 miles, if the low spurs, which advance from them eastward into the plain to the distance of 30 miles and more, are not taken into account. South of the Hosso Angady the mountains extend near 40 miles east and west, and fill up the country between the upper branches of the Cavery river.

The rapidity with which the Western Ghauts descend to the sea renders it very difficult to ascend the table-land of the Deccan on this side. The mountain-passes or ghauts are not numerous, and most of them are not passable for beasts of burden. These most used are, from north to south, the following:—1. The Bor Ghaut, which begins at Panwelly, opposite Bombay, and leads between steep rocks over Khandoola to the excavated temples of Carli, which are on the table-land; 2. The Colpar Ghaut, which leads from Fort Victoria (17° 56′ N. lat.) along the river Bancut to the town of Mharr, and hence through the pass northward to Poonah and southward to Satarah; 3. The Ghaut of Balgaum, which leads from Goa to Darwar, and rises to 2477 feet; 4. The Kutaki Ghaut, which begins on the coast at Sadashevagur (south of 15° N. lat.), and leads through the mountains to Yellapoor on the table-land; 5. The Hosso Angady Ghaut (13° 42′ N. lat.), one of the most frequented passes of the Ghauts, keeps up the commercial communication between Bednore and Mangalore; but we have no particular account of it; 6. The Kordadibol Ghaut (13° 8′) leads from Mangalore and Jamallabad, near the high mountain of Balaroyn Droog (5000 feet above the sea), to Wustara; 7. The Bessely Ghaut (12° 40′) connects Mangalore with Uscottah on the table-land, traversing Bessely, situate at the foot of the northern declivity of Mount Subramani (5611 feet above the sea); 8. The Yallanir Ghaut runs along the southern declivity of Mount Subramani, between Mariara, the capital of the raja of Coorg, and Mangalore; 9. The Manantoddy Ghaut (11° 45′), through which the road passes, which leads from Tellicherry on the coast to the table-land on the banks of the river Cubany, and hence to Seringapatam. The highest point on this road rises to 3000 feet, and seems to be hardly more than 100 feet higher than the table-land to which it leads.

These mountains, which are merely the broken and abrupt declivity by which the table-land of the Deccan descends towards the Indian Ocean, are entirely covered with thick forests of tall trees, except in a few places where the rocky masses are too steep to permit any accumulation of earth. In all other parts the mountains are covered with a thick layer of earth, capable of maintaining a vigorous vegetation. Many of the trees are very valuable. On the upper parts are forests of bamboo, which grow to the height of trees. Lower down the sandal-wood tree is abundant, and supplies an important article of exportation to China, Japan, &c. The middle of the range is occupied by forests of teak. During the rainy season, when the numerous torrents descending from the mountains acquire a great volume of water, the teak timber is floated down to the several harbours on the coast, especially to Mangalore, and thence to the other ports of Hindustan. On these mountains alone in Hindustan sandal-wood grows (Buchanan), and it occurs only between 12° and 14° N. lat. Cassia and cardamoms are also collected in these forests, but the latter not north of Goa.

The whole of the narrow coast which intervenes between the Western Ghauts and the Indian Sea is sometimes comprehended under the name of Malabar. But properly the northern part of it, as far south as 15° N. lat., is called the Concan; the middle part, between 15. N. lat. and 12° 3°, Canara; and only the southern part, as far as Cape Comorin, is named Malabar. The surface of this narrow tract is never entirely level, except along the sea-shore and to a distance at the utmost of five miles from it. But the low hills which are offsets from the Ghauts frequently approach nearer the sea. The level tract along the sea-shore is covered with sand, and overgrown with cocoa-palms; near the termination of the hills the soil is better, and planted with rice. The sandy coast is indented with numerous small inlets, which during the rainy season are the receptacles of torrents, most of which, as they flow only for a few months, have received no name. The small valleys which lie farther inland between the low ranges of hills are converted into swamps by the abundant rains, but when the water has run off they are cultivated, and give very rich crops of rice. On the sides of the hills which separate these valleys from one another are situated numerous villages, enclosed by extensive plantations of fruit-trees. The top of these ranges of hills is level, but dry and naked.

This coast experiences the full effects of the south-western monsoon, more especially in the southern part. It begins there at the end of May or the beginning of June, but commences somewhat later farther north, and sets in with tremendous thunder-storms. The rain pours down continually for several days in torrents, after which it decreases, and is occasionally interrupted by fine weather for about a month. In July it increases again, and then attains its maximum. It begins to decrease in August, but slowly, more rapidly so in September, and in October the rain and the monsoons depart with thunder-storms. The annual quantity of rain in Malabar amounts to 116 inches, of which 36 inches fall in July; at Bombay it does not exceed 64 inches; and farther north the quantity is still smaller. The mean annual temperature at Bombay is about 80°, but observations on that of Malabar are wanting. The climate of this coast is considered very healthy, notwithstanding the immense quantity of rain and the cultivation of rice.

No kind of grain is cultivated except rice, for the growth of which no artificial irrigation is required, as the soil is saturated by the abundant rains. This country contains a great variety of fruit-trees, especially different kinds of palms; the cocoa-palms cover an immense tract of land along the sea. The sugar-cane is also extensively cultivated. Cattle and buffaloes are the only domestic animals, and both are distinguished by their size. Fowls, geese, ducks, and turkeys are only raised by the Portuguese families which are settled along the coast. Wild elephants are numerous; and also tigers, leopards, hyænas, and jackals.

The whole of this maritime tract, as far south as 10°, is now in possession of the East India Company, with the exception of that portion which lies between 15° and 16°, which is nearly equally divided between the Portuguese and the raja of Sawunt Warree, and the towns of Mahé and Damaun, of which the first belongs to tho French, and the second to the Portuguese. The English possessions north of 16° N. lat. are annexed to the presidency of Bombay, and those south of 15° to that of Madras. Damaun, the Portuguese settlement (20° 22′ N. lat.), which was formerly more important, has lost much of its commerce since the rise of Bombay. It lies nearly halfway between Surat and Bombay, and has a safe harbour for vessels of small size, there being 17 feet water over the bar. Vessels of teak-timber are built here. Farther south (18° 56′) is Bombay [BOMBAY]; on the neighbouring islands of Salsette and Elephanta temples are excavated in the rocks. [ELEPHANTA.] Near Fort Victoria (18° N. lat.) is the town of Bancote, or Bancoot, with 14,000 inhabitants. It has a harbour for small vessels, and carries on a considerable commerce with Punah and Satara. Goa, the Portuguese settlement, is situate about 15° 30′, and consists properly of two towns. [GOA.] Mangalore (12° 50′), which is built on the banks of a salt lake, into which several rivers discharge their water, was destroyed by Tippoo in 1784, but has risen again since it came into the hands of the English. Ships drawing less than 10 feet water can enter the harbour at high tides. The town is thriving, and derives its importance from being situated not far from the Hosso Angady Ghaut and other mountain-passes, by which it carries on a considerable commerce with the table-land of the Deccan. Much teak is floated down from the mountains to tho town. It now contains more than 40,000 inhabitants. [CANARA.] Cananore (11° 52′) is built at tho bottom of a small lake, which is one of the best harbours on this coast. It has some commerce with Arabia and the harbours of Hindustan, and contains about 10,000 inhabitants. Tellicherry (11° 44′), which was long the chief settlement of the English on the coast of Malabar, but is much neglected at present, has about 5000 inhabitants; it has still a considerable commerce in the produce of the country, coir, sandal-wood, cardamoms, pepper, cassia, and cocoa-nuts; shark-fins and salangana-nests are also sent to China. Mahé (11° 42′), the only French settlement on this coast, has a harbour for small vessels, and 6000 inhabitants. It is rather well built, and principally exports pepper. Farther south is the town of Calicut. [CALICUT.]

We pass to the Southern Ghauts, a term not yet in use, but one which ought to be adopted to designate those mountain-ranges which support the table-land of the Deccan on the south, and have only been discovered within the last twenty years. They cover by far the greatest part of the space contained between 11° and 12° N. lat., and 76° and 79° E. long. The western portion of the Southern Ghauts is occupied by the Nilgherry Mountains, which are well known to Europeans resident in India as affording them the climate and productions of Europe at a distance of only 11 degrees from the equator. These mountains are connected with the southern extremity of the Western Ghauts extending between 76° 26′ and 77° 20′ E. long. and between 11° 10′ and 11° 35′ N. lat., so that their length from west to east is more than 60 miles, and their width about half as much. All this space is occupied by one mass of high land, unbroken by ravines or deep valleys. Its surface is not level, but a continual succession of ascents and descents, separated from one another by tracts of level ground. The lowest parts of these level tracts are estimated to have an elevation of from 5000 to 6000 feet. The hills by which they are overtopped are generally not high, but through the centre of this region there runs a more elevated ridge, containing various summits, the highest of which, nearly in the middle of the whole mountain-mass, the Dodabetta Peak, is 8429 feet above the level of the sea. The surface of this region is a fertile soil overgrown with a green sward of grass and several kinds of alpine herbs where it is not cultivated. Only one-thirtieth part of it is under cultivation. The excellent climate on these heights has led to the establishment of several sanatory stations, in which Europeans may re-establish their health, when impaired by a long residence in the hot countries. One of these European settlements is at Utakamund, 7000 feet above the sea, at the foot of the Dodabetta Peak; the other is at Dimhutty, 5785 feet above the sea. The mean annual temperature at Utakamund is 56°, and consequently 28° less than at Madras; that of Dimhutty 64°. At the former place the thermometer sometimes rises to 69°, and has been observed to descend as low as 20°, but only once in 12 years. The changes in the temperature are very slow, and the difference in 24 hours hardly exceeds two degrees. The effect of both monsoons is slightly felt; moderate rains occur all the year round, but more during the south-west than during the north-east monsoon. Frost occurs between September and April, but it is moderate; the thickest ice does not exceed 1½ inch in thickness. Agriculture is limited to wheat, barley, millet, peas, and pulse, to which of late years European vegetables have been added. The fruit-trees of England succeed everywhere, and are frequently seen covered with blossoms and fruits in all stages at the same time. Oranges grow only in the lower districts. No animals are kept, except cattle and buffaloes; sheep, goats, and dogs are found in a wild state. Some very large species of deer are common. Game abounds everywhere. To the south this hilly table-land descends with a steep slope to the Gap of Ponany and the plain of Coimbatore, from which it is divided by the river Bhovany. The deep valley through which the small river Moyar runs along its northern side separates it from the table-land of Mysore. The slopes on all sides are wooded, and it is only here that the animals of the tropical regions, as tigers, leopards, and elephants, are found.

North-east of the Nilgherry Mountains are the central Southern Ghauts, which occupy nearly the whole space between the Cavery and the Bhovany river, an affluent of the former, as far west as 77° E. long. Very little is known of these mountains, which occupy more than twice the space of the Nilgherry Mountains, though a mountain-road leads through the northern part of them, connecting the fortress of Satteagala with the small town of Caverypooram. We only know that this road passes over several high and steep ridges. The mountains in this region rise to a considerable elevation; Kumbetarine Peak, which is a short distance north of the town of Sattimungalum, attains the height of 5548 feet above the sea. To the east of the Cavery river the Southern Ghauts extend eastwards, and their southern declivity approaches the towns of Salem and Atoor; they terminate near the last-mentioned place. It is only their southern border that is known to any extent. On the banks of the Cavery, west of Salem, stands tho Paulamally Peak, which is 4955 feet high. North of Salem are the Sherwaray Mountains, whose highest summit, Mount Mutu (4935 feet) forms a table-land seven miles long and three wide, where Europeans whose health has been impaired seek the recovery of their strength.

The Southern Ghauts are broken through by the river Cavery, which for about one-fourth of its course drains the table-land of the Deccan, for nearly the same space winds between the high mountains of the Ghauts, and for the remainder runs through a level plain. It enters the mountains a little above the fortress of Satteagala, which is built on a rock a little above the cataracts of Sivanasamudra [CAVERY], and in this tract its course is extremely winding between high rocks, which approach so near its banks as not to leave space enough for a road: this part of the river has not been visited by any European. At Caverypooram the river issues from between the mountains, and enters a valley extending to the west of south. Where it receives the Bhovany river it has already entered the plain, and is a large river in the rainy season. For about one-half of its course in the plains it runs in one channel, but below the town of Trichinopoly it divides, and encloses the island of Seringham, famous for its two pagodas and as a place of pilgrimage. Below this island the river again unites for a short distance, and then divides again. The northern arm, called Coleroon, runs in an east-north-east direction, and falls into the Bay of Bengal between Deviacotta and Chillumbrun; but its waters have been so exhausted by irrigating the adjacent fields, that it carries only a small quantity to the sea. The water of the southern arm is employed in feeding a great number of canals which traverse the sandy alluvial plain extending on the coast between Cape Calymere and Deviacotta. The waters of these canals being conducted over the adjacent fields, convert them into one of the most fertile tracts in Hindustan, their crops of rice being only inferior to those of the district of Burdwan in Bengal. The principal of these canals terminate on the shore at Calymere, Negapatam, Nagore, Carrical, and Tranquebar. This extensive country is dotted with villages, each of which has a well-built pagoda, with architectural ornaments in a good style. The towns also are numerous, and each of them has a well-stocked bazaar. The Cavery river receives its principal supply of water from the south-west monsoon and the rain which during its continuance falls on the Western Ghauts. At Caverypooram it begins to rise at the end of May, and attains its greatest height from 13th of July to 13th of August; before the rains of the north-east monsoon set in, its waters begin to decrease, and after the 11th of January they are so low as to be fordable.

The delta of the Cavery and the level country along its lower course in the plain lie in the parallel of the Gap of Ponany, which may be considered as a prolongation of the plain to the Indian Ocean. That part of this plain which extends between the Gap and the delta, or between Trichinopoly and Coimbatore, contains many fertile tracts, some of which are cultivated; but the greatest portion is covered with forests, which however do not exhibit such a vigorous egetation as those in the Gap itself.

The countries extending along the Southern Ghauts and the lower course of the Cavery constitute a portion of the Carnatic, the principal division of the presidency of Madras. The most remarkable places in it are: Coimbatore [COIMBATORE], which is beginning to be a place of importance; Salem, a well-built thriving place, with some manufactures and a good deal of commerce, but unhealthy. Trichinopoly is a fortress built on a rock. Tanjore is a place of great strength. [TANJORE.] Negapatam, formerly a Portuguese and afterwards a Dutch settlement of importance, has lost its trade since it was united to the British dominions (1783). Carrical, a French settlement, built at one of the outlets of the Cavery, which is navigable for small river-boats, has a harbour, considerable commerce, and 15,000 inhabitants. Tranquebar, a Danish settlement, with a harbour, some commerce, and 20,000 inhabitants, is one of the principal stations of the Protestant missionaries in Hindustan. Chillambrum, or Chillumbrum, has an extensive and beautiful pagoda, one of the most antient in India.

The Eastern Ghauts, which separate the table-land of the Deccan from the low and level country extending along the Bay of Bengal, between 12° and 18° N. lat., occupy in width a much larger space than the other Ghauts. South of 13° 10′ N. lat., where their longitudinal direction is south-south-west and north-north-east, their average breadth is not less than fifty miles. Between 13° 30′ and 16° N. lat., where they are called Nella Malla Mountains, and, lying in a general northern direction, occupy the whole space between 78° and 79° E. long., they are probably nearly 80 miles across; between 16° and 18° N. lat. they run south-west and north-east, and here their breadth is probably somewhat less. These mountains consist of a number of mountain-ridges running parallel to one another in their general direction, and this peculiar feature is still more distinctly marked in the Nella Malla Mountains than in the southern portion of the Eastern Ghauts. The longitudinal valleys which separate the single ridges appear to be rather narrow. Their elevation has not been ascertained. It is stated that the most western range of the southern portion, which borders on the table-land about Bangalore, is about 500 or 700 feet above the plain, and may therefore attain an elevation of between 3500 and 4000 feet above the sea. In the Nella Malla Mountains the eastern range is said to be the most elevated; but its highest summits do not seem to exceed 3000 feet. The surface of the whole region is very stony, dry, and exceedingly broken, and presents very few spots fit for agricultural purposes. It is also nearly destitute of trees, with the exception of a few tracts covered with wild date-trees. In many places it is covered with bushes, and affords indifferent pasture-walks; but in general it is almost entirely without vegetation.

Three rivers, originating on the table-land, pass through this mountain-region in transverse valleys, so narrow, that they are, properly speaking, mere clefts. The most southern is the Pann-air, which runs about 250 miles. It enters the mountains between the fortresses of Raicotta and Kistnaghurry, and issues from them near Vaipoore. Its intermediate course is not known. The Pal-air, which flows about 220 miles, enters the mountains to the south-east of Colar, and from this point its course is not known to Antoor, from which place it traverses a fine and well-cultivated valley, passing near Vellore to Arcot. The most northern of these rivers is the Penn-air, whose course extends to 280 miles. It enters the mountains between Ooderpee Droog and Gooty Droog; but at Gandicotta its valley becomes exceedingly narrow, and admits no road along its banks. It enters the low land some distance below Sidhout. Though its course is long, it brings down a comparatively small volume of water, and is of little use for irrigating the low-lands; whilst the Pann-air and Pal-air fertilize the whole country which they traverse.

The mountain-passes through this region are as difficult as those over the Western Ghauts. As the rivers which traverse it flow through very narrow valleys, the roads have been conducted over the mountains. These roads are very little visited, and are nearly unknown, except the great military road which leads from Madras to the table-land. It runs over the plain to Arcot, on the Pal-air, and thence to Vellore, whence it begins to ascend the mountains, and runs to Santghur (1120 feet above the sea). Here it divides into two branches: the northern traverses Vencatagherry (2180 feet) and Pednadurgam (1907 feet), and terminates at Colar, on the table-land: the southern branch leads from Santghur to Kistnagherry, and thence over the Pann-air to Raicotta, whence it passes to Oossoor and Bangalore. The two last-mentioned places are on the table-land. The Malla Nella Mountains are rich in metals; iron is very abundant, and copper and lead are worked in several places. Diamonds are found, especially to the north of the river Penn-air; and most frequently near Cuddapah and at Banganpally, in the neighbourhood of Nandial.

The country which separates the Eastern Ghauts from the Bay of Bengal, and comprehends the central and northern Carnatic, with the Guntoor Circar, has a low sandy beach, from which the surface rises gradually, but slowly, to the foot of the mountains. Arcot, which is nearly 60 miles from the sea, is 490 feet above it. The surface of the whole is nearly level, but towards the mountains somewhat undulating. Near the coast the soil is a mixture of sea-sand and loam, with some remains of marine animals. In some parts it is covered with an efflorescence of common salt in dry weather. Towards the mountains, where the low hills commence, it consists chiefly of a mixture of loam and sand, with a considerable proportion of vegetable mould. This latter kind of soil is very fertile when irrigated, which is partly done by canals from the rivers, and partly by numerous tanks; but the upper part of the hills is dry and sterile. Along the sea-coast the country is less fertile, but produces good crops of rice when the rainy season has been abundant, or where it can be irrigated from tanks. Millet, maize, cotton, and indigo are also raised, with a few leguminous plants. Sugar is cultivated in small quantities. The southern portion, as far north as the lake of Pulicat, is much more fertile than the country which extends between the lake and the river Goondlagama; but the Guntoor Circar, which comprehends the tract between the Goondlagama and the Kistna rivers, is fertile, though perhaps less so than the country south of the lake of Pulicat. This lake appears to owe its existence to the sea breaking through a low sandy beach, and overflowing the land within. It extends 33 miles from north to south, and is 11 miles across in the broadest part. It contains several large islands. It communicates with the sea at three points, but the outlets are extremely narrow and shallow.

The rainy season is later here than on the western coast of the Deccan. When the south-west monsoon (June to August) is in full force, only moderate showers refresh the air and soil. They become more abundant at the end of the south-west monsoon in September, increase greatly in October, and are heaviest in November, when they descend in torrents, sometimes for several days together. The north-east monsoon sets in regularly at the same time. In December the rains decrease, and with the end of the year they cease entirely. During the dry season (from January to June), a few showers only occur. The annual quantity of rain at Madras is about 48 inches. The climate of the Carnatic is very hot. Its mean annual heat is stated to be between 82° and 84° Fahr. On the coast the heat is somewhat mitigated by the sea-breeze, which sets in between ten and eleven o'clock; but at a distance of from 10 to 12 miles inland this breeze has lost its cooling property by passing over a heated surface of sand. Sometimes the sea-breeze fails altogether, and then the thermometer rises to 130° in the shade.

The Carnatic, or the low country extending from Cape Comorin to the river Goondlagama, constitutes the main body of the presidency of Madras. Though exposed to a heavy surf from the sea, which renders landing very difficult and dangerous, and though destitute of harbours, it has been for a long time the favourite country for European settlements. The whole country is now under the dominion of the English, the Danes having preserved only their settlement at Tranquebar, and the French the towns of Carricall and Pondicherry. The towns of Madras, Arcot, Conjeveram, and Cuddalore are noticed under their respective articles. Near the small town of Sadras, 47 miles south of Madras, are the ruins of an extensive town, cut in the rock, called Mahâmalaipuram, or the Seven Pagodas.

The river Kistna or Krishna originates on the eastern declivity of the Western Ghauts. All the waters collected on the eastern side of that range, between 13° and 19° N. lat., unite successively in its channel. The source of the river, which is called Kistna, is near 18° N. lat., between Poonah and Satara, hardly more than 30 miles from Fort Victoria on the coast of Concan. The river runs for more than 100 miles south-south-east, receiving numerous small streams from the west, among which the Warna, which separates the territories of the rajas of Satara and Colapore, is the most considerable. Afterwards it flows south-east, and its waters are increased by the two rivers Gatpurba and Malpurba. The remainder of its course on the table-land is nearly east, with some great bends towards the north and south. Here it receives from the north the Beema, whose farthest branches rise north of 19° N. lat., and whose winding course through the table-land probably exceeds 300 miles. Where the Kistna approaches the Nella Malle mountains, it is joined from the south by the Toongabudra, whose upper branches, the Toonga and the Budra, originate near 13° N. lat. After entering the mountain-region it forms some considerable cataracts near Timoracotta, and rushes between Warapilly and Kondapilly through a narrow chasm in the mountains. Below Kondapilly it flows south-south-east through a low plain, in which it divides into several arms, embracing a small delta. Its whole course is about 650 miles. On the table-land, as well as in the low plain, the surface of the water is from 20 to 30 feet below the adjacent land, and consequently it cannot be used to irrigate the fields. This river brings down a comparatively small volume of water, and is not navigable in any part.

The mountain-region between the Kistna and Godavery, which separates the table-land of the Deccan from the low tract along the coast, and which may be considered as a continuation of the Nella Malle mountains, occupies nearly 60 miles from west to east. On the Kistna it begins in the neighbourhood of Timeracotta, and extends to Kondapilly; on the Godavery, its western border is at Mahadeopoor, near 80° E. long., whence it extends eastward to the east of Polenshaw (near 81°). We are almost entirely unacquainted with the character of this region. It seems however that the mountains are of inconsiderable height towards the Godavery, whose course is not interrupted by rapids and cataracts, like that of the Kistna. In these mountains, and near the banks of the Kistna, in the neighbourhood of the town of Kondapilly, are the diamond-mines of Mallavilly. They belong to the Nizam of Golconda, though they are situated within the British territory.

The low country between the lower course of the rivers Kistna and Godavery comprehends the Circar districts of Kondapilly and Ellore; and Rennell properly compares it with the delta of the Nile, though it is somewhat smaller. A considerable portion of it is annually inundated by the lake of Colair, which is a freshwater lake, situated in a deep depression, nearly in the centre of the low tract. It is about 24 miles long, and half as wide in the broadest part, and is connected with the Godavery and Kistna by channels which in the dry season contain no water, but from July to September convey a portion of the water of these rivers to the lake, which is then filled, and inundates the adjacent country, when it becomes from 40 to 50 miles long. During the dry season the water is conveyed by means of canals to a considerable distance from the lake. The lake covers 200 square miles, and contains fifteen islands, which, as well as the neighbouring country, are fertilized by the deposit of mud brought down by the rivers. The superfluous water is carried off by the river Oopatair, in which the tides ascend to the lake, but are prevented from entering it by embankments. This river is navigable for small vessels, and of great use for the export of produce. The soil of the whole tract is the black cotton ground, mixed with a rich vegetable mould. Besides rice, a great quantity of javary (*Holcus sorghum*) is raised. This tract, like the other Circars, is annexed to the presidency of Madras, and contains the large commercial town of Masulipatam.

The Godavery, the largest river of the Deccan, rises in the most north-western corner of the table-land, north of 20° N. lat., between the town of Nassuck and the fortress of Chandore, about 60 miles from the Indian Ocean. It flows about 150 miles east-south-east without receiving any great tributary; it then winds through the plain in a general eastern direction for 250 miles more, and in this space it is joined by the Manjera river from the south, and by the Poorna and Whurdha from the north. The Whurdha is a considerable river, which, together with its tributaries, drains a great extent of country extending along the southern declivity of the Northern Ghauts and the elevated table-land of Omercuntuc, between 76° and 80° E. long. Its principal affluents are the Pain Ganga from the west and the Bain or Wyne Ganga from the north. The last-named affluent receives the Nag Nadi, a small river, on which the town of Nagpoor, the capital of Berar, is built. After the junction with the Bain Ganga, the Whurdha is called by the natives Pranhceta, but the Europeans give it the name of Whurdha up to its junction with the Godavery. After this junction the Godavery is a mile wide, but at the end of the dry season it has only 15 inches of water. Soon afterwards it enters the mountain-region by the strait of Muticotta, near Mahadeopoor, and issues from it below Polenshaw. In the low country it is 4 miles wide, and has a great volume of water, but soon divides into two branches, which include a small delta. Where it approaches the sea it divides into many more branches, in which the tide ascends to some distance, and which admit vessels of considerable burden. On the most northern of these arms is the harbour of Coringa, the only smooth water on the coast between Cape Comorin and the Hoogly during the south-west monsoon. This is owing to Godavery Point, which projects to the northward and breaks the swell. A bar of mud lies across the entrance, through which ships must be forced. Coringa is a place of considerable traffic. The course of the river Godavery exceeds 700 miles, and as it presents no obstacles to navigation, it is thought that a water-communication might be established between Coringa and Nagpoor by means of the Godavery, Whurdha, Bain Ganga, and Nag Nadi, at least for some months in the year.

The north-eastern portion of the Deccan, extending along the Bay of Bengal, between the mouth of the Godavery and the Bay of Balasore, and from that coast westward into the interior, presents features very different from those of the remainder of the peninsula. Along the banks of the Godavery, from the neighbourhood of the town of Rajamundry as far inland as the junction of the Whurdha with the Godavery, high lands come close to the bed of the river, and only in a few places recede to the distance of some miles. When seen from the river they appear like a continuous mountain-range, with an elevation which probably nowhere exceeds 2000 feet. Along the western border of this region another tract of high land skirts the course of the Bain Ganga on the east, passing near the town of Wyragut, which remains on the west of it. This chain is very little known as to its elevation and width; but it seems to continue northward until it joins the table-land of Omercuntue, between 80° and 81° E. long. It must be considered as the natural boundary of the table-land of the Deccan in this part, which table-land to the west of it is not more than 1000 feet above the sea. Another range of high land runs along the Bay of Bengal, between 20 and 60 miles from the shore, beginning near Rajamundry on the Godavery, and terminating at the lake of Chilka, near 20° N. lat. It rises from 600 to 1200 feet above the sea. The whole tract of country included by these high lands, and extending as far north as 20° N. lat., must be considered as unexplored ground, having never been visited by Europeans, partly on account of the difficulties which the steep mountains oppose to such an attempt, and partly because the whole of it is inhabited by a race of barbarians, who are not inclined to permit the visits of foreigners. This people are called Gonds or Goands, and this extensive tract of country is called from them Gondwarra or Gandwana. It is only known that the whole surface of Gondwarra is covered with mountains and very thickly wooded, which latter circumstance distinguishes this tract from the Eastern Ghauts. The British government and the raja of Berar are considered as sovereigns of this country in nearly equal parts, but the authority of both is only nominal. The low tract however along the sea-coast which skirts the Gondwarra on the east belongs to the British, and is annexed to the presidency of Madras. It comprehends the Circars of Rajahmundry, Vizapatam, Cicacole, and Ganjam. [CIRCARS.]

The mountainous country of Gondwarra extends between 82° and 83° 40′ E. long., farther northward, even to 21° 40′ N. lat., but here it does not fill up the whole space between the Circars and the basin of the Godavery; for between this projection of the mountains and the ridge along the Bain Ganga lies a level country, whose width we are not acquainted with, but which in length from south to north extends from the neighbourhood of Konkeir (near 20° 10′ N. lat.) to Ruttenpoor (22° 20′) about 150 miles. This plain of Ruttenpoor is a fertile tract with fine rivers, tanks, fields, and villages, and produces wheat and other grain in abundance, but rice only in such places as can be irrigated by artificial means. It forms the eastern portion of the territories of the raja of Berar, but is rarely visited by Europeans.

The Mahanuddy, whose upper branches drain this plain, receives its principal supply of water from the unknown mountain-region of Gondwarra, and partly also from the range which skirts the Bain Ganga. It afterwards encircles the mountain-region which projects northward from Gondwarra, and in this part its course is in a wide valley. At Sumbhulpoor, where it is a mile across, it turns southward, but from the junction with the Kobrugur river at Sohnpoor to the sea its course lies to the east. At Cuttack, where it is 2 miles across, it enters a level plain, which is fertilized by its waters. Below Cuttack it divides into three branches, one of which, called the Cajori, runs directly southwards, and passes near the temple of Juggurnaut. The main body of the river, called Chittertola, continues eastward to the sea; and the northern arm, named Betoopa, runs north-east until it joins the Braminy river, and then runs eastward to the sea, into which it falls near Cape Palmyras. The whole course of the Mahanuddy is estimated at 500 miles: it is certainly the most important river of the Deccan, being navigable for vessels of 300 or 400 *maunds* (a maund is 82 pounds) burden as far as Sumbhulpoor, and for smaller river-boats to the mouth of its tributary the Hoostu, a distance of 380 miles. But during the dry season, from January to June, its waters decrease very much. The extent of country which is fertilized by its waters is only inferior to that drained by the Cavery.

The delta of the Mahanuddy extends along the sea from the lake of Chilka (19° 40′ N. lat) to the town of Balasore (21° 30′ N. lat.). The lake of Chilka, which forms the boundary between the Circars and the province of Cuttack, receives its waters partly by one or two channels which branch off from the Cajori, or southern arm of the Mahanuddy. The lake is about 35 miles long and 8 miles wide on an average. It is divided from the Bay of Bengal by a low and sandy tract, which is less than half a mile across. Its mean depth is only from 4 to 6 feet. Its banks are sandy and low, but a range of hills approaches its north-west corner. The islands of this lake are composed of large but rounded pieces of porphyritic granite. A great quantity of salt is prepared from the water of the lake by evaporation. The channel by which its waters are discharged into the sea has been filled up in modern times, and a new channel has been made north of Manickpatam, or Manickaputtun. The lake abounds in fish.

The delta of the Mahanuddy rather resembles that of the Ganges than that of the Cavery, being occupied along the shore by a swampy woody tract. But it is not covered with high forest-trees, like the Sunderbunds of Bengal; its swampy surface is only overgrown by jungle and low bushes, among which few trees rise to a great height. This tract, which extends from 5 to 20 miles inland, is more the habitation of tigers, leopards, wild buffaloes, and crocodiles, than of men. Great quantities of salt, of the finest quality, are made here. The most southern part of the coast, between the Chilka Lake and the Black Pagoda, has a dry sandy soil, and is destitute of trees. Contiguous to this woody tract, but farther inland, lies the fertile portion of the delta, called Mogulbundi, which is generally only from 10 to 15 miles across, but in some places 30 or 40 miles. Though its soil is not of the first quality, it produces, when irrigated, abundant crops of rice, sugar, and tobacco; in the less fertile tract millet is raised. It produces wild dates and mangoes. For particulars as to its climate and towns see CUTTACK. It forms, with the adjacent mountainous country, the province of Orissa, which is annexed to the presidency of Calcutta.

The middle course of the Mahanuddy lies through a valley, which is generally wide and covered with alluvium, and of great fertility, producing rice, wheat, and sugar in abundance, and of the first quality. At Sumbhulpoor this level tract is only 410 feet above the sea. But north-west of the delta of the Mahanuddy, and north of its valley, there spreads out an extensive mountain-region, whose southern declivity forms part of the Deccan, while the northern belongs to the mountain-region of Northern Hindustan. The highest portion of this mountain-tract lies in the line of the table-land of Omercuntue (between 22° and 23° N. lat.), and may be considered as its eastern continuation; whilst the Vindhya Mountains branch off from it on the west in the same direction from east to west. This mountain-tract, north of the valley of the Mahanuddy, seems to be a kind of mountainous table-land, whose mean elevation, according to estimation, is from 3000 to 4000 feet above the sea; while the ridges by which it is traversed, and which here run east and west, rise about 2000 feet higher. It is only at its most eastern extremity that a single range projects from it towards the Bay of Bengal, where it terminates west-south-west of Balasore, under the name of Nelligreen or Nila Ghira (Nilgherry Mountains). The whole region however does not rise abruptly from the plains which lie east and south of it, but gradually; the first ascent varies between 300 and 1200 feet; farther towards the interior it rises higher. Though the ridges which traverse it are numerous, a great portion of the region is occupied by level plains of considerable extent, which are partly covered with high grass and partly cultivated, especially along the foot of the ridges, where the soil is more fertile. As many of these level tracts have no slope, or only a very gentle one, the great quantity of water poured down during the rainy season cannot be carried off, and thus extensive swamps and lagunes, or *djils*, are formed, which however dry up at the end of the dry season. These temporary lakes are used by the inhabitants for irrigation. The climate is not so hot as on the low coast. The thermometer varies in the rainy season between 72° and 80°, in the cold season between 32° and 66°, and in the hot season between 75° and 98°. In the higher places, as in Sirgoojah, it falls in January even to 28° Fahr. The rainy season lasts from June to October, with prevailing north-eastern winds: the quantity of rain which descends in these months must be considerable, as the rivers, which are mere swamps or are entirely without water in the dry season, have then from 15 to 20 feet water. The dry season is divided into the cold and hot, the former comprehending the months between October and April, and the latter those between April and June. At the end of the rainy season the jungle-fever is very prevalent. The productions which are cultivated are chiefly rice and javary, but the greatest wealth of this region consists in its forests, which cover the ridges and valleys, and contain thirteen different kinds of trees useful as timber or for cabinet-work. A considerable portion of the population is employed in preparing these trees for the market, and in floating them down to Cuttack. These forests are inhabited by numerous wild animals, among which are wild buffaloes. Iron-ore is very abundant in this region, and diamonds are found in the tract which separates the valley of the Mahanuddy at Sumbhulpoor from the sources of the Braminy river. This country is a part of the province of Orissa, and annexed to the presidency of Calcutta.

The table-land of the Deccan is separated from the mountain-region of Northern Hindustan by the valleys of the parallel rivers Tapty and Nerbudda. The Tapty rises in the mountain-tract which joins the table-land of Omercuntuc on the south-west, with two branches, the Tapty and the Poorna; the former running west-south-west, and the second due west, till they unite, after a course of about 150 miles, near 76° E. long. The high mountain-range which separates these two rivers, and rises to 4000 feet, is called the Mahadeo Phar; it terminates on the west at their junction, and extends eastward to the sources of the Tapty and Whurdha, a distance of nearly 150 miles. Its average width may be 20 miles. Both declivities of this range are extremely steep, but partly covered with forests. After the junction of the upper branches the Tapty flows in a wide valley between the Sautpoora Mountains, on the north, and the Northern Ghauts on the south, for about 280 miles, until it enters the Indian Ocean by a wide æstuary below the town of Surat. The valley contains a broad tract of level ground along the banks of the river, which is well cultivated in the upper parts, but almost entirely covered with bushes and jungle along its middle course. In its lower course it flows 30 or 40 feet below the adjacent plain, which is covered with a deep black mould of great fertility, but traversed in a very remarkable manner by chasms 30 or 40 feet deep, and frequently several miles long. This plain is in a high state of cultivation. In the upper valley of the Tapty is the town of Burhampoor, situated on a fertile plain; it is of considerable size, though less extensive than formerly, and carries on an active commerce with the countries both to the north and south of it. Not far from the mouth of the river is the great emporium of Surat.

The Nerbudda rises on the table-land of Omorcuntuc, but its sources have not been seen by Europeans, though the temple of Omercuntuc, which is built close to them, is visited by crowds of Hindu pilgrims. It is said to wind slowly over the mountain-plain in a westerly direction until it is precipitated from its steep western declivity not far from the town of Mundlah. Thence it runs in a narrow valley and between masses of rocks with a rapid course past Jubbulpoor, below which town it forms a cataract at Bedaghur. Farther west the valley grows wide, the mountains to the south rise with a gentle declivity, and the river has a less rapid course. Thus it arrives at Hussingabad, or Hoshungabad, where it is 900 yards wide and from five to six feet deep, so as to become navigable for small vessels. It continues to be navigable as far west as ten miles below Chiculdah, near the town of Burwanee (west of 75° E. long.), a distance of between 130 and 140 miles, though there are two rapids in it, the first at Deyri, between Hindia and the island of Mundatta Unka, or Unkar Mandatta, on which there is a famous temple and place of pilgrimage; and the second at Sansadarah, below the town of Mheysir. About ten miles below Chiculdah is the Hurn Pahl (deer's leap), where the river, which at Mundleysir is 1200 yards wide, is narrowed to 200 yards, and basalt-rocks rising from 10 to 12 feet above its usual surface lie across its bed. The water of the river rushes with great violence through three openings. Farther downwards the river is still more narrowed by the rocks, which advance from the mountains on both sides to the water's edge; and thus the river becomes entirely unfit for navigation for a great distance. But about 10 miles above Tulluckwarra it enters the low lands of Gujerat, and is navigable from this place to its mouth for river-boats, a distance of about 90 miles, and for vessels of moderate size half that distance. Below the town of Baroach it forms a wide æstuary. The whole course of the river is about 600 miles. Neither the Nerbudda, nor any other of the rivers of the Deccan that empty themselves into the Indian Ocean, forms a delta at its mouth, as is the case with all the larger rivers which fall into the Bay of Bengal.

The valley of the Nerbudda extends mostly along the southern banks of the river, since the Vindhya Mountains, which enclose it on the north, often advance to the banks of the river or very near them. The upper part of the valley from Mundlah to Hoshungabad is comparatively narrow, and mostly filled up by low offsets from the mountains which lie farther south. When a level tract or a gentle declivity occurs, the surface is covered with a black mould of great fertility, but it is little cultivated, and the forests which cover the adjacent mountains frequently descend to the bed of the river. South of Hoshungabad, at the sources of the Tapty, the mountains take the form of a continuous chain, called the Sautpoora Mountains. This chain at its commencement runs nearly south-west, but by degrees turns westward and continues nearly parallel to the Vindhya Mountains, until it approaches that range, at about 76° E. long., but afterwards it resumes its western direction. These mountains are not very high, their mean elevation towards the east not exceeding 3000 feet, and farther westward they are somewhat lower. But both their declivities are steep, and the mountains are nearly inaccessible. They are rich in iron-ore, which is worked in several places; and at their western extremity, in the mountains of Raj Peepla, are mines of carnelians, which have been noted for their produce from antient times. The central portion of the valley of the Nerbudda from Hoshungabad to the Hurn Pahl, where the mountains approach the banks of the river, is called the valley of Nemaur or Nemawur. In length it extends about 130 or 140 miles, and its breadth varies between 24 and 32 miles. Its surface is undulating, and west of Mheysir nearly level; its soil is very fertile and was formerly well cultivated, but great part of it is now overgrown with jungle, the inhabitants having been obliged to abandon it during the continuous wars of the last century. A great portion of it is now used as pasture-ground. That portion of the valley which is situated between the Hurn Pahl and the issuing of the river from the chasm above Tulluckwarra has not been visited, and is unknown. It seems to be filled up by steep rocks. The lower part of the river runs through the plain of Gujerat. The most considerable places in the valley of the Nerbudda are Jubbulpoor, 1458 feet above the sea, whence a road leads over the Vindhya Mountains through Belhari to Pannah in Bundelcund; Hoshungabad, a large town with good buildings, and an important place for the communication between the plain of the Ganges and the western countries of the Deccan; Mundleysir, or Mundlesir, which, though not large, is an important place, because the most frequented pass leads from it northward over the Vindhya Mountains to Oujein; Mheysir, a little farther west, a large place, with good buildings and a well stocked bazar; and Burwanee, which is the most considerable town in Nemaur, and contains many good buildings and a large palace.

The upper portion of the valleys of the Tapty and Nerbudda are subject to the English, and annexed to the province of Allahabad, under the name of the Ceded Districts on the Nerbudda. The western districts on both rivers belong also to the English, with the exception of a tract in the middle, which is subject to the Guicowar. The British possessions in this part are annexed to the presidency of Bombay, forming a portion of the province of Khandeish, or Candeish. The country between Allahabad and the presidency of Bombay is partly subject to Maharaja Scindia, and partly to other Mahratta chiefs, especially to Holkar.

III.—*The Mountain-Region of Northern Hindustan* has nearly the form of a triangle, whose base is formed by the Vindhya Mountains, skirting the vale of the river Nerbudda on the north, and whose apex is at Rewarree, at no great distance from Delhi, on the Jumna, to the south-west. It contains a table-land of considerable extent, that of Malwa, which occupies its southern portion, and is everywhere enclosed by mountain-ranges, and also a mountain-region, called Uppermal, which extends on the north of the table-land. To these two extensive portions are to be added the peninsula of Gujerat and the island of Cutch, which ought to be considered as detached members of this mountain-region.

The Vindhya Mountains begin on the west between 73° and 74° E. long., about 10 or 15 miles from the north banks of the Nerbudda, with the high hill of Powaghur situated between the town of Dubhooee and Champaneer, and extend eastward along the vale of the Nerbudda. The western portion, as far east as Chiculdah on the Nerbudda, has not the appearance of a continuous range, being frequently broken into isolated groups and presenting many steep summits. So far its width is very considerable, its southern offsets approaching to the very banks of the river, and its northern declivity being intimately connected with the extensive mountain-tract which extends between 73° and 75° E. long. in a north-north-west direction on both sides of the river Mhye, and which unites the Vindhya Mountains with the Aravulli range. East of Chiculdah (near 75° E. long.) the range approaches the river Nerbudda and continues along it like a steep wall, with a broad-backed surface and without summits. Its upper line preserves nearly always the same elevation, and only slight changes are observable in it. On an average, it is about 1700 feet above the vale of the Nerbudda, and hardly more than 2200 feet above the level of the sea. As the table-land extending north of it, where it is contiguous to the range, has an elevation of 2000 feet above the sea-level, the mountainous character of the range disappears on that side. But towards the vale of the Nerbudda its declivity is exceedingly steep, and indented by short transverse cuts, which give to many of its single parts the appearance of projecting bastions: on many of them fortresses, or *ghurs*, of great extent were built, but they are rapidly going to decay. Such are the Vindhya Mountains as far east as the road which connects the town of Bhopal on the table-land of Malwa with that of Hoshungabad on the Nerbudda, and it is only to this portion of the range that the name of Vindhya Mountains is applied by the natives. But the range continues east of the road, with a slight inclination northward, is connected with the table-land of Omercuntuc (between 80° and 81°), and occupies farther east the greatest part of the tract between the Ganges and the river Sone, approaching the Ganges within a short distance between the towns of Mirzapoor and Chunarghur; it terminates on the banks of the Sone between Rotasghur and Sasseram. This eastern portion of the Vindhya Mountains is called by the natives the Kimoor range. It rises from both rivers with a steep acclivity, but its upper surface, where not deeply furrowed by water-courses, is rather a hilly plain, intersected with rocky eminences, and mostly covered with wood; cultivation is carried on in a few isolated spots. It may be, in general, 1000 feet or a little more above the sea-level, and about 700 feet above the plain of the Ganges near Patna.

The roads leading over the Vindhya mountains are few. The most frequented seem to be the following. The most western connects Burwanee in the vale of the Nerbudda with Oujein on the table-land of Malwa, passing the river at Chiculdah, and then ascending the mountains by the bed of a small river to Baug, in whose neighbourhood there are temples excavated in rocks; it afterwards traverses the Tanda Ghaut, and terminates on the table-land at Bhowapoor; whence it continues to Oujein or Oodipoor. Farther east is the Jaum Ghaut, which is more frequented than the others: it is in 22° 23′ N. lat. and 75° 49′ E. long., and rises to 2328 feet above the sea-level: it connects the towns of Mheysir and Mundleysir on the Nerbudda with Mow on the table-land, and thence leads to Indore and Oujein. A third road farther east connects the towns of Bhopal on the table-land with Hoshungabad. Where the Vindhya mountains approach the table-land of Omercuntuc, and the highest parts of the country extend in uneven and hilly plains, a road leads from Jubbulpoor in the vale of the Nerbudda, which is 1456 feet above the sea-level, to Belhari (about 2000 feet), and thence to Lohargong (1248) and Pauna. The Kimoor range is traversed by a road which runs from Chunarghur on the Ganges south through Suctasghur and Bilwanya, and terminates on the river Sone, at the small village of Selpy.

Between the Kimoor range and the mountains which divide the province of Orissa in the Deccan from the basin of the Ganges (between 23° and 24° 30′ N. lat.), extends a mountain-tract, comprehending all the countries between the numerous branches of the Upper Sone and the upper course of the rivers Dummooda, an affluent of the Ganges, and the Shubunrecka, which falls into the Bay of Bengal. A line, beginning on the south at Balasore and running north through Bishunpoor and Nagore to the Rajamahal hills divides this mountain-tract from the plain of the Ganges. Along this line of division lie the extensive coal beds which have recently been discovered in Bengal. This mountain-tract is not entirely covered with ridges, but includes numerous plains of considerable extent and elevation, some of which are fertile and well cultivated, especially along the foot of the ridges. The highest parts of the ridges are estimated to attain an elevation of 4000 feet, and some parts of the plain are as high as 2000. They seem to descend in terraces to the plain of the Ganges. The mountains are generally covered with high trees, useful both as timber and for cabinet-work. The northern portion of this region is occupied by a broad-backed range, called the Goomah Ghauts, or Rajamahal Hills, and sometimes, from a nation inhabiting it, the Pooharree Hills. They are divided from the Kimoor range by the narrow valley of the Sone, near Rotasghur, and may therefore be considered as the most eastern offsets of the Vindhya mountains. Between Boglipoor and Rajamahal these mountains advance so near the Ganges that there is hardly space enough to make a good road along the river. Recently however the East India Company has caused an excellent road to be made between Rajamahal and Colgong, which traverses the narrow pass of Sicligully on the banks of the river. It may be compared with the military roads of the Romans. These Goomah Ghauts have excellent pastures and a fertile soil, but cultivation is much neglected; wheat and barley are raised in no great quantities. The hills are mostly covered with wood, and are very picturesque.

We pass to the table-land of Malwa. The Vindhya mountains constitute its southern boundary. On the north it is enclosed by a chain of mountains, which Malcolm called the Mokundra range, but Ritter prefers the name of Harraouttee range. On its eastern extremity it is connected with the Vindhya mountains, near the sources of the river Sonar, at Chandpoor (79° E. long.). From this point it extends north-west to Saugur, then west-north-west to Seronge and Chuppra, and then westward to Rampoor on the Chumbul, and to Neemuch (75° E. long.), where it is connected with a mountain-region occupying the country south of Oodipoor, and joining the Aravulli range near 24° N. lat., and between 73° and 74° E. long. This range, which probably does not rise more than 500 or 600 feet above its base, is not a continuous chain, being at many places broken through by the rivers, which originate in the Vindhya mountains, and in their northern course traverse the table-land of Malwa, and afterwards force their course through the Harraouttee mountains, where they form numerous rapids and cataracts in the narrow valleys.

The table-land of Malwa extends from Dohud or Dowud on the west (near 74° 20′ E. long.) to Bhopal on the east (77° 20′ E. long.), about 170 miles, and its average width from south to north may be about 80 miles; its area consequently may be estimated at 13,600 square miles, or more than half the surface of Scotland. Malwa is a plain, gently inclined towards the north, with an elevation varying between 2000 and 1300 feet. Indore, near the Vindhya mountains, is 2000 feet high; Oujein, 1640 feet; Barode, near the junction of the Chota Sind with the Chumbul, 1520 feet; and Rampoor, near the Harraouttee mountains, 1276 feet above the sea-level. These towns, which are built on the banks of the Chumbul river, indicate the declivity of the table-land northward. On the plain itself no range of any extent appears: a few hills only occur, which do not rise more than from 100 to 200 feet above their base. Its soil is a black, soft, and rich loam, producing rich crops of rice, Indian corn, peas, beans, &c. Large quantities of sugar-cane, tobacco, cotton, linseed, and sesamum are also raised and exported. Two dye-stuffs, achu (Morinda citrifolia) and safflower (Carthamus tinctorius), are also cultivated on a large scale. But the most important of its productions is opium, of which 350,000 pounds are annually raised, and more than 200,000 exported. The cultivation of this article increases rapidly. There are three seasons. The rain falls during the south-west monsoon, from June to September; its annual quantity amounts to 50 inches. The thermometer never rises above 88°, and at the utmost 90° in the day, and falls in the night to 72°. Towards the end of the rainy season it becomes colder, and then the mean temperature of the day varies between 72° and 79°. The cold season comprehends the months of December, January, and February, during which the thermometer sometimes, though rarely, descends to 28°. During the hot season, from March to June, the north-western winds prevail; they are dry and frequently boisterous.

The thermometer sometimes attains 98°, but the nights are always cool and refreshing. Though the cholera is considered endemic on the table-land of Malwa, it is in general allowed to be a healthy country.

On this table-land are several towns of importance. Near the Vindhya mountains is Bhopal, a large town built near an extensive tank; it is of great antiquity, and carries on some commerce, being situated on one of the great roads which traverse this part of Hindustan. Indore, likewise near the Vindhya mountains, is the residence of the Mahratta prince Holkar. Dhar, once a very large place, has still a population of 38,000. Nearly in the centre of Malwa is Oujein, a very antient town, through which the first meridian of the Hindu astronomers is drawn; it was formerly the residence of Maharaja Scindia, is well built, full of temples and other buildings, and contains 150,000 inhabitants. Bhampoor (24° 31′ N. lat., 75° 50′ E. long.), on the river Chumbul, nearly opposite Rampoor, is a place of great commerce, being situated at the pass of Mokundra, which leads over the Harraouttee mountains to Uppermal; it contains 5000 houses. South of it is the town of Gurrote, with 1200 houses, and in its neighbourhood the temples of Dhumnar (24° 12′ N. lat., 75° 34′ E. long.), which are excavated in the rocks. In the north-western corner of the table-land is Pertabghur, a considerable place, situated on the great road which leads from the table-land to the plain of Gujerat and to Cutch; it is noted for its works in gold.

A line drawn from the last-mentioned town southward to Taundla, and hence to Dohud, marks the western boundary of the table-land of Malwa. West of this line is a mountain-tract, about 50 miles across from east to west, connecting the Vindhya mountains with the Aravulli range. The ridges which cover the greatest part of its surface run south and north, and are mostly connected with the western broken portion of the Vindhya mountains. The valleys between the ridges are not wide, but well watered; yet they are mostly uncultivated. The forests, which nearly cover all the ridges, are valuable for their timber, which consists of much teak and many other timber-trees. This region, called Kauntel, extends westward to the meridian of Lunawarra on the Mhye river.

West of this meridian lies the plain of Gnjerat, with an average breadth of about 45 miles, extending southward to the very banks of the Tapty at Surat, and northward to the river Subermatti, or Sabarmati, which enters the most northern corner of the Gulf of Cambay. It is one of the richest and most popnlous countries of Hindustan, having a good soil, and receiving the heavy rains brought on by the south-western monsoon. It is also well watered, though some of its rivers, especially the largest, Mhye, have furrowed out a deep bed, sometimes 200 feet below the surface of the plain. Rice is nearly the only grain which is cultivated; but the nnmerous villages are surrounded hy extensive plantations of cocoa, mango, and other fruit-trees, and full of tanks, temples, and choultries. The number of large towns is considerable. Among its harbours those of Baroach [Baroach] and Cambay [Cambay] have been noted since the oldest historical times. The latter, which was the seaport of Ahmedabad, has lost much of its importance, but still contains 30,000 inhabitants. In the interior is Baroda, the residence of the Guicowar, with 100,000 inhabitants [Baroda]; and on the banks of the Sabarmati is Ahmedabad, with its extensive ruins, occupying a space of 30 miles in circuit; it still contains a population of more than 100,000 souls. [Ahmedabad.]

The Gulf of Cambay, which divides the plain of Gujerat from the peninsula of the same name, is very difficult of navigation, on account of the violence with which the high tide enters it, and of the circumstance that at low tide the northern portion of it, as far south as 22° 3′, is left entirely dry, with the exception of a channel about three miles wide. If a vessel cannot reach Cambay in one tide, and sticks fast in the mud and quicksand, it is certain to be upset by the next flood-tide. For this reason vessels generally do not go farther with one tide than Gongway, at the mouth of the Mhye river, opposite Cambay, and the second tide carries them into Cambay creek. The violence with which the spring-tides enter the gulf and run up it is compared with that of the bore in the Ganges at Calcutta, and really seems to be still greater. This gulf extends in length about 72 miles, but its width varies between 32 and 8 miles. It is supposed that the depth of the gulf has progressively decreased for more than two centuries past.

At the most northern corner of the Gulf of Cambay, and on the western banks of the river Sabermati, lies a very flat tract, covered with an alluvial soil, which continues in a north-western direction until it meets that part of the Runn which forms the interior of the Gulf of Cutch. This tract is so low, that when the Runn is covered with water, it is likewise inundated, and the peninsula of Gujerat is changed into an island. It is only used as pasture-ground, and may be considered as a continuation of the Runn, which is nothing but a salt-morass, which during the dry season becomes dry in several places; but when the rains of the south-western monsoon set in, it is entirely covered with water, and forms an impenetrable swamp. When the water has been evaporated by the heat of the dry season, the Runn is covered with a layer of salt. This salt-marsh occupies the eastern part of the Gulf of Cutch, as far west as Mallia in Gujerat, but the greatest portion of it extends on the northern side of the island of Cutch, which is separated by it from the sandy desert lying east of the lower course of the Indus.

The peninsula of Gujerat, which is separated by the Gulf of Cutch from the island of that name, and by the Gulf of Cambay from the plain of Gujerat, but connected with the latter by the low swampy tract extending from the most northern corner of the Gulf of Cambay to the Gulf of Cutch, comprehends, according to a rough calculation, an area equal to that of England, or about 50,000 square miles. The greatest part of it is covered with mountains and hills, but a fertile plain extends along its northern shores from 15 to 20 miles inland, and the flat swampy tract along its eastern border continues along the Gulf of Cambay as far south as Bhownuggar. The mountains in the interior are very imperfectly known. They seem to extend in two continuous ridges, of which the northern, called the Mandva mountains, runs nearly north-east and south-west, beginning not far from the low swampy tract on the east, and terminating on the west near the harbour of Poor Bunder: the southern range, called the Joonaghur mountains, runs east and west at a distance of about 30 miles from the southern shores of the peninsula; its offsets however advance to the neighbourhood of the coast, and extend along it from Gopnath Point, at the entrance of the Bay of Cambay, to Puttun, and even farther. This part of the coast is rocky and high, but all the remainder low, and in many places swampy, and especially so between Nuvvee Bunder and Poor Bunder, where several lagunes occur. The mountains do not seem to attain a great elevation, but their declivities are steep. The northern range is mostly destitute of trees, but the southern is well wooded. The whole of the peninsula is well watered, and the rivers, with the exception of those which fall into the Gulf of Cutch, preserve their water all the year round: the Bhunder, which enters the sea at Nuvvee Bunder on the western coast, is even navigable for small river-boats during the greatest part of the year as far as Kotyana. In the lower country which separates the two mountain-ranges several extensive tracts occur which are cultivated, but the best cultivated district is the northern plain, where the common grains of Hindustan are raised in abundance, together with cotton. Here also is the principal commercial town, Nowannuggur, which carries on a considerable commerce with Arabia and the Persian Gulf. It is a large place, and has good manufactures of cotton and many dye-houses. The most western district, called Oka Mundal, is covered with low hills, and separated from the main body of the peninsula by a low swampy tract, similar in its character to the Runn. The most mountainous districts are inhabited by some savage tribes which live by the produce of their herds. The climate of Gujerat is rather mild, and not unhealthy even for Europeans. The highest point to which the thermometer has been observed to rise is 102°; in January it sinks as low as 45°. In December and January eastern and north-eastern winds prevail, and are accompanied by thick fogs, which however disappear at the rising of the sun. Dry and hot winds from the west are general in May and June, after which follows the south-west monsoon with its rains, which are rather abundant. At the most southern point of Gujerat the Portuguese are in possession of the small island of Diu, where there is a good harbour and a fort erected for its protection. It was formerly a considerable place, but has now little or no commerce.

The Gulf of Cutch, which lies between the peninsula of Gujorat and the island of Cutch, grows more shallow as it proceeds east. Large vessels can sail up to Nowannuggur, and small ones only to Jooria; at Mallia it is a swamp. The island of Cutch is only an island during the rainy season of the south-western monsoon, when the Runn enclosing it on the northern side is covered with water. The strong wind forces the sea-water through the Koree or eastern mouth of the Indus into the low plain, but at the same time the rivers which fall into the Runn, as the eastern branch of the Indus, the Loony river, and the Bunnass, which enter the eastern extremity of the Runn, bring down a great volume of fresh water, with which the Runn is partly covered. Those districts which are situated near the mouths of these rivers supply during the dry season much pasture-ground, whilst the remainder is an impassable swamp, or is covered with a saline incrustation. During this season Cutch is separated from the continent of India by a desert. This island extends from east to west about 140 miles; its greatest width is about 60, but in some places not more than 12 miles: its surface may cover about 10,000 square miles, or about the extent of Sicily.

Two ranges of low mountains traverse the island from one extremity to the other. The higher, called the Lunkhi or Lukbi Mountains, is the southern; its width does not exceed 8 or 10 miles, but it is a continuous chain, dry, without springs and destitute of wood, but broken by deep ravines on its declivities. Along the northern shores of the main body of the island there is another range, which constitutes the high coast of the Runn, but it is frequently broken by declivities, and appears in single peaks or in groups. It is connected by some transverse ridges with the Lukhi Mountains. The valleys between these two ranges constitute, with the southern plain, the cultivable portions of the island. The southern plain, which varies in width from 5 to 30 miles, is separated from the sea by a continuous series of sand-hills, which protect it against the fury of the sea during the south-west monsoon; and it seems that the low plain behind these hills is lower than the level of the sea. From the northern side of the main body of the island a remarkable tongue of land projects far into the Runn. It is about 60 miles long, but not more than 10 miles wide on an average. It is called the Bhunnee. Its surface is somewhat raised above the level of the Runn, but not sufficiently high to admit the cultivation of grain. It is consequently only used as pasture-ground for numerous herds of buffaloes and cattle; and the produce of their dairies, the ghee, is one of the most important articles of export from Cutch. The three islands situated within the Runn, Puchum, or Cowra, the most western, Khurur in the middle, and Charar, lying in what is called the Little Runn, farther east, are of the same description. In the last-mentioned island is the town of Sauntulpoor, a place of some trade, the great road between Cutch and Ahmedabad passing through it. Though no active volcano is known to exist at present on this island, a great portion of its surface consists of particles of lava and other volcanic products, and extinct volcanoes have been observed in some places. It is subject to earthquakes, and suffered much by one in the year 1819, in which many hundred persons lost their lives, and the mouth of the river Indus underwent some remarkable changes. The climate of this island, which is traversed by the tropic of Cancer, and is near the rainless region of the globe, is very dry and hot. The south-west monsoon brings rain from June to October, but as this island constitutes the most north-western boundary of its range, the rains are not copious, and it sometimes happens that they do not set in at all. This seems to be the principal reason why the cultivation of the ground is in a very backward state, and the produce not sufficient to supply the scanty population of 400,000 souls. The summers are hot, but the winters rather cold. In the former season the thermometer rises to 106°, and in the latter it sinks to 33°. The prevailing winds during ten months are from the west of the meridian. Respecting the productions and considerable towns see CUTCH. We shall only add, that, towards the northern extremity of the island, an excellent kind of alum is collected, of which nearly 100,000 maunds annually are exported to Bombay and Gujerat, where it is used in the dye-houses with great advantage. The first commercial town is Mandawce. [CUTCH, vol. viiii., p. 243.] The second is Moondra, farther within the Gulf of Cutch; it has 12,000 inhabitants, and a good deal of commerce.

We return to the continent of Northern India. On the north side of the table-land of Malwa, and separated from it only by the Harraouttee Mountains, lies a mountain-region called by the natives Upermal, or mountainous country. Its western boundary is well defined, and protected by the Aravulli range, which runs in a north-north-east direction between 24° and 28° N. lat. and 73° and 76° E. long., beginning on the south, near Edur or Eder, and terminating on the north to the south-west of Rewaree. [ARAVULLI.] The country between this range, the Harraouttee mountains and the Kimoor division of the Vindhya chain, is traversed by several ridges running nearly parallel to the Aravulli mountains. They decrease in elevation and width as they advance eastward, and the valleys which divide them are also comparatively more narrow. This country occupies nearly double the area of the table-land of Malwa.

The Chitore Mountains are nearest to the Aravulli, with whose southern extremity they are united by a kind of mountain-knot, in which the Harraouttee range also terminates on the west. They may be considered as beginning to form a separate range north of Neemuch, near Jawud, whence they proceed in a north-east direction towards Agra on the Jumna, where they terminate near Dholpoor Baree, in the plain of the Ganges, about 30 miles from the banks of the Jumna. Towards the south they are from 40 to 50 miles across, and fill up the whole tract between the Chumbul and the Bunnass rivers. Though of inconsiderable elevation, being only about 600 feet above their base, and 2000 feet above the sea-level, their steep declivities and extremely broken surface oppose great impediments to an easy communication between the two valleys which they separate. Among the difficult roads which traverse this range, the most frequented is that which, near its southern extremity, leads from Jawud to Chitore; and another farther north, which passes from Kotah on the Chumbul, through Boondeo to Jhaipoor on the Bunnass, and to Ajmeer; but the most noted is the mountain-pass of Lakhairi, through which the road runs near the fortress of Indurghur. At a considerable distance from this pass, to the north-east, the range is broken through by a narrow valley, which the Bunnass river traverses in an east and south-east direction, until it joins the Chumbul below Pally. That portion of the range which lies to the north-east of this transverse valley is less steep and broken.

The country between the Chitore Mountains and the Aravulli, which, on an average, is 60 miles across, but towards the north considerably wider, may be considered as a plain with an undulating surface, which becomes hilly towards the north. Its southern portion forms an inclined plain, descending gently to the east. Near the foot of the Aravulli it may be nearly 2000 feet above the sea-level; but on the banks of the Bunnass, which runs along the base of the Chitore Mountains, it is not more than 1500 feet high. The soil is pretty good, and produces wheat, barley, and javary in abundance; opium is also raised. The rains fall from June to September with western winds, and are abundant; but they are preceded by north-eastern winds, which last uninterruptedly for four months, and are extremely hot. During these months all vegetation disappears, with the exception of some evergreens. The northern portion of the plain, north of 26° N. lat., is much less favoured by nature. Its sandy soil gives it the appearance of a desert, from which isolated and strangely-formed rocks rise, generally to an elevation of 300, and rarely to 600 or 700 feet. On the highest of these isolated rocks is the town of Alwur, 1200 feet above the plain. During the winter months the air is cool, and sometimes it freezes during the night, though in the daytime the heat is insupportable. The rains are followed by the hot season, during which the winds blow from the east, and produce great storms. This stormy period generally occupies three weeks between the beginning of February and July, when the sand is raised in such quantities as to hide the sun. With all these disadvantages the climate is healthy, but the country is poor. Its principal production is javary; in a few places indigo, the sugar-cane, and cotton are raised. The most remarkable places in this wide and elevated valley are Oodipoor, the residence of the raja of Mewar, situated towards the southern extremity of the valley between mountains; and farther northward Ummerghur, Bhilwara, and Bunaira, three well-built and industrious towns. Farther north is Ajmeer, with the English military station of Nusseerabad: the town, which lies within the mountain-range of the Aravulli chain, is full of ruins; but it has improved since it came into the possession of the English (1817), and now contains more than 25,000 inhabitants. In the northern districts is the large and well-built town of Jypoor, the residence of the raja of Jypoor.

As to the country south-east of the Chitore Mountains, and between them and the Vindhya range, its western districts are known by the name of Harraouttee, and in the eastern are called Bundelcund. It is a succession of narrow valleys, separated from one another by broad-backed ranges, which, in their upper parts, extend in uneven plains. The only low and level plain of any extent occurs on the eastern banks of the Chumbul, between Kotah and Pally, where the river Parbutty joins the Chumbul. In climate and productions it resembles the valley east of the Chitore Mountains. The valleys are narrow, and produce only javary and other more coarse grains, no irrigation being possible, on account of the bed of the rivers being so deep. Cotton plantations however are numerous and extensive. The plains on the mountains, which rise from 1000 to 2000 feet above the sea-level, are still less productive, and mostly covered with bushes of a stunted growth. On the table-land of Pannah, between the Cane and Tonsa rivers, is the town of Pannah, or Punnah, a well-built place, perhaps 1800 feet above the sea, the neighbourhood of which contains the richest diamond-mines in Hindustan. North of Pannah, on the banks of the river Cane, is the town of Bandah, which is well built, has some manufactures, and carries on a considerable commerce, especially in cotton, from the valley south of it. This town is situated where the mountain-region borders on the plain of the Ganges. Another place, in a similar situation, is the fortress of Gwalior, which is built on a rock, having a tolerably level surface of considerable extent, and a steep descent on all sides. At the foot of the rock is the town of Gwalior, which contains 30,000 inhabitants. On the right bank of the Chumbul, in a very mountainous country, is the town of Kotah, the residence of the raja of Kotah, a well situated but unhealthy place. In the plain which extends between the last-mentioned place and Pally is Patun, a thriving commercial town, in which nearly the whole commerce between Malwa and the other parts of Northern Hindustan is now concentrated. In its neighbourhood are magnificent ruins.

All the rivers which traverse the table-land of Malwa and the mountain-region of Upermal fall into the Jumna or the Ganges, their course being north-east. The rivers which drain the western part of the table-land of Malwa with a slow current, break through the chain of the Harraouttee Mountains in very narrow valleys, where they form a series of rapids and cataracts. The largest is the Chumbul, which originates on the northern declivity of the Vindhya Mountains, in three branches, between which the towns of Dhar, Sagore, and Indore are built: it receives a great portion of the drainage of the table-land before it leaves it, and enters the Harraouttee range between Rampoor and Bhampoor. It then runs in a narrow cleft as far north as Kotah, and as there is no level land along its banks sufficient for a road for beasts of burden, the great thoroughfare in this part of India traverses the Harraouttee Mountains by the pass of Mokundra, which is some distance east of the Chumbul, and which keeps up the communication between the thriving commercial towns of Bhampoor in Malwa and Patun in Upermal. In the plain below Kotah it is joined by other rivers, especially the Newuj and Parbuttee, which bring to it the waters of the eastern districts of Malwa, and likewise traverse the Harraouttee Mountains in narrow glens. The Chumbul begins to be navigable only a short distance above its junction with the Jumna, which takes place between the great towns of Etawah and Calpee, after a course of about 400 miles. The other rivers of Upermal, the Sinde, Betwah, Cane, and Tonsa, which fall likewise into the Jumna, with the exception of the Tonsa, which empties itself in the Ganges, are all full of cataracts, cannot be used for irrigation, and are only navigable a short distance above their respective mouths. The most eastern of the rivers of the mountain-region of Northern Hindustan, the Sone, rises on the eastern declivity of the table-land of Omercuntuc, south of 23° N. lat., and near 82° E. long. It skirts that table-land on the east, flowing in a north-north-western direction to 24° N. lat., where it suddenly turns to the east-north-east, in which general direction it continues until it joins the Ganges above Patna. Its course is in a narrow valley as far as Ratasghur, below which fortress it enters the plain of the Ganges and becomes navigable.

The mountain-region of Northern Hindustan is for the most part in the possession of native princes. The British have however annexed the countries south of the Sone to the presidency of Calcutta, and the tract between the Sone and the Ganges to Allahabad. Between the territories of Calcutta and Allahabad the possessions of the raja of Rewah are enclosed, which comprehend a tract of mountainous country on the Upper Sone and on the Tonsa. The remainder is divided between the Mahratta princes, Scindia, Holkar, and the Guicowar, and the Rajpoots. The Rajpoots were formerly in possession of the whole of Upermal, including even Bundelcund, which country therefore frequently is called Rajastan, or Rajpootana; but as the Rajpoots extended and still extend their dominions on the western side of the Aravulli range over a great portion of the desert lying between the mountain-region of Northern Hindustan and the banks of the Indus river, the name of Rajastan is applied also to these countries. The Rajpoot princes of Oodipoor and Jypoor, with the raja of Kishnaghur, have their principal possessions in the flat country between the Aravulli and Chitore ranges; whilst the raja of Kotah is in possession of a considerable part of Harraouttee, and in Bundelcund are several small rajas, called the princes of Bundela. The remainder of these two countries, with by far the greatest part of Malwa, belongs to Maharaja Scindia. A small portion of Malwa is in the possession of the raja of Bhopal and the Mahratta chief Holkar. The plain of Gujerat is divided between the English and the Guicowar, a Mahratta chief, who also possesses nearly the whole of the peninsula of Gujerat. The English territory in this part is annexed to the presidency of Bombay. The island of Cutch is subject to the raja of that name.

IV. *The Plain of the Ganges.*—The Ganges, or Ganga, rises with its two principal branches in the highest elevation of the Himalaya Mountains, near 31° N. lat. and between 78° 30′ and 80° E. long. The most western branch, whose remotest sources lie on both sides of the mountain-pass of Gangtang Ghaut [HIMALAYA], is called Bhaghirettee. Between the higher masses of the Himalaya its general course is south-south-west, in a very narrow valley; but where it enters the lower mountains it turns south-east, and after passing Tiri, the capital of Ghurwal, it meets the other branch, the Alakananda, at Deoprang, or Deva Prayaga. This other branch, the Alakananda, rises in the immense snow masses which cover the Himalaya range near the mountain pass of Manah Ghaut, and flows south-south-west until it joins another mountain-stream, the Douli, which comes down from the Neetee Ghaut. After their junction at Josee Muth, which is still 6300 feet above the sea, the Alakananda flows in a west-south-western direction past Sireenaggar to Deoprang. The river formed by the junction of the Bhaghirettee and Alakananda is called the Ganges. Its course within the region of the Himalaya Mountains is not long, but very winding, until it entirely leaves it below Hurdwar, and enters the plain of the Ganges. The surface of the river at this point is hardly more than 1000 feet above the sea-level. The length of its course, including the Alakananda as the longer branch, does not fall short of 150 miles. In the plain it continues its course for a considerable distance due south, or nearly so, until it begins to decline imperceptibly to the south-south-east, in which direction it flows to its junction with the Jumna at Allahabad. In this part of its course, of more than 400 miles, it receives no considerable affluent, except the Ram Ganga, which, with its principal tributary, the Kosila, originates in the lower portion of the Himalaya range, runs south-south-east, and joins the Ganges above Canoge. The Jumna, or Yamuna, which joins the Ganges at Allahabad, rises west of the Ganges within the more elevated masses of the Himalaya range in two branches, of which the eastern soon takes the name of Jumna, whilst the western is called Supin, or Tonse. They unite near Kalsi, within the lower range of the Himalaya, and soon afterwards leave the mountain-region above Khiderabad. In the plain the surface of the river is about 1200 feet above the sea-level. Its course is parallel to that of the Ganges, being first south and afterwards south-east. By degrees it approaches nearer to that river until it joins it at Allahabad, at the Deva Prayaga. Its course within the mountains does not perhaps exceed 120 milos; but in the plain it runs nearly 150 miles more than tbe Ganges up to their junction. Though its waters during its course are increased by those of the mountain-region of Nortbern India, tbe Chumbul, Sinde, Betwah, and Cane, yet at the point of their confluence the Ganges is much larger, being a mile across, while the Jumna is only 1400 yards.

From Allahabad to below Boglipoor, situated at the foot of the Rajamahal hills, the Ganges runs with a winding course eastward, and in this part of its course it receives a great number of large streams. The Goomtee, rising near the foot of the Himalaya range, runs through the plain past Lucknow and joins the Ganges between Benares and Ghazepoor; its numerous bends have given it the name of Goomtee, which signifies 'the winding river.' Above the town of Chupra the Ganges is joined by the Gogra, the largest of its affluents from this side: it rises far within tbe highest portion of the Himalaya range near tho mountain-pass of Taklakot, and passes Fyzabad and Oude. Its course is hardly less than 600 miles, which is equal to that of the Rhine. Opposite Patna, near Hageepoor, the Ganges receives the Gbandaki Ganga, or Gunduck, wbose farthest source lies near the Mastang Pass, on the table-land of Tibet, and it is not much inferior in length to the Gogra. Farther down the waters of the Ganges are increased by those of the Bagmutty, which rises on the southern declivity of tbe higher Himalaya cbain, passes near Khatmandu, the capital of Nepaul, and entering the plain, changes its soutbern into a south-eastern course. Nearly opposite Boglipoor the Coosy falls into the Ganges, wbose farthest branches seem to originate on the table-land of Tibet, and whicb, like the Ghandaki Ganga and the Gogra, brings down the waters of a considerable area of the mountain-region of the Himalaya. At Sicligully, about 30 miles below Boglipoor and 10 miles above Rajamahal, the Ganges having passed the hills, which here approach its bed, turns soutbward, and here the great delta of the river may bo considered to begin. Though it does not at present divide at this place, it is evident that its waters formerly did, and that one arm passed near the extensive ruins of Gour, which at present are five miles distant from tbe river. At present the first bifurcation of the Ganges takes place at Sooty, about 20 miles below Rajamahal. Tho name of Ganges, or Ganga, continues in the eastern arm; the western is called Bhaghirettee by the natives, and Cossimbazar by the Europeans. The Ganges flows soutb-east, and the Bbagirettee south. The former divides again about 40 miles lower down, near Jellinghy, from wbich the western branch is called the Jellinghy river. It flows mostly in a southern direction, and joins the Bbaghirettee near Nuddea. The island thus enclosed is called the Cossimbazar Island. Another arm branches off from the Ganges a few miles from Jellinghy. This arm, called the Matabunga branch, runs likewise southward with many largo bends, and joins the Bhaghirettee nearly at an equal distance between Nuddea and Hoogly. After the junction of these three arms of the Ganges, the western branch of the Ganges is called the Hoogly, under which name it passes Calcutta and reacbes the Bay of Bengal near the island of Sagor. The principal branch of the Ganges, continuing its course to the south-east, sends off anotber arm near Custy, or Custea, whicb is called the Chundna river, and passes near Comercolly. The fifth great bifurcation takes place at no great distance lower down, near Maddapoor, and here the smaller or western branch is called the Gurroy river. These two great branches, the Chundna and Gurroy, unite again near Colna, and hence proceed southward to the Bay of Bengal under the namo of Boirub, or Horingotta river, which, like the Hoogly, forms a wide æstuary at its mouth. Whilst the Ganges loses a great deal of its waters by sending off so many large branches, besides several smaller ones, it receives new supplies from the Himalaya range and the Brahmapootra. The Mahanada and tho Teesta, wbich both run from 250 to 300 miles, rise on the southern declivity of tbe higher Himalayas in Nepaul and Bootan, and run southward. Tbey communicate by several branches with one another during the rainy season, but they join the Ganges at different points,—the Mahanada near Nabobgunge, and the Teesta below Jaffiergunge. At the last-mentioned place tbe Ganges receives the first supply of water from tbe Brahmapootra by the branch called the Jenye, which leaves its principal stream opposite the town of Sheerpoor, is very deep, and brings down a great volume of water. Where the Ganges is increased with the waters of the Jenye it divides again, and its eastern branch, called the Booree Ganga, passes Dacca at no great distance, and enters the wide bed of tbe Brahmapootra below Nurain-gunge. The Booree Ganga receives three other navigable branches of the Brahmapootra, the Bangs, or Bungs, the Banar, and the Lukbya. Tbe last is the most important, and joins the Booree Ganga near Nurain-gunge; it is joined higher up by the Banar. The Brahmapootra is so much drained of its waters by these different offsets tbat during the dry season it is not navigable between Sheerpoor and the moutb of the Booree Ganga. The principal branch of the Ganges flows nearly parallel to the Booree Ganga and tbe Brabmapootra, but falls into tbe sea by a separate embouchure between the continent and the island of Deccan Shabazpoor. The Ganges runs nearly 1500 miles.

All the affluents of the Ganges rising within the mountain-region of the Himalaya are navigable for smaller or larger river-boats to the very foot of the range for six months and longer. The Ganges itself and all its arms within the delta, and also the Jumna, are navigable all the year round, but not for vessels of the same size. The Bhaghirettee and the Jellinghy branches in the dry season are so shallow that only barges can pass drawing not more tban one foot of water; the Matabunga however admits always boats drawing two feet. The Horingottah river and its branches, tbe Chundna and Gurroy, may always be navigated by vessels of considerable size, and the same is said to be the case with the Jenye and Luckhya brancbes of the Brahmapootra and with the Boorree Ganga. Even before the river divides its waters are not very deep. As far upward as Allahabad it consists of a series of pools divided from each other by shallow tracts, by which navigation is rendered difficult and even dangerous. Above Allahabad numerous shallow places and rapids occur, which impedo navigation during the dry season, but disappear after the river is swollen by the rains. Two swellings of its waters are observed. The first begins in June, and attains its maximum in July or the beginning of August. It is followed by a depression which lasts for three or four weeks, when the waters again rise in September, and attain their maximum in October. The Hoogly can only be navigated as far up as Calcutta by vessels not drawing more than fifteen feet water, and all larger vessels are obliged to remain at the island of Sagor, where the unhealthy climate causes great loss among the crews. The tide at full and change causes a terrible boro in the Hoogly [Bore], and its ascent as far as Culna, and even Nuddea, is very perceptible; but though the bore in the Megna, or Brahmapootra, is said to be still greater, the tide does not ascend farther than the town of Dacca, on the Booree Ganga. In tbe Horingottah branch it is felt as far as Custy, where this river branches off from the principal body of tbe Ganges.

The great plain which is drained by the Ganges and its affluents may be divided into three parts:—the plain of Bengal, which comprehends the delta of the river and the country north of it as far as tbe lower range of the Himalaya mountains; tbe plain of Bahar, which is divided from Bengal by the river Coosy and the Rajamahal hills, and extends as far wost as the confluence of the Ganges with the Jumna; and the plain of the Doab, Oude, and Rohilcund. The first extends lengthwise from south to north, the second from east to west, and the third from south-east to north-west.

The plain of Bengal extends from the mouths of the Ganges to the Himalaya mountains, about 280 miles, and its widtb may perbaps exceed 180 miles; its surface is therefore equal to that of England without Wales. Its western boundary runs from Balasore on tbe Bay of Bengal, through Midnapoor, Bishunpoor, and Nagore to Rajamahal, and thence along the Coosy river to the mountains. On the east its border skirts the Tiporah bills, includes the province of Silhct in the form of a gulf, and follows here and farther north the southern and wostern declivity of the Garrow Hills, until in the meridian of Goyalpore it traverses the Brahmapootra, and attains in that direction tbe Himalaya Mountains. On this side the plain is connected with the maritime low tract of Chittagong and the valleys of Silhet and Asam, which differ considerably in their natural cbaracter from the plain of Bengal.

The Tiperah or Tripurah mountains, which cover a great space between Chittagong and Silhet, seem to form an extensive table-land with an uneven surface, but their interior is entirely unknown. They are probably connected with the mountain-region from which the great mountain-range of Aracan or the Yeomadong mountains run off to the southward. The Garrow hills are the continuation of that range of mountains which skirts the valley of Asam on the south, and is connected with the eastern extremity of the Himalaya range by the Langtan mountains at the sources of the Brahmapootra. The Garrow hills do not rise to a great elevation, their highest summits probably not exceeding 6000 feet above the sea-level; but the Brahmapootra running at their northern declivity is not more than 200 feet above that level. In these hills, at a place called Chirapoonje, north of Silhet, a sanatory station has been established for the presidency of Bengal.

The plain of Bengal comprehends four natural divisions: the Sunderbunds, the country subject to inundation, the country which is not inundated, and the Tarai. The Sunderbunds occupy the most southern part of the plain between the mouths of the Ganges and Brahmapootra, and as far north as the salt water of the sea is carried by the tides. This district extends farthest along the Horingottah branch, where it advances to the neighbourhood of Colna at the junction of the Chundna and Gurroy branches of the Ganges, a distance of 70 miles: the mean width may be about 50 miles. This tract is entirely uncultivated. The soil is extremely swampy all the year round, and overgrown with tall trees, which produce excellent timber; these thickets are inhabited by tigers, rhinoceroses, and other wild animals; while the numerous branches into which the different arms of the Ganges divide within this tract harbour gavials, and contain numerous kinds of fish. The inhabitants are few in number, owing to the great unhealthiness of the country. Their occupations are the cutting down of timber trees, and the preparation of salt from the sea-water, which enters these rivers and canals with the tides. It is only towards the two extremities, along the Hoogly and the principal branch of the Ganges, that some cultivated tracts occur within the Sunderbunds. The district of Backergunge on the last-mentioned river is noted for most abundant crops of rice, though the produce is of inferior quality.

The country subject to inundation comprehends not only what is called the delta, or the country between the branches of the Ganges, but also the country between that river and the Brahmapootra, as far north as 25°. The inundation is not equally spread over the whole surface; it is greatest in the eastern districts, especially where the waters of the Brahmapootra are connected with the Ganges, in which part an immense tract of country is covered for several months with water many feet deep, so that at the end of June the towns and villages, which are built on artificial mounds and protected by embankments, appear like islands. The river has then risen 15 feet above its level in the dry season, but it still continues to rise for several weeks, about 5 inches every day. At Custy, at the bifurcation of the Chundna branch, it rises between 31 and 32 feet; at Dacca, only 14 feet; and farther southward, at Luckipoor, not more than 6 feet. In the Sunderbunds themselves it is not perceptible. In October, when the water rapidly decreases, the country is sown with rice, and the produce of this tract is sufficient to furnish the whole plain of Bengal with this principal article of food. The western districts of the country subject to inundation are only slightly covered with water; and though they likewise produce rice, they are principally covered with plantations of mulberry-trees, especially towards the middle tracts; whilst in the northern parts indigo, sugar, cotton, and tobacco are raised in abundance. The plantations, with which the villages are surrounded, consist of mango-trees, jack-trees, cocoa-trees, and other kinds of palms. The whole of this plain is covered with several layers of alluvial earth, to a depth of 130 or 140 feet, and in spite of numerous attempts, no wells have been made in it. In this alluvial soil the rivers frequently change their course, furrowing new channels through it, and leaving the old channels dry. The banks of the old channels appear like low sandy hills, and these hills, together with the abandoned beds, constitute the waste land of the country, which frequently extends for 8 or 10, or even 15 miles from the present channel of the river. The best cultivated portion of this plain is the island of Cossimbazar, between the Bhaghirette and the Jellinghy branches of the Ganges. [BENGAL.]

The country not subject to inundation lies partly west of the Hoogly, and partly north of 25° N. lat. The district west of the Hoogly is of great fertility, especially Burdwan, which produces grain, sugar, cotton, silk, and indigo, in the greatest abundance and of excellent quality; it is the best cultivated, most populous, and most productive district in India. The country north of 25° N. lat. is fertile and well cultivated in its southern districts, as the lower tracts along the rivers are covered with water during the rainy season; and those which lie higher are partly irrigated by artificial means, and partly used for raising such kinds of grain as do not require irrigation. But farther north large tracts of waste land occur, which are covered with rank grass, reeds, and fern. These sterile tracts increase in number and extent as they approach the Tarai.

The Tarai (*i. e.* the swamp) divides the plain of the Ganges from the lower region of the Himalaya mountains, and extends from the banks of the Brahmapootra along the foot of the mountains to the place where the Ganges issues from them at Hurdwar. But it varies in width and also in its character, narrowing insensibly as it proceeds farther to the north-west. In Bengal it is from 20 to 25 miles across, but towards its north-western extremity only a few miles wide. Its soil is extremely soft, and as its slope is not sufficient to draw off the water of the numerous springs which issue from the mountains, it is converted into a deep swamp of great fertility, which is covered with a vigorous vegetation and large forest-trees. [HIMALAYA.] It is the haunt of elephants, rhinoceroses, wild buffaloes, tigers, monkeys, and other wild animals. But as the exhalations of the decaying vegetable matter and of the swampy ground, united to a great degree of heat, engender the most dangerous fevers, it is very thinly inhabited, and by a very miserable class of people, among whom goître is common. These people chiefly maintain themselves by cutting down the forest-trees, which are sent to Calcutta and other towns in Bengal, where they are used for constructing boats and for building purposes. No part of this tract is cultivated, nor does any portion of it serve as pasture-ground. Farther north, in Bahar, Oude, and Rohilcund, the underwood and the climbing plants disappear, and the ground between the trees is covered only with long coarse grass, which being destroyed by putting fire to it, herds of cattle pasture on the new grass which immediately springs up.

The plain of Bahar, which extends west of the river Coosy and the Rajamahal hills as far as the meridian of Allahabad, is divided by the Ganges into two regions. The southern, or Bahar Proper, has not a great width, being narrowed at both extremities by the Rajamahal hills and the projecting offsets of the Kimoor range. Its surface along the banks of the river is undulating, but farther south it rises into hills. The soil contains more sand than in Bengal, but water is found everywhere at no great distance from the surface, which gives it such a degree of fertility that even the few tracts which are not cultivated display a very vigorous vegetation. No part of it is inundated by the Ganges, which runs 30 feet below its general surface, but its waters present the means of abundant irrigation. By the industry of its inhabitants this country has attained such a degree of cultivation that it resembles a garden, and its crops are not inferior to those which are obtained in the inundated districts with less labour. Its principal products are opium, indigo, rice, and cotton. [BAHAR.]

The country north of the Ganges is called Tirhut or Trihuta. It is an inclined plain, near the Himalaya mountains, about 600 or 700 feet above the sea, and sloping towards the Ganges, where its mean elevation may be about 300 feet. Its surface is undulating, and the districts which border on the Ganges do not differ much from Bahar Proper in soil and cultivation. But about 30 or 40 miles from the river large tracts are covered with forest-trees, especially saul-trees, which increase in extent as the country approaches the Tarai. The great abundance of water which descends in the heavy rains and is brought down by the numerous rivers from the Himalaya, forms extensive lakes, or djils, which render this part of the Gangetic plain nearly as unhealthy as the Tarai, and prevent the extension of cultivation in a country distinguished by an extremely fertile soil. But with all these disadvantages its agriculture is on the increase, as no part of India is better adapted for the raising of indigo. The cultivation of opium is also on the increase. In no part of the great plain is saltpetre obtained in such abundance; indeed the ground seems to be generally impregnated by it. The large forests of saul furnish an article of export.

The portion of the Gangetic plain which extends west of the meridian of Allahabad, and comprehends the Doab, or country between the rivers Ganges and Jumna, together with Oude and Rohilcund, differs considerably from Bahar, and still more from Bengal, in its climate and productions. The soil between and on the banks of the rivers does not differ much from that of Bahar, being sandy and loamy, and having likewise water under it at no great distance from the surface; but it slopes with more rapidity, descending from north-west to south-east from 1200 feet to 300 or 400 feet, and consequently the running water is sooner drained off and the soil is much drier. As the heat of the summer, though excessive, lasts only a short time, and the cold in winter is considerable, the vegetation differs greatly from that of the lower plain. The winter crops resemble those of Europe, consisting chiefly of wheat, barley, oats, and millet, together with peas, beans, vetches; also tobacco, flax, and hemp. The summer crops, which grow during the rainy season, are rice, javary, cotton, indigo, &c. The palm-tree disappears; but the European fruit-trees grow together with bananas, custard-apples, and the fruits which have been transplanted from China. Almonds, peaches, nectarines, pomegranates, figs, and most of the fruits of England are cultivated with success. The number of evergreen trees is small; nearly all trees loose their leaves in December. Forests are rare in this plain, except towards the Himalaya mountains, where the level of the country is lower, and approaches the Tarai, which however is of small width in this part of the plain.

The country which lies to the west of the Jumna, and extends as far as the banks of the Sutlej and Gharra, constitutes the connecting link between the plains of the Ganges and the Indus. It is a level tract; no mountains or even high hills occur in its whole extent. The surface consists of a loose sand, and as the equatorial rains here begin to cease, and the winter rains of the northern latitudes do not extend so far south, it is nearly without cultivation. Where this plain borders on the Himalaya range, it is in some measure watered and fertilized by the numerous small rivers which originate along the declivity of the lower range and a short distance within it; and numerous villages, with some cultivated tracts, occur here. But the small volume of water brought down by these rivers is soon absorbed by the sandy soil, and some of them cease to flow at a distance of about 30 to 40 miles. The remainder unite in one somewhat larger stream, the Gagur, which continues to flow for about 100 miles, and then also is lost in the sand. It is said that it once joined the Indus, and that its antient bed can still be traced. With the decrease of the waters of these rivers the villages become fewer in number and smaller in extent, and the country gradually assumes the dismal aspect of the Indian desert. At the inhabited places fresh water can only be found at a depth of from 50 to 100 feet. Where this country borders on the Indian desert, it is chiefly covered with low sandy hills.

The climate of the Gangetic plain presents still more marked differences than its surface and soil. The rains are brought by the south-west monsoon. It commences in March, but in the beginning affects only the waters of the Bay of Bengal, which are raised by it several feet: the current, which during the dry season runs to Cape Comorin, being then directed to the interior angle of the Bay. This higher level of the Bay lasts to the end of the monsoon in October. The rains set in towards the end of April or in May: they are however not abundant in Calcutta before the beginning of June. In the countries farther east, as Chittagong, Silhet, and along the base of the Himalaya mountains, the abundant rains begin a month earlier, and therefore the rivers which drain these districts inundate the adjacent lands earlier. They are also more abundant than in the western districts of Bengal. At Calcutta the mean annual quantity of rain is 71 to 72 inches, but at Dacca it probably does not fall short of 100 inches. The heat is excessive all the year round, but especially so before the setting in of the rains. The mean annual temperature of Calcutta is 79° of Fahr.; that of the hottest month (May) 86°; and that of the coldest (January) 67°. The thermometer sometimes rises above 100°. The climate of Bengal, especially of the western districts, is not unhealthy for Europeans; but the excessive heat which prevails nearly all the year round gradually enfeebles the constitution. The eastern districts are less favourable to health. The climate changes greatly as soon as the hills of Rajamahal are passed in ascending the Ganges. In Bahar the difference between the hottest and coldest season is much greater. Though we are not acquainted with the fact by meteorological observations, it is certain that the greatest heat is not inferior to that of Bengal; but, on the other hand, in the month of December and January frost is experienced, and fire is kindled in the houses. This difference of cold cannot be ascribed to the difference in elevation of the two countries, as Bahar is only from 200 to 300 feet higher than Bengal. It probably has its cause in the direction of the Rajamahal hills, which break the force of the monsoons; and this conjecture seems to be confirmed by the smaller quantity of rain, which at Benares does not exceed 40½ inches annually. The rains set in here a month later. In June only a few showers occur, and the most abundant rains are in July. In Tirhut however the rains occur earlier, and they are also more abundant, and form the numerous rain-water lakes, or djils, which, with the forests, render that district rather unhealthy, whilst the countries along the banks of the Ganges in Bahar are considered very healthy. Before the rains commence, Bahar experiences strong western or north-western winds, which raise the thermometer considerably, and occasion an intense degree of heat. The difference between Bahar and the Doab, in respect of climate, is not so great as between Bengal and Bahar, though the difference of elevation is greater, a great portion of the Doab being more than 600 or 700 feet above Bahar. The winter months (from November to March) are somewhat colder. In January and February the thermometer sinks below the freezing-point, and stagnant waters are covered with thin ice. In the hot season (from April to June) the temperature rises gradually to 90°, and sometimes even to 105°. The difference between January and June is 68° Fahr. (between 37° and 105°). But both states of the air are of short duration, and do not much affect vegetation. The western districts of the Doab however are visited during the hot season by the scorching westerly winds which come from the Indian desert. The rains are abundant in the districts between the Himalaya mountains and the Ganges, but much less so in those farther west, and very moderate to the west of the Jumna. Farther to the west in the desert country between the last-mentioned river and the Sutlej they disappear entirely, or are only limited to a comparatively narrow tract along the Himalaya range.

The Gangetic plain is the most fertile, the best cultivated, and most thickly inhabited portion of Hindustan. It contains more than one half of all its population, and the number of inhabitants probably exceeds 60 millions. The number of large towns is considerable. The most important in the lower portion of the plain are enumerated with their population in the article BENGAL, and for a description of the largest see CALCUTTA, DACCA, &c. Colna, at the confluence of the Chundna and Gurroy branches of the Ganges, is a rapidly increasing place. In the middle plain of the Ganges, or Bahar, the large towns are also numerous; especially along the banks of the Ganges. Boglipore contains 30,000 inhabitants [BOGLIPORE], and Monghir, a fortress with an equal population, is noted for its manufactures of iron. Farther west, about the mouths of the river Sone and Gunduck, is a very populous district containing the great town of Patna, and near it the large towns of Bankipoor, Hajcepoor, and Dynapoor. Then follow the towns of Chupra, Buxar, and Gazipoor. Benares, farther west, is considered in some respect as the capital of this portion of India. [BENARES.] Between Benares and Allahabad are Chunarghur, a fortress with 15,000 inhabitants, and the great commercial town of Mirzapoor. At some distance from the Ganges on the south is the town of Gayah with 36,000 inhabitants and a famous temple of Vishnu, which is visited by a great number of pilgrims; and not far from it on the Sone is Daoudnaggur, with 18,000 inhabitants. The towns of the Tirhut have not yet risen to importance, but are rapidly increasing with the extension of cultivation in this fertile district. The largest towns are Mullye and Goruckpoor. The northern portion of the plain has from the earliest times been the seat of the most powerful empires in India, and it contains several towns which successively have been the capitals of this country. All of these are situated either on the Ganges or the Jumna. On the first-mentioned river are the antient capitals of Cawnpoor, or Caunpoor, Canoge and Furruckabad. Cawnpoor is still a large town, extending six miles along the river, but it is thinly peopled and the streets are intersected hy large orchards and gardens. Canogo, which once covered a surface equal to that of London, is now of very little importance. Furruckabad has still a population of 70 or 80,000, and is one of the most commercial towns of Northern Hindustan. On the Jumna are the antient capitals of Calpee, Etawah, Agra, Muttra, and Delhi. [Agra; Delhi.] Calpee is still a considerable place, and carries on an extensive trade in cotton. Etawah has also preserved a considerahle population, hut is not otherwise important. Muttra, or Mathura (the Methora of Arrian, *Indic.*, c. 8), is still a large town, and a sacred city, to which great numbers of pilgrims annually resort, as well as to the neighbouring town of Bindrabund. Among the antient capitals of this part of Hindustan, one of the oldest seems to be Hustanapoor, near 29° N. lat. and 78° E. long., north-east of Merut, whose ruins covered a great extent of ground. In the Doah, or country between the Ganges and Jumna, are the towns of Merut and Scharanpoor, which in latter times have risen to some importance. In Oude are Lucknow and Fyzabad. In Rohilcund are Shahjehanpoor with 50,000 inhabitants, Bareilly with 65,000 inhabitants, and Rampoor on the Kosila river, which is said to have a population of 100,000 inhahitants. Hurdwar, which is situated where the Ganges issues from the mountain-region of the Himalaya range, is a place of pilgrimage, and has a considerahle commerce.

The whole of the Gangetic plain is immediately subject to the government of the Company, with the exception of the kingdom of Oude, which occupies that portion of the plain which extends, between 80° and 82° E. long., from the banks of the Ganges to the Himalaya Mountains. Its area may he about 25,000 square miles, or half the extent of England. The British possessions are annexed to the presidency of Calcutta and to Allahabad, the river Sone constituting the boundary between them on the south of the Ganges, and the Gunduck for a great part of its course on the north. The arid plain lying between the Jumna and the Sutlej is possessed hy some chiefs of the Seiks, who are under the protection of the Company.

V. *The Plain of the Indus.*—The Indus, called in its southern course also Sinde, rises on the table-land of Tibet, hut its sources have not heen visited hy Europeans. It is supposed that they are situated at no great distance from the sacred lakes Rawan Hrad and Manas Sarowar, to the north-north-west in 31° 20 N. lat. and near 80° 30′ E. long., on the western declivity of one of the mountain-ranges which traverse the table-land of the south of Central Asia, called the Gangdiari or Kailasa Mountains. Hence it runs north-west passing the town of Ghertope to Leh in Ladakh, and it is called hy the Chinese, in this part of its course, Sing-he-tsiu. After a course of perhaps not less than 250 miles on a table-land from 12,000 to 15,000 feet above the sea, it is joined below Leh hy the Shayuk, which rises at a great distance north-east in the Karakorum Mountains, and prohahly exceeds the Sing-he-tsiu in the volume of water, if not in the length of its course. This affluent of the Indus has not been visited hy Europeans, and indeed it is only that portion of the Sing-he-tsiu which lies between Ghertope and Leh that has heen seen hy European travellers. Nothing is known of the Sanpoo, or Great River, as the Indus is called after its junction with the Shayuk, until it issues from the Himalaya range a few miles east of Attock. In this part of its course it gradually declines more to the west, and traverses the narrow valley hy which the north-western mountain-range of the Himalaya, the Gosseie Mountains, are separated from the elevated mountain-masses of the Hindu Coosh. Above Attock its course lies due west, and it is joined hy the river of Cahul, the only considerahle affluent which it receives from the west after it has left the mountains. After leaving the high mountains ahove Attock, it continues its course in a south-western direction for about 70 miles more between lower ranges, until at 33° 7′ N. lat. it enters the great plain. This plain however lies almost entirely on the eastern side of the river, as the mountain-ranges which support the table-lands of Afghanistan and Beloochistan accompany the river in its course as far south as 30° N. lat. South of this parallel the plain extends also on the west, hut only to a short distance. The Hala Mountains, which run along the eastern border of the table-land of Beloochistan, rise at a short distance from it, at some places within a few miles.

As soon as the Indus has left the mountains it divides into four arms, which run southward with great bends, and sometimes unite, hut separate again, so that the whole volume of its waters is seldom united in one hed. South of 29° N. lat., near the small town of Mittun Cote, it is joined on the east hy the united rivers of the Panjah, Penjâh, or Punjauh, and changes its southern course to a south-western. It is here 2000 yards wide. It continues its south-western course to Shidelkarpoor and Bukkur, and then turning to the south-east, it reaches Hyderahad, above which town it divides into two arms and encloses a delta. The most eastern of these arms, the Fulaili, passes the town of Hyderahad on the east, and flowing farther down in an east-south-eastern and southern direction, enters the Runn, out of which it flows hy the wide æstuary which separates the island of Cutch from the plains of Sinde. This hranch of the river has only a great volume of water during the inundation; the greatest part of the year it is dry. Where it approaches the Runn, a place called Sindree, with an extensive tract of land in its neighbourhood, was plunged into the water hy the frightful earthquake of 1819, and at present is a large lake, whose waters are discharged into the Koree, or eastern mouth of the Indus. The æstuary of the Koree has 12 feet of water as far as Busta, hut farther inland it is not so deep. The western and principal hranch of the Indus divides again south of 29° N. lat. near Jarruck; the smaller or eastern branch, called the Pinyari, runs nearly parallel to the Fulaili, and loses also a great part of its waters before it reaches the sea hy the mouth called Sir. It is navigahle however as far as Gunda for vessels of 38 tons hurthen, and it is much navigated, though the merchandise must be transferred into small river-boats at Gunda. Below Tatta, and about 60 miles from the sea, the principal hranch of the Indus separates again into two hranches, of which the smaller, called Buggaur, runs westward, and the larger, the Sata, continues in a south-south-western direction to the sea. The last-mentioned hranch is hy far the larger, being, after the hifurcation, still 1000 yards across, and carrying off the greatest volume of water. It divides into seven arms hefore it reaches the sea. The widest of its mouths, the Gora, is only accessible to small vessels on account of its shoals and rapid current. Another of its embouchures, called the Hujamri, lies farther west, and admits vessels of 50 tons burthen, which may sail as far up as Vikkur, more than 20 miles from the sea. The Mull mouth of the Sata, which is to the south-east of the Gora hranch, may be navigated hy vessels of 25 tons hurthen as far up as Shah-Bunder. Vikhur, as well as Shah-Bunder, exports great quantities of rice. The most western of the branches of the Indus, the Buggaur, divides again helow the town of Daraji into two arms, called Pittee and Pieteeanee, both of which are navigahle as far as their point of separation for small vessels. Daraji has some commerce, hut at present these two arms have less water than they had formerly.

The Indus receives only one great affluent in its extensive plain, hut this affluent unites all the rivers which drain the Panjab, or the Five Rivers, the Pentapotamia of the Greeks. These five rivers, enumerated from east to west, are the Sutlej or Satadru (the Zaradrus of Ptolemy), the Beeah or Beas (the Hyphasis of Arrian), the Ravee (the Hydraotes of Arrian), the Chenauh (the Acesines), and the Jhilum or Behut (the Hydaspes). The Sutlej has the longest course. It originates on the tahle-land of Tibet, in some mountains north of the sacred lake of Rawan Hrad, and it is even supposed that this lake discharges its waters into the Sutlej. Its course on the tahle-land, where it flows in some measure parallel to the Sing-he-tsiu, or Indus, amounts to more than 150 miles. At Shipkee, where it enters the territories of Bissahir, it is still 10,484 feet ahove the sea. So far it flows north-west. Changing its course to the south-west, it soon enters the Himalaya range, through which it runs in a narrow valley, with numerous hends, more than 100 miles. It enters the plain, near Ropur, whence it flows due west past Ludiana as far as Hurree, where it is joined hy the Beas. The Beas originates in the Paralasa range of the Himalaya mountains [Himalaya], traverses the mountain-region with two great bends to the south and north, and enters the plain ahove Nadaun after a course of less than 100 miles. Hence it flows west-south-west, gradually approaching the Sutlej, until it joins it. The united river then takes the name of Garra or Gharra, and continuing to flow in a south-western direction, unites with the Chenauh near Ooch, below Bhawulpoor. The

Ravee does not appear to rise in the highest range of the Himalaya, but on one of its intermediate parallel chains, called the Santch Mountains. Its upper course is not known, but it does not seem to be long. Above Kotoa or Kothua it enters the plain of the Panjah, where it flows in a south-west direction parallel to the Beas and Garra, until it joins the Chenaub at Fazilshab. The Chenauh, whose Sanscrit name Chandrabbága (*i. e.* moon-river) was not adopted by the followers of Alexander, because it sounded like Sandaro-phagos (*i. e.* Alexander-eater), rises in the Paralasa range of the Himalaya, near the sources of the Beas and the mountain-pass of Para-Laha, and runs for about 100 miles in a longitudinal valley of the mountain-region to the north-west; it afterwards turns gradually to the west, passes the town of Kishtawar, and inclining by degrees more to the soutb, leaves the Himalaya mountains above Jommu, after a course of perhaps not much less than 200 miles. In the plain of the Panjab its course is west-south-west until it has joined the Ravee, when it declines to the soutb-south-west. The last of the rivers of the Panjab, the Jhilum, rises in the Tibet Panjahl range of tbo Himalaya mountains [HIMALAYA], not far from tho high peaks of Mer and Ser. Like the Chenaub, it flows first in a longitudinal valley of the mountain-region [CASHMERE] in a north-north-west direction, traverses the lake of Wooler, and issues from the valley hy the narrow valley of the Baramule pass. Within the mountain-range it passes near Mozufferabad, up to which place its course is to the west. Soon afterwards it turns by a bold hend to the south, in which direction it reaches tbe plain, where it again takes a western course above Pindee Dader Khan. Its course within the range of the Himalaya exceeds 200 miles. The remainder of its course, somewhat more than 100 miles, is mostly directed towards tbe south, until it joins the Chenaub at Trimo, below Jung. After the five rivers have united, tbey still flow between 40 and 50 miles until they fall into the Indus at Mittun Cote. The natives call the united river Chenaub, but in the other countries of India it is known hy the name of Punjund. All the rivers of the Panjab are in general navigable up to tbe place where they issue from the mountains, and the Indus itself to Attock, hut above that placo tbere is a whirlpool which cannot be passed hy boats.

The northern portion of tho plain of the Indus, the Panjab, or country of tho five rivers, extends from the lower ranges of tbe Himalaya mountains to tbe confluence of the Chenaub with tbe Indus, between 34° and 29° N. lat., and has the form of an isosceles triangle, whose sbortest line, or base, which is about 450 miles in length, lies along the Himalaya, and the equal sides, each about 600 miles, unite at the confluence of the Indus and Chenauh. Its surface may be on an average about 1000 feet above the sea; tbe Ravee at Lahore is 900 feet above it, and 100 feet bigher than tbe Ganges at Delhi. This immense tract of country varies considerably in soil and surface. It contains very fertile and very sterile tracts. Perbaps not moro than one-fourtb of its surface is under cultivation. Tbe country along the foot of tbe Himalaya range, and to a distance of ahout 100 miles from it, has an undulating surface; it is well supplied with water, and has the advantage of more abundant rains, and of a plentiful irrigation. It is well cultivated, and contains a greater portion of cultivated land than the remainder. The Julinder Doab, or country between the Sutlej and Beas, is very populous, and so likewise is the Barri Doab, between the Beas and Ravee as far as Amritsir. But in the Richna and Chinut Doab, hetween the Ravee, Chenauh, and Jbilum, tbe waste lands are more extensive. The remainder of tbe three last-mentioned doabs, or the country west of a line drawn from Hurree at the confluence of the Sutlej and Beas, through Lahore, and hence to Pindee Daden Khan, bas a much smaller portion of cultivated land. It is only found along the rivers to a distance of 5 or 15 miles. This narrow tract is level, and not much elevated above the surface of the rivers, so that it is either inundated when the rivers are swollen, or may easily be irrigated. The villages are commonly built at tho place where the inundation ceases, or the farthest edge of tbe cultivated ground. Those parts of the country which are beyond the reach of irrigation and inundation are considerably more elevated, and tbeir surface towards the Indus is generally covered witb low sand-hills; but hetween the Chenaub and Gbarra it is level, and tho soil is a hard loam. These tracts are not cultivated, and serve only as pasture-ground during and after the rainy season. The soil is extremely dry, and water can only he found at a depth of between 50 and 100 feet, and it is often salt. The cultivated tracts along the rivers are of great fertility. Rice is the principal object of agriculture all over tbe Panjab, hut wheat is also raised in sufficient quantity for the consumption. Other kinds of grain, as javary, gram, and several kinds of legumes, are imported. The sugar-cane is cultivated with great care, and much sugar is made. Wine and different kinds of fruits are produced in many places. The date-tree gives very good fruit south of Lahore. Other fruits are mangoes, guavas, and jamhu, and also those of Europe, as peaches, apricots, figs, pomegranates, quinces, oranges, lemons, almonds, and apples. There is a good hreed of horses in the tracts between the Indus and Jhilum, and there are also good and strong mules reared. Cattle are very numerous, though commonly of small size. Melons constitute the principal food of the lower classes.

We are very imperfectly acquainted with the climate of the Panjab, no series of meteorological observations having yet been made there. In Lahore the maximum of beat in July was 102°, and tbe minimum in January 24°. In Multan it seems to rise still higher; at other places even to 110°. The highest degree of heat is generally accompanied by violent nortb-western winds or tornados, which sometimes occur several days successively, but do not last more than an bour. Rain seems to fall all tbe year round, but not in equal proportions: in July a greater quantity falls than in other months.

The country south of the Panjab is occupied by the great sandy desert of Hindustan, wbicb extends southward to the Aravulli range and the salt-morass of the Runn. Its western border approaches the banks of the Indus, from whicb it is only divided by a fertile tract of land, from 10 to 15 miles in width. But as the Indus is almost always divided into several channels in this part of its course, of which some penetrate farther into tbe country east of it, the cultivated tracts extend in some places to 20 miles and more from its principal channel. This country resembles in fertility and productions tbe cultivated tracts in the soutbern Panjab, hut its seasons seem to he more regular: several months pass without rain, and in others the rains are more abundant.

The Desert of Sinde, or the Thurr, which on the north-east is connected with the sterile country which separates tbe plain of the Ganges from that of the Indus, does not present so dreary an aspect as the Sahara or the deserts of Western Asia. Its surface is covered with ridges of sand-hills, generally extending from soutb-west to north-east. In some places these hills, called *tibas*, are overgrown with coarse grass or low bushes, but tbey cbiefly consist of loose sand witbout any vegetation on it. Even on tbose tibas where grass and bushes grow, this scanty vegetation lasts only for two montbs, and the remainder of the year their surface is bare, and exposed to great changes from the winds. Between these ridges occur some lower tracts, whicb have a bard, loamy, or stony soil, and on these the vegetation lasts much longer. They are however generally of very small extent, and rarely contain a tract whicb can be cultivated; yet tbey are used as pasture-ground for camels and sheep, and for a small race of cattle, tbe only domestic animals which are kept here. Tbese small oases, called *dehris*, are not numerous in the neighbourhood of the Indus, but they increase in number and extent as wo approach the Aravulli range. In the middle of the desert is tbe more extensive oasis of Jessulmer, and along the Aravulli mountains are the still larger oases of Bikanair, Nagore, Jboudpoor, and Sirohi, which contain a considerable extent of cultivated land. Their principal agricultural products aro bajery and javary. A little cotton is raised. No fruit-trees grow, but melons are abundant. Irrigation from wells is impossiblo; soon after the rains, water is found near tbe surface, but at all other seasons only at a depth of 180 feet or even more. In some places it occurs only at tbe depth of 480 feet. A small quantity of rain falls during the south-west monsoon, but sometimes tbere is none. The daily variations of heat aro very great in winter: at two o'clock the thermometer rises to 75°, but at sunrise it is as low as 30°, and tbe water of some lakes is covered with ice. In summer the heat is oppressive.

The desert of Sinde may be considered as extending over the greater part of the delta of the Indus. All the eastern part of the delta resembles the desert in sterility of soil, though its surface is a perfect level, and so low that it is frequently inundated to a great extent. But the water of the Indus does not carry down such fertilizing soil as that of the Ganges. Though the inundated country is covered with grass after the inundation ceases, its soil is not adapted to the production of corn, and it offers only pasture-ground for the numerous herds of cattle, and especially buffaloes, which, as well as their herdsmen, are continually moving from one place to another. Such is the condition of the whole country east of the Sata branch of the Indus, with the exception of a narrow tract along the banks of the river where the fields can be irrigated. A great part of the interior between the Fulaili and Pinyari branches is covered by a salt marsh. The best part of the delta lies between the Sata branch and the Buggaur, where a considerable portion of the country is cultivated and produces rich crops; yet it does not extend over more than one-fourth of its surface. The cultivated lands do not reach the shores of the sea, being separated from them by a broad belt of country covered with bushes and entirely unproductive. The navigation along the delta is very dangerous. The bottom of the sea slopes very regularly from the shore, and at a distance of one mile and a balf from it the sea is only from 12 to 15 feet deep. Farther from the shore are numerous sandbanks, against which the water when agitated by heavy storms breaks with great violence. The spring-tides rise 9 feet in the mouths of the Indus. In the river the tide ascends only 75 miles, and is not perceptible at Tatta. Besides rice, which is the principal object of cultivation, the other dry grains of Hindustan are raised. There are also considerable plantations of sugar-cane; but fruit-trees, except dates, are rare: and timber is imported from the coast of Malabar. Besides cattle, buffaloes, and sheep, the extensive pastures support numerous horses and camels, both of good breeds, though the horses are small. Only a few showers of rain fall during the year, and sometimes none at all. The rising of the river is only caused by the melting of the snow in the Himalaya, and by the rains which fall along its southern declivity. It begins at the end of April, increases up to July, and in September the river returns to its usual bed. The heat is great all the year round. In March the thermometer has been observed to rise to 90°; but the climate is considered healthy.

The plain of the Indus probably does not contain one-tenth of the population of that of the Ganges; and the number of considerable towns is very small. The most populous portion is the Panjab. Its present capital, Amritsir, which has a population of 100,000 souls, is situated in a fertile country, between the Beas and Ravee, and carries on a considerable trade with Cashmere and Tibet. Lahore on the Ravee has 80,000 inhabitants, but its commerce is not so great as that of Amritsir. Mooltan on the Chenaub has 60,000 inhabitants, and considerable manufactures of silk and cotton. These fabrics go to other parts of India, and to Cabul and Persia. The commerce of this place is considerable. In the southern part of the plain of the Indus is Shikarpoor, 32 miles from the banks of the river to the west, near 28° N. lat., a town with an extensive commerce, being situated not far from one of the most frequented roads which leads from the plain of the Indus to the table-land of Persia. Hyderabad on the Indus, the capital of Sinde, contains 20,000 inhabitants; Tatta contains 15,000, and Curachee about the same number. The last-mentioned town, which lies west of the most western arm of the river, has a good harbour, and, like Tatta, carries on a considerable trade. In the Thurr, or desert, are several large towns, as Jessulmer, with 20,000 inhabitants; Jhoudpoor, the capital of Marwar, with 60,000; Palli, a commercial town, with 50,000; Mairta, with 20,000; and Nagore, with 40,000 inhabitants.

The Panjab is subject to Runjit Singh, the great chief of the Seiks, whose dominions extend likewise over the whole of the Himalaya range which lies north of the Sutlej river, including Cashmere. Along the southern banks of the Gharra is Daoudpotra, which is subject to an independent Afghan chief or khan, be resides in Bhawulpoor on the Gharra. The southern portion of the plain of the Indus is possessed by the Amirs or Emirs, the descendents of a chief of Beloochistan, who conquered this country towards the end of the last century; their country is called Sinde. The desert is divided between several Rajpoot princes, who are protected by the East India Company. The principal are the rajas of Bikanir, Marwar, Jessulmer, and Sirohi. Along the northern banks of the Runn lies the small and isolated country of Parkur, which has an independent raja.

People of Hindustan.—The population of Hindustan amounts, according to a probable estimate, to between 110,000,000 and 120,000,000. More than 100,000,000 may be considered as aborigines; for though it is supposed that the Hindus came from another country into Hindustan, this supposition rests on a very slender foundation. The circumstance of their being nearly exclusively in possession of all the districts which are adapted to agricultural purposes renders it very probable that they were the first inhabitants who introduced agriculture into this country.

The aboriginal tribes, besides the Hindus, who are spoken of in a subsequent part of this article, are at present only found in the mountainous parts of the country, where they live chiefly on the produce of the chase and their cattle, though they also cultivate some kinds of grain in the more level parts of the districts occupied by them. Many of them consist of a comparatively small number of families. In the Nilgherry mountains alone five small aboriginal tribes exist even now, the Erular, the Kurumbar, the Gohata, the Buddagur, and the Tudas, and many others are found in the Ghauts. We shall only mention those which occupy a considerable extent of country. These larger tribes are dispersed over the countries which extend on the east between the river Godavery and the plain of the Ganges, and on the west enclose the valleys of the Tapty and Nerbudda. The most widely dispersed of these tribes are the Gonds or Goands. They occupy the whole of the mountains extending from the Circars in a north-western direction over the higher branches of the Mahanuddy river to the table-land of Omercuntuc, which is in their possession, and west of it to the sources of the Tapty and Whurdha. In this immense tract of country they have only been obliged to leave entirely the plain of Ruttunpoor, which extends from that town southward to Konkair, and which is inhabited by Hindus. The Gonds are in a very low state of civilization compared with the Hindus; they live in a state of independence of the governments whose territories they inhabit, and rarely permit foreigners to traverse their country. Their country, as already observed, is called Gondwarra or Gondwana, by which name however at present that part only of their country is generally understood which lies about the table-land of Omercuntuc. The western neighbours of the Gonds are the Bhils, or Bhilla, who occupy the northern Ghauts and the Vindhya range, together with the mountain-region connecting the last-mentioned chain with the Aravulli mountains. Southward they extend to Poonah, and they are also in possession of the northern portion of the Western Ghauts as far south as the parallel of Damaun. They are not more advanced in civilization than the Gonds, though they are more intermixed with Hindus, and less independent of their masters. The neighbours of the Bhils, the Coulies and Ramusis, are dispersed over a comparatively small tract of country. The Coulies occupy the Western Ghauts south of the Bhils, and as far as Bombay, and even farther. They enjoy no independence, are a laborious people, and at Bombay and other places serve as labourers, and especially as porters. Hence porters in Hindustan are commonly called Coulies by Europeans. The Ramusis are dispersed over the Western Ghauts, south of the Coulies, and even partly over the table-land of the Deccan as far as Bejapoor; they are more advanced in civilization, and partly agriculturists. Of the smaller tribes we shall only mention the Puharrees, who inhabit the hills of Rajamahal, and the Katti and Coalies on the peninsula of Gujerat. The Katti, from whom that country has also obtained the name of Kattiwarra, are settled in the mountains which extend over the north-east of the peninsula, and the Coalies in those along the southern coast above Diu. Both tribes are little known, and seem to be in a low state of civilization.

The foreigners settled in Hindustan are partly Asiatics and partly Europeans. The Asiatics have come both by sea and by land. To the former class belong the Arabs, who are very numerous on the coast of Malabar, a circumstance which shows that their commerce with that coast must date from a very early period. There are also some Syrian Christians (Suriani) and Jews settled on the same coast. Some Parsees, or Guebres, are dispersed in the cities on the coast between Bombay and Surat. The Asiatics who entered India by land are chiefly settled in the plains of the Ganges and Indus. They came to these countries with the conquerors, who at several epochs have established their empires here. They are mostly Afghans, and commonly called Patans. Their number is considerable and said to amount to ten millions. But many, if not the greater part of them, are of Hindu origin, as the Mohamedans used to buy children from their parents in times of great dearth for the purpose of educating them in their own creed. In Sinde, and especially in the delta of the Indus, there are many families which emigrated to that country from Beloochistan with the family of the Amirs.

The Europeans in Hindustan are chiefly descendants of the Portuguese, who being rather conquerors than merchants, established themselves permanently in the places where they settled. But they are only numerous along the western coast, where their whole population is said to be two millions, an estimate which however seems exaggerated. Next to the Portuguese the British are the most numerous, but though they are at present in possession of nearly one half of the country, and dictate to more than three-fourths of it, their number is stated not to exceed 60,000.

For statistical details relating to Hindustan see EAST INDIA COMPANY. See also BOMBAY, CALCUTTA, &c.

(Rennell's *Memoir of a Map of Hindustan;* Dr. Buchanan's *Journey through Mysore, Canara, and Malabar;* Lord Valentia's *Voyages and Travels in India;* Malcolm's *Memoir on Central India;* Heber's *Narrative of a Journey through India;* Heyne's *Tracts, Historical and Statistical, on India;* Todd's *Annals and Antiquities of Rajast'han;* Burnes's *Narrative of a Voyage by the River Indus to Lahore;* Burnes's *Travels into Bokhara;* W. Hamilton's *Description of India; Asiatic Researches; Transactions of the Royal Asiatic Society; Transactions of the Geological Society; London Geographical Journal;* Ritter's *Erdkunde von Asien*, iv. 1 and 2, and v.)

Antient India as known to the Western Nations.—Commerce between India and the western nations of Asia appears to have been carried on from the earliest historical times. The spicery, which the company of Ishmaelites mentioned in *Genesis* (xxxvii. 25) were carrying into Egypt, must in all probability have been the produce of India; and in the 30th chapter of *Exodus*, where an enumeration is made of various spices and perfumes, cinnamon and cassia are expressly mentioned, which must have come from India or the islands in the Indian Archipelago. It has been thought by many that the Egyptians must have used Indian spices in embalming their dead; and Diodorus Siculus says (i. 91) that cinnamon was employed by the Egyptians for that purpose. This trade appears to have been carried on by means of the Arabs, who brought the produce of India from the modern Sinde or the Malabar coast to Hadramaut in the south-western part of Arabia, or to Gerra on the Persian Gulf, from which places it was carried by means of caravans to Petra, where it was purchased by Phœnician merchants. A great quantity of Indian articles was also brought from the Persian Gulf up the Euphrates as far as Circesium or Thapsacus, and thence carried across the Syrian desert into Phœnicia. Europe was thus supplied with the produce of India entirely by means of the Phœnicians; but we cannot assent to the opinion of Robertson (*Historical Disquisition on India*) that Phœnician ships sailed to India; for there is no reason for believing that the Phœnicians had any harbours at the head of the Red Sea, as Robertson supposes, but, on the contrary, the Idumæans remained independent till the time of David and Solomon; and in the 27th chapter of *Ezekiel*, which contains a list of the nations that traded with Tyre, we can discover none of an Indian origin; but the names of the Arabian tribes are specified which supplied the Phœnicians with the products of India (v. 19, 22).

The conquest of Idumæa by David gave the Jews possession of the harbour of Ezion-geber on the Red Sea, from which ships sailed to Ophir, bringing 'gold and silver, ivory, apes, and peacocks.' (1 *Kings*, ii. 28, x. 11, 22.) Considerable variety of opinion prevails concerning the situation of Ophir [ARABIA, vol. ii., p. 214); but we are inclined to consider it as an emporium of the African and Indian trade in Arabia. The Arabian merchants procured the gold from Africa, and the ivory, apes, and peacocks from India. The Hebrew words in this passage appear to be derived from the Sanskrit (see Gesenius' *Hebrew Lexicon*, under קוֹף, תֻּכִּיִּים, שֶׁנְהַבִּים). In the troubles which followed the death of Solomon the trade with Ophir was probably neglected; and till the foundation of Alexandria the trade with India was carried on by the Arabs in the way already mentioned.

The produce of India was also imported into Greece by the Phœnicians in very early times. Many of the Greek names of the Indian articles are evidently derived from the Sanskrit. Thus the Greek word for pepper, *pepperi* (πίπερι), comes from the Sanskrit pippalî; the Greek word for emerald is *smaragdo-s* or *maragdo-s* (σμάραγδο-ς or μάραγδο-ς), from the Sanskrit *marakata*. The *bussinê sindôn* (βυσσίνη σινδὼν), 'fine linen' or 'muslin,' mentioned by Herodotus (ii. 86; vii. 181), seems to be derived from *Sindhu*, the Sanskrit name of the river Indus. The produce of the cotton plant, called in Greek *karpaso-s* (κάρπασο-ς), comes from the Sanskrit *karpâsa;* this word we also find in Hebrew (*Esther*, i. 6) *karpās* (כַּרְפַּס); and it was probably introduced into Greece together with the commodity by the Phœnicians. That this was the case with the word cinnamon, Herodotus (iii. 111) informs us. The word cinnamon (Greek, *kinnamômon* or *kinnamon*, κιννάμωμον, κίνναμον; Hebrew, *kinnamon*, קִנָּמוֹן) is not found in Sanskrit; the Sanskrit word for cinnamon is *gudha tvach*, 'sweet bark.' The word cinnamon appears to be derived from the Singalese *kakyn nama*, 'sweet wood,' of which the Sanskrit is probably a translation. We are not however surprised at missing the Sanskrit word for this article, since the languages in southern India have no affinity with the Sanskrit. Tin also appears to have been from early times an article of exportation from India; the Greek word for tin, *kassitero-s* (κασσίτερο-ς), which occurs even in Homer, is evidently the same as the Sanskrit *kastîra*.

It is usually considered that the Greeks obtained their tin, by means of the Phœnicians, from the Scilly Islands or Cornwall; but there is no direct proof of this; and it appears probable, from the Sanskrit derivation of the word, that the Greeks originally obtained their tin from India. The islands Cassiterides however, the position of which was unknown to Herodotus (iii. 115), are supposed to be the Scilly Islands or the peninsula of Cornwall, though their position is not very exactly defined by Strabo (iii. 175). Still there can be little doubt that the 'Cassiterides' to which the Phœnicians from Gades (Cadiz) went for tin, and the Romans afterwards traded for the same commodity, were on the south-western angle of Great Britain.

The western nations of Asia appear to have had no connection with India, except in the way of commerce, till the time of Darius Hystaspes, B.C. 521. The tales which Diodorus relates respecting the invasion of India by Sesostris and Semiramis (i., p. 50; ii. 103, ed. Rhodoman) cannot be estimated as historical facts. The same remark may perhaps apply to the alliance which, according to Xenophon in his 'Cyropædeia' (vi. 2, 1), Cyrus made with a king of the Indians. But in the reign of Darius Hystaspes, Herodotus informs us (iv. 44) that Scylax of Caryanda was sent by the Persians to explore the course of the Indus; that he set out from the city Caspatyrus and the Pactyican country (Pakali?), in the northern part of India; that he sailed down the Indus till he arrived at its mouth, and thence across the Indian sea to the Arabian Gulf, and that this voyage occupied 30 months. Darius also, it is said, subdued the Indians, and formed them into a satrapy, the tribute of which amounted to 360 talents in gold. (Herodot., iii. 94.) The extent of the Persian dominions in India cannot be ascertained with any certainty. The Persians appear to have included under the name of Indians many tribes dwelling to the west of the Indus; it seems doubtful whether they ever had any dominion east of the Indus; and it is nearly certain that their authority did not extend beyond the Panjab.

The knowledge which the Greeks possessed respecting India, previous to the time of Alexander, was derived from the Persians. We do not find the name of Indian or Hindu in antient Sanskrit works; but the country east of the Indus has been known under this name by the western nations of Asia from the earliest times. In the Zend and Pehlvi languages it is called *Heando*, and in the Hebrew *Hoddu* (הֹדּוּ, *Esther*, i. 1), which is evidently the same as the *Hend* of the Persian and Arabic geographers. The first mention of the Indians in a Greek author is in the 'Supplices' of Æschylus (l. 287); but no Greek writer gives us any information concerning them till the time of Herodotus. We may collect from the account of Herodotus a description of three distinct tribes of Indians: one dwelling in the north near the city Caspatyrus and the Pactyican territory, resembling the Bactrians in their customs and manners of life. The second tribe or tribes evidently did not live under Brâhmanical law; some of them dwelt in the marshes formed by the Indus, and subsisted by fishing; others, called Padæi, with whom we may probably class the Calantiæ, or Calatiæ, were wild and barbarous tribes, such as exist at present in the mountains of the Deccan. The third class, who are described as subsisting on the spontaneous produce of the earth and never killing any living thing, are more likely to have been genuine Hindus. (Herodot., iii. 98-105.) Herodotus had heard of some of the natural productions of Hindustan, such as the cotton plant and the bamboo; but his knowledge was very limited.

Ctesias, who lived at the court of Artaxerxes Mnemon for many years, has given us a fuller account than Herodotus of the manners and customs of the Indians and of the natural productions of the country. He had heard of the war elephants, and describes the parrot, the monkey, the cochineal, &c.

The expedition of Alexander into India (ALEXANDER, vol. i., p. 300), B.C. 326, first gave the Greeks a correct idea of the western parts of India. Alexander did not advance farther east than the Hyphasis; but he followed the course of the Indus to the ocean, and afterwards sent Nearchus to explore the coast of the Indian Ocean as far as the Persian Gulf. The Panjab was inhabited at the time of Alexander's invasion by many independent nations, who were as distinguished for their courage as their descendants the Rajpoots. Though the Macedonians did not penetrate farther east than the Hyphasis, report reached them of the Prasii, a powerful people on the banks of the Ganges, whose king was prepared to resist Alexander with an immense army. After the death of Alexander, Seleucus made war against Sandracottus, king of the Prasii, and was the first Greek who advanced as far as the Ganges. This Sandracottus, called Sandracoptus by Athenæus (*Epit.*, i. 32), is probably the same as the Chandragupta of the Hindus. (See Sir W. Jones in *Asiatic Researches*, vol. iv., p. 11; Wilson's *Theatre of the Hindus*, vol. ii., pp. 127-150, 2nd ed.; Schlegel's *Indische Bibliothek*, vol. i., p. 246.) Sandracottus is represented as king of the Gangaridæ and Prasii, who are probably the same people; Gangaridæ being the name given to them by the Greeks, and signifying merely the people in the neighbourhood of the Ganges; and Prasii being the Hindu name, the same as the Prachi (*i. e.* 'eastern country') of Sanskrit writers. Seleucus remained only a short time in the country of the Prasii; but his expedition was the means of giving the Greeks a more correct knowledge of the eastern parts of India than they had hitherto possessed; since Megasthenes and afterwards Daimachus resided for many years as ambassadors of the Syrian monarchs at Palibothra* (Sanskrit, Pataliputra), the capital of the Prasii. From the work which Megasthenes wrote on India later writers, even in the time of the Roman empire, such as Strabo and Arrian, appear to have derived their principal knowledge of the country. The Seleucidæ probably lost all influence at Palibothra after the death of Seleucus Nicator, B.C. 281; though we have a brief notice in Polybius (xi. p. 652, ed. Casaubon) of an expedition which Antiochus the Great made into India, and of a treaty which he concluded with a king Sophagasenus (Sanskrit, Subhagasêna? *i. e.* 'the leader of a fortunate army'), whereby the Indian king was bound to supply him with a certain number of war-elephants. The Greek kingdom of Bactria, which was founded by Theodotus, or Diodotus, a lieutenant of the Syrian monarchs, and which lasted about 120 years (B.C. 256—134), appears to have comprised a considerable part of northern India.

After the foundation of Alexandria, the Indian trade was almost entirely carried on by the merchants of that city; but few ships appear to have sailed from Alexandria to India till the discovery of the monsoons by Hippalus; and the Arabians supplied Alexandria, as they had formerly done the Phœnicians, with the produce of India. The monsoons must have become known to European navigators about the middle of the first century of our æra, since they are not mentioned by Strabo, but in the time of Pliny were well known. Pliny has given us (*Nat. Hist.*, vi. 23) an interesting account of the trade between India and Alexandria, as it existed in his own time. We learn from him that the ships of the Alexandrine merchants set sail from Berenice, a port of the Red Sea, and arrived in about 30 days at Ocelis, or Cane, in Arabia. Thence they sailed by the wind Hippalus (south-west monsoon) in 40 days to Muziris (Mangalore), the first emporium in India, which was not much frequented on account of the pirates in the neighbourhood. The port at which the ships usually stayed was that of Barace (at the mouth of the Nelisuram river?). After remaining in India till the beginning of December or January, they sailed back to the Red Sea with the wind Vulturnus (north-east monsoon); and after entering the Red Sea, met with the wind Africus or Auster (south or south-west wind), and thus arrived at Berenice in less than a twelvemonth from the time they set out. The same author informs us that the Indian articles were carried from Berenice to Koptos, a distance of 258 Roman miles, on camels; and that the different halting-places were determined by the wells. From Koptos, which was united to the Nile by a canal, the goods were conveyed down the river to Alexandria.

We have another account of the Indian trade written by Arrian, who lived in all probability in the first century of the Christian æra, and certainly not later than the second. Arrian had been to India himself, and describes, in a small Greek treatise entitled 'The Periplus of the Erythrean Sea,' the coast from the Red Sea to the western parts of India; and also gives a list of the most important exports and imports. According to his account, the two principal ports in India were Barygaza on the north-western, and Barace or Nelcynda on the south-western coast. To Barygaza (the modern Baroach on the river Nerbudda), goods were brought from Ozene (Oujein), Plithana (Pultaneh), and Tagara (Deoghur). But Barace or Nelcynda seems, from the account of Pliny and Arrian, to have been the principal emporium of the Indian trade. The Roman ships appear to have seldom sailed beyond this point; and the produce of the countries farther east was brought to Barace by the native merchants.

The knowledge which the Romans possessed of India beyond Cape Comorin was exceedingly vague and defective. Strabo describes the Ganges as flowing into the sea by one mouth; and though Pliny gives a long list of Indian nations which had not previously been mentioned by any Greek or Roman writer, we have no satisfactory account of any part of India except the description of the western coast by Arrian. Ptolemy, who lived about 100 years later than Pliny, gives us the names of many towns on the Coromandel coast and the Bay of Bengal, and is the earliest writer who attempts to describe the countries east of the Ganges; but there is great difficulty in determining the position of any of the places enumerated by him, in consequence of the great error he made in the form of the peninsula, which he has made to stretch in its length from west to east instead of from north to south, a mistake the more extraordinary since all preceding writers on India with whom we are acquainted had given the general shape of the peninsula with tolerable accuracy. In addition to which, Ptolemy appears to have derived his information from the Alexandrine merchants, who only sailed to the Malabar coast, and could not therefore have any accurate knowledge of the eastern parts of India, and still less of the countries beyond the Ganges. The Aurea Chersonesus of Ptolemy represents the peninsula of Malacca, on which the port of Zaba was situated, probably in the neighbourhood of Singapore. The Sinus Magnus is considered the same as the Gulf of Siam, and the Thinæ Metropolis is probably Canton. [ASIA, vol. ii., p. 456.] The Romans never extended their conquests as far as India, nor visited the country except for the purposes of commerce. But the increase of the trade between Alexandria and India seems to have produced in the Indian princes a desire to obtain some further information concerning the western nations.

* The position of Palibothra has been much disputed. Robertson places it at Allahabad; but the opinion of Major Rennell, who places it in the neighbourhood of Patna, near the confluence of the Ganges and the Sone, appears more correct. Strabo says (xvi., vol. 6, p. 79, ed. Siebenkees) that it is at the confluence of the Ganges with another river, but he does not mention the name. Arrian (*Ind.* c. 10) says that it is at the confluence of the Ganges with the Erannoboas; this Sir W. Jones remarks is evidently the Sanskrit Hiranyavâha. The Amara Kosha, an antient Sanskrit Dictionary, gives this river as synonymous with Sone. (See Schlegel's *Réflexions sur l'Etude des Langues Asiatiques*, p. 100; *Indische Bibliothek*, v. ii., p. 394; Wilson's *Theatre of the Hindus*, ii., p. 135, 2nd ed.)

We read of embassies to Augustus Cæsar, sent by Pandion and Porus, and also of an embassy from the island of Ceylon to the Emperor Claudius. Bohlen, in his work on the Indians (i. 70), doubts whether these embassies were sent; but as they are both mentioned by contemporary writers, the former by Strabo, and the latter by Pliny, we can hardly question the truth of their statements.

We may form some idea of the magnitude of the Indian trade under the emperors by the account of Pliny (vi. 23), who informs us that the Roman world was drained every year of at least fifty millions of sesterces (upwards of 400,000*l.*) for the purchase of Indian commodities. The profit upon this trade must have been immense, if we are to believe the statement of Pliny that Indian articles were sold at Rome at 100 per cent. above their cost price. The articles imported by the Alexandrian merchants were chiefly precious stones, spices and perfumes, and silk. It has usually been considered that the last article was imported into India from China; but there are strong reasons for believing that the silkworm has been reared in India from very early times. Mr. Colebrooke, in his 'Essay on Hindu Classes' (*Miscellaneous Essays*, vol. ii., p. 185), informs us that the class of silk twisters and feeders of silkworms is mentioned in an antient Sanskrit work; in addition to which it may be remarked that silk is known throughout the Indian archipelago by its Sanskrit name, *Sûtra.* (Marsden's *Malay Dictionary*, under *sûtra.*) Those who wish for further information on the articles of commerce both imported and exported by the Alexandrian merchants, may consult with advantage the Appendix to Dr. Vincent's 'Periplus of the Erythrean Sea;' in which he has given an alphabetical list, accompanied with many explanations, of the exports and imports of the Indian trade, which are enumerated in the Digest, and in Arrian's 'Periplus of the Erythrean Sea.'

We have no further account of the trade between Alexandria and India till the time of the Emperor Justinian, during whose reign an Alexandrine merchant of the name of Cosmas, who had made several voyages to India, but who afterwards turned monk, wrote a work, still extant, entitled 'Christian Topography,' in which he gives us several particulars respecting the Indian trade. But his knowledge of India is not more extensive than that of Arrian, for the Alexandrine merchants continued only to visit the Malabar coast, to which the produce of the country farther east was brought by native merchants, as in the time of Arrian. Alexandria continued to supply the nations of Europe with Indian articles till the discovery of the passage round the Cape of Good Hope by Vasco de Gama in 1498. But the western nations of Asia were principally supplied by the merchants of Basra, which was founded by the caliph Omar near the mouth of the Euphrates, and which soon became one of the most flourishing commercial cities in the East. In addition to which, it must be recollected that a land trade, conducted by means of caravans which passed through the central countries of Asia, existed from very early times between India and the western nations of Asia.

History.—First period: From the earliest times to the Mohammedan Conquest.—The materials for the history of this period are very few and unsatisfactory. The only antient history written in the Sanskrit language which the researches of modern scholars have been able to obtain is a chronicle of the kings of Cashmere, entitled 'Raja Taringini,' of which an abstract was given by Abulfazl in the 'Ayin-i-Akbery.' The original Sanskrit was obtained for the first time by English scholars in the present century, and was published at Calcutta in the year 1835: an interesting account of the work is given by Professor Wilson in the fifteenth volume of the 'Asiatic Researches.' But though this chronicle throws considerable light upon the early history of Cashmere, it gives us little information respecting other parts of Hindustan. The existence of this chronicle is sufficient to disprove the assertion which some persons have made, that the Hindus possessed no native history prior to the Mohammedan conquest; and it may be hoped that similar works may be recovered by the researches of modern scholars. We may also expect to obtain further information by a more diligent examination of the various inscriptions which exist on public buildings in all parts of Hindustan, though the majority of such inscriptions relate to a period subsequent to the Mohammedan conquest. The Brâhmans profess to give a history of the antient kingdoms of Hindustan, with the names of the monarchs who successively reigned over them, and the principal events of their reigns. But their accounts are derived from the legendary tales of the Puranas, a class of compositions very similar to the Greek theogonies; and although these, and especially the two great epic poems, the 'Ramayana' and 'Mahabbarata,' are exceedingly valuable in an historical point of view for the information they give us respecting the religion, civilization, and customs of the antient Hindus, they cannot be regarded as authorities for historical events.

The invariable tradition of the Hindus points to the northern part of Hindustan as the original abode of their race, and of the Brahmanical faith and laws. It appears probable, both from the tradition of the Hindus and from the similarity of the Sanskrit to the Zend, Greek, and Latin languages, that the nation from which the genuine Hindus are descended must at some period have inhabited the central plains of Asia, from which they emigrated into the northern part of Hindustan. Heeren and other writers have supposed that the Brahmans, and perhaps the Kshatriyas and Vaisyas, were a race of northern conquerors, who subdued the Sudras, the original inhabitants of the country. But whatever opinion may be entertained respecting the origin of the Hindus, it is evident that the Hindus never regarded the southern part of the peninsula as forming part of *Aryavarta*, or 'holy land,' the name of the country inhabited by genuine Hindus. Aryavarta was bounded on the north by the Himalaya, and on the south by the Vindhya mountains (*Manu*, vi., 21-24); the boundaries on the east and west cannot be so easily ascertained. In this country, and especially in the eastern part, there existed great and powerful empires at least a thousand years before the Christian æra (the probable date of the Ramayana and Mahabbarata), which had made great progress in knowledge, civilization, and the fine arts, and of which the antient literature of the Sanskrit language is an imperishable memorial. According to Hindu tradition, two empires only existed in the most antient times, of which the capitals were Ayodhya, or Oude, and Pratisbthana, or Vitora. The kings of these cities, who are respectively denominated children of the Sun and of the Moon, are supposed to have been the lineal descendants of Satyavrata, the seventh Manu, during whose life all living creatures, with the exception of himself and his family, were destroyed by a general deluge. Another kingdom was afterwards established at Magadha, or Bahar, by Jarasandha, appointed governor of the province by a sovereign of the Lunar race. A list of these kings is given by Sir William Jones in his 'Essay on the Chronology of the Hindus.' (*As. Res.*, ii., pp. 111-146, 8vo. ed.)

The kings of Ayodhya appear to have conquered the Deccan, and to have introduced the Brahmanical faith and laws into the southern part of the peninsula. Such at least appears to be the meaning of the Ramayana, according to which Rama, an incarnation of Vishnu, and the son of the king of Ayodhya, penetrates to the extremity of the peninsula, and conquers the giants of Lanka (Ceylon). This is in accordance with all the traditions of the peninsula, which recognise a period when the inhabitants were not Hindus. We have no means of ascertaining whether these conquests by the monarchs of Ayodhya were permanent, but we know that in the time of Arrian and Pliny the Brahmanical faith prevailed in the southern part of the peninsula, since all the principal places mentioned by these writers have Sanskrit names. We learn from tradition and from historical records extant in the Tamul language (Wilson's *Descriptive Catalogue of the Oriental MSS. collected by the late Lt.-Col. Mackenzie*, and Taylor's *Oriental Historical MSS. in the Tamil Language*, 2 vols. 4to., Madras, 1835) that three kingdoms acquired in early times great political importance in the southern part of the Deccan. These were named Pandya, Chola, and Chera, and are all said to have been founded by natives of Ayodhya, who colonized the Deccan with Hindus from the north. Pandya was the most powerful of these kingdoms: it was bounded on the north by the river Velar, on the west by the Ghauts, though in early times it extended as far as the Malabar coast, and on the south and east by the sea: its principal town was Madura. The antiquity of this kingdom is confirmed by Pliny, Arrian, and Ptolemy, who all mention Pandion as a king who reigned in the south of the peninsula. Chola was bounded on the south by the territories of Pandya, and did not extend farther north than the town of Pulicat; its western boundary is uncertain. The kingdom of Chera was of small extent: its northern limit was originally at Palini, near Dharapur: it was bounded on the east by Pandya and Chola, and on the west by the kingdom of Kerala, or Malabar, which extended along the western coast. This last kingdom was probably founded in later times, since, in the time of Arrian the Malabar coast is said to have belonged to the Pandya kings. The Brahmanical colonists appear to have settled principally in the southern parts of the Deccan: the native traditions represent the northern parts as inhabited by savage races till a much later period. This is in accordance with the accounts of the Greek writers. The names of the places on the upper part of the eastern and western coasts are not Sanskrit. The modern Concan is described both by Arrian and Pliny as the pirate coast; and the coast of the modern Orissa is said by Arrian to be inhabited by a savage race called Kirrhadæ, who appear to be identical with the Kiratas of Sanskrit writers, who are represented as a race of savage foresters.

The accounts of the Greeks who accompanied Alexander, and more particularly that of Megasthenes, give us, as we have already shown, some information respecting the northern part of Hindustan in the third and fourth centuries before the Christian æra. But hardly anything is known of the history of Hindustan from this period to the time of the Mohammedan conquest. There are only a very few historical events of which we can speak with any degree of certainty. After the overthrow of the Greek kingdom of Bactria by the Tartars, B.C. 126, the Tartars (called by the Greeks Scythians, and by the Hindus Sakas) overrun the greater part of the north-western provinces of Hindustan, which remained in their possession till the reign of Vicramaditya I., B.C. 56, who, after adding numerous provinces to his empire, drove the Tartars beyond the Indus. This sovereign, whose date is pretty well ascertained, since the years of the Samvat æra are counted from his reign, resided at Ayodhya and Canoj, and had dominion over almost the whole of northern Hindustan from Cashmere to the Ganges. He gave great encouragement to learning and the fine arts, and his name is still cherished by the Hindus as one of their greatest and wisest princes. He fell in a battle against Salivahana, raja of the Deccan. We also read of two other sovereigns of the same name, Vicramaditya II., A.D. 191, and Vicramaditya III., A.D. 441. The most interesting event in this period of Hindu history is the persecution of the Buddhists and their final expulsion from Hindustan. It is difficult to conceive the reasons that induced the Hindu sovereigns, after so long a period of toleration, to aid the Brahmans in this persecution; more especially as the Jains, a sect strikingly resembling the Buddhists, were tolerated in all parts of Hindustan. But this portion of Hindu history has already been discussed in another part of this work. [BUDDHA, vol. v., pp. 526-532.] During this period many of the islands of the Indian Archipelago were colonized both by Brahmans and Buddhists; for though the Brahmans were finally successful, yet at first they appear to have been overcome by the Buddhists in some parts of Hindustan, and to have been obliged to emigrate to foreign countries. (Crawford, in *Asiatic Res.*, vol. xiii., p. 154.) Sir Stamford Raffles, in his 'History of Java,' ii., pp. 1-65, describes the splendid remains of Hindu art which are still to be seen in that island; and a recent traveller in Borneo remarks that 'in the very inmost recesses of the mountains, as well as over the face of the country, the remains of temples and pagodas are to be seen similar to those found on the continent of India, bearing all the traits of Hindu mythology; and that in the country of Waaho, at least 400 miles from the coast, there are several of very superior workmanship, with all the emblematical figures so common in Hindu places of worship.' (Dalton, in *Asiatic Journal*, N.S., vol. vii., p. 153.)

Christianity is said to have been introduced into Hindustan in the first century; according to some accounts, by the Apostle Thomas; and, according to others, by the Apostle Bartholomew. But there is very little dependence to be placed upon these statements. The first Christians who settled in any number in Hindustan appear to have been Nestorians, who settled on the Malabar coast for the purposes of commerce. Nestorius lived in the middle of the fifth century; and in the sixth century we learn from Cosmas that Christian churches were established in the most important cities on the Malabar coast, and that the priests were ordained by the archbishop of Seleucia, and were subject to his jurisdiction. When Vasco de Gama arrived at Cochin, on the Malabar coast, he was surprised to find a great number of Christians, who inhabited the interior of Travancore and Malabar, and who had more than a hundred churches. But these Christians appear to have been the descendants of those Nestorians who emigrated to Hindustan in the fifth and sixth centuries, for there is no reason for believing that any Hindus were converted by their means to the Christian religion.

Second Period: History of the Mohammedan States.—Some Arabian historians pretend that part of Hindustan was conquered by the Mohammedans as early as the eighth century; but the earliest invasion of the country by the Mohammedans, of which we can speak with any degree of certainty, was made in the latter part of the tenth century by Sabuktaghin, a Tartar soldier, who had been proclaimed by the army monarch of Ghizni. He passed the Indus at least twice, laid waste the province of Lahore, and returned to Ghizni laden with plunder. But he made no permanent conquests. He died A.D. 997, and was succeeded by his son, the celebrated Sultan Mahmud, who is usually regarded as the first Mohammedan conqueror of Hindustan. The Mohammedan historians celebrate the twelve expeditions which he undertook against the Hindus, and extol the religious zeal which prompted him to destroy the idols and temples of the inhabitants. He died A.D. 1028, and was succeeded by his son Massud. Though Mahmud had conquered the northern part of Hindustan from the Indus to the Ganges, yet regular government had only been established in Lahore and the north-western provinces. Massud and his successors were unable to prosecute their conquests in the country, in consequence of the formidable enemies they possessed at home. Several Tartar tribes, denominated Seljukides, from the name of their leader, had been invited by Mahmud to settle in Khorasan. After his death they seized upon Bokhara and Samarcand, and threatened the destruction of the empire of Ghizni. In the year 1171 Yeasuddin, king of Gaur in Khorasan, conquered all the countries west of the Indus which were subject to the monarchs of Ghizni, and compelled the reigning sultan to take refuge in Lahore. Lahore was taken by Mohammed, brother of Yeasuddin, in 1184, and Khosrou II., the last monarch of the house of Sabuktaghin, was put to death.

The Hindus however received no benefit from this change of dynasty. In 1191 Mohammed marched farther east, and though he was at first defeated by the Hindu rajas, he finally conquered the greater part of the northern provinces. He appointed Kuttub, a favourite slave, governor of the newly-conquered provinces, who continued to prosecute the conquests of Mohammed; and in 1193 took Delhi, and made it the seat of government, whence he has frequently been called the founder of the Mohammedan empire in Hindustan. During the life of Mohammed, who succeeded his brother Yeasuddin, the northern provinces of Hindustan formed part of the empire of Ghizni; but after the assassination of Mohammed, in 1206, Kuttub became independent, and left his dominions to his son Aram, who succeeded to the throne in 1210. Aram was obliged to surrender the power to Altumsh, the son-in-law of Kuttub, a prince of great courage and vigour, who extended the Mohammedan conquests still farther. He died 1235. During this reign Genghis Khan conquered the greater part of Asia, but did not penetrate into Hindustan. But the Moguls were soon tempted by the riches and fertility of the country, and the successors of Altumsh were engaged in constant wars in order to repel their invasions. Mahmud II., who ascended the throne in 1244, and his successor Balin (1266), were two able princes, who frequently defeated the Moguls; but Kai-Kobad, the successor of Balin, was a weak prince, who was murdered in 1289. By his death the Gaurian dynasty ended, after having reigned for 117 years.

The dominion now passed into the hands of the Afghans. During the reign of Firoz II., who succeeded Kai-Kobad, the Mohammedans first undertook the conquest of the Deccan. Deoghir was taken by Alâ, the nephew of Firoz; but the entire subjection of the northern part of the Deccan was not effected till the following reign. Firoz II. was succeeded by Alâ, in 1295, who, though a cruel, was an able and powerful monarch. He defeated the Moguls, subdued the Rajpoots, and, by means of his general Kafoor, added the greater part of the Deccan to his dominions. But with his death in 1316 the prosperity of the Mohammedan empire in Hindustan rapidly declined. A succession of weak princes followed, during whose reigns many Hindu rajas in Bengal and the Deccan recovered their independence. The invasion of Timur (Tamerlane) in 1398 overturned the already tottering power of the monarchs of Delhi. Timur did not remain in Hindustan more than a few months; but after his departure the country became divided into a number of small independent states governed by Mohammedan chiefs, which were nominally subject to the emperor of Delhi. Confusion prevailed in every department of the government, till at length, in the reign of Ibrahim II., Baber, a descendant of Timur, invaded Hindustan, and put an end to the Afghan dynasty. In 1526 he took Delhi, and was the founder of the Tartar, or as it is more usually but erroneously called, the Mogul dynasty. He extended his dominions as far as the Ganges; and though constantly engaged in military expeditions, he found time to cultivate the arts of peace, and devoted his attention to whatever appeared calculated to promote the prosperity of his empire. The troubles of Humaiun's reign, who succeeded Baber in 1530, prevented him from attending to the internal organization of the empire; and it was not till the accession of Akbar in 1556 that the Tartar (or Mogul) dominion in Hindustan was placed upon a firm basis. During his reign the Hindus appear to have enjoyed greater prosperity than they had ever experienced since the invasion of the Mohammedans. Akbar was distinguished by a spirit of toleration and a love of justice; and the memory of his virtues still survives among the Hindu as well as the Mohammedan population of the country. An excellent political and statistical account of the Mogul empire was written during his reign by his vizir Abul Fazl. [AYEEN AKBERY.] Akbar died in 1605, and was succeeded by his son Selim, who took the title of Jehanghir, *i.e.* 'conqueror of the world.' His reign was troubled by foreign and intestine enemies. The Uzbeks obtained possession of Cabul; the king of Persia took Candabar; the Rajpoots again commenced their struggles for independence; the Afghans revolted in the north; and his son Shah Jehân rebelled against him. But notwithstanding these troubles, the country appears upon the whole to have enjoyed considerable prosperity; literature was extensively cultivated; many new cities were built, and the Hindu religion experienced even greater toleration than in the reign of Akbar. During the reign of Jehanghir, Sir Thomas Roe arrived at the court of Agra, and obtained from the emperor many advantageous grants to the East India Company. Jehanghir was succeeded in 1627 by Shah Jehân, during whose reign a great part of the Deccan, which had not been subdued by Kafoor, was conquered by his son Aurungzebe. The ingratitude which Shah Jehân had shown to his father he was destined to experience from his own sons. He was thrown into prison by Aurungzebe, in which he died at the age of 74, on the 21st January, 1666. He was succeeded by Aurungzebe, who had been proclaimed emperor in 1659. Aurungzebe was the last powerful sovereign that ruled over the Mogul empire of Hindustan. He took the cities of Hyderabad, Bejapore, and Golconda, and extended his dominions nearly to the limits of the Carnatic. During his reign the Mahrattas first rose into power, and rapidly extended their conquests over the greater part of the Deccan. They were frequently defeated in the plain by the troops of Aurungzebe; but all the efforts of this powerful prince were unable to subdue the country of these mountaineers. Sevajee, the founder of the Mahratta empire, died in 1682, and was succeeded by his son Sambajee, who was taken prisoner by Aurungzebe, and put to a cruel death in 1689. After the death of Aurungzebe in 1707, the Mogul dominion rapidly declined.

He was succeeded by Shah Alum, who died, after a short reign, in 1712. New enemies arose on every side. The Mahrattas extended their conquests in the south; the Rajpoots, who had never been entirely subdued by the Mogul princes, again asserted their independence; and the Sikhs, who first rose into power in the reign of Shah Alum, ravaged the provinces of Lahore and Delhi. The Sikhs now form a powerful nation in India, and occupy a great portion of the western provinces of the antient Mogul empire. Their origin and early progress belong to the religious history of the Hindus, of which an account is given in this article. The Mogul power was still further weakened by intestine commotions. Each of the four sons of Shah Alum contended for the throne, which was obtained after a severe struggle by the eldest brother Moez-eddin. He was dethroned at the end of a few months by his nephew Farrukhsir (1713), who was succeeded in 1720 by Mohammed Shah, a grandson of Shah Alum. During his reign the Moguls lost all real dominion in Hindustan. The Deccan became virtually independent of their authority under the viceroyalty of Nizam-al-Mulk, tho vizir of Mohammed; and a considerable portion of the northern provinces was wrested from them by the Rohillas (an Afghan race), who established themselves in that part of the country, which was afterwards known by the name of Rohilla-khand (Rohilcund). The sanguinary invasion of Nadir Shah in 1739, and tho massacre of the inhabitants of Delhi by his troops, tended still further to weaken the Mogul empire.

Mohammed was succeeded in 1747 by his son Ahmed Shah. During his reign, which lasted six years, the dissolution of the Mogul empire may be said to have taken place. The northern and north-western provinces were seized upon by the Afghans and the Sikhs, and the Rajpoots extended their dominions as far as Ajmeer. Ahmed Shah was dethroned in 1753 by Alamghir, a grandson of Moez-eddin. Alamghir was assassinated after a reign of seven years; and the nominal sovereignty devolved upon Shah Alum II., who, after undergoing many vicissitudes, at last became the pensioner of the East India Company, which succeeded to the power of the Mogul emperors.

Third Period: History of the European Conquests.—The Portuguese were the first nation of Europe that obtained any dominion in Hindustan. Vasco de Gama landed with three ships at Calicut on the Malabar coast, on the 20th of May, 1498. The Portuguese rapidly acquired extensive power in the country. By the possession of Malacca, which fell into their hands twenty-four years after the voyage of Gama, they commanded the trade of the Indian Archipelago; and by their numerous settlements along the Malabar coast, especially at Goa and Diu, they monopolized the commerce with Europe. In the beginning of the seventeenth century, the English, Dutch, and French began to make settlements along the coast; and the Portuguese lost their dominions almost as rapidly as they had acquired them.

The Dutch never acquired much political power in Hindustan; though at one time they carried on the greater part of the Indian trade. The French on the contrary obtained extensive possessions in the Deccan. Their principal settlement was at Pondicherry, of which they acquired possession in the latter part of the seventeenth century, and which soon became one of the most splendid European establishments in the country. But their power in the Deccan was principally owing to the wise and vigorous government of Dupleix in 1749. Under his administration the Northern Circars were occupied by the French, and the English power was almost destroyed. Dupleix was succeeded by Count de Lally, who was sent from France with a large fleet in 1756; but this expedition entirely failed; and Pondicherry was taken by the English in 1761. At present the French possessions consist only of Pondicherry, which was restored, and a fow other places.

The commencement and early progress of the political power of the British in Hindustan have already been described. [BENGAL.] An account of the British government, revenues, &c., together with a list of the British possessions, is given under EAST INDIA COMPANY

Languages.—The numerous languages spoken in Hindustan at the present time may be divided into two great classes; the one consisting of those languages which are derived from the Sanskrit, and which are spoken in the northern and central provinces; and the other comprising those languages which are unconnected with the Sanskrit, and which are spoken in the southern parts of the peninsula.

Languages derived from the Sanskrit.—The groundwork of these languages is altogether Sanskrit, such as that of the Italian or Spanish is Latin, with a comparatively small addition of words which cannot be traced to that source. They are not however derived immediately from the Sanskrit, but through the medium of the Prakrit, which is still more akin to the Sanskrit than the vernacular languages of Hindustan, and which became the modern language of the people when the Sanskrit ceased to be spoken. None of the dialects of the Prakrit are spoken at the present day; but several works, especially parts of dramatic poems, are preserved in these languages. It is therefore evident that a knowledge of Sanskrit is not alone sufficient for an accurate investigation of the history and structure of the modern languages spoken in the northern provinces, since these languages are immediately derived from the Prakrit, as the Prakrit was from the Sanskrit. An account of the Prakrit, and of the Pali, the sacred language of the Buddhists, which is also immediately derived from the Sanskrit, is given in another part of this work. [SANSKRIT LANGUAGE.]

The languages derived from the Sanskrit may be said in general terms to be spoken in the provinces which lie between the Himalaya and Vindhya Mountains; which, as has been already remarked, is the proper country of the Hindus. But this definition is not sufficiently accurate; since the Sanskrit appears to have been also spoken to a considerable extent in the northern part of the Deccan. Lassen, who has investigated this subject with great accuracy, remarks (*Institutiones Linguæ Pracriticæ*, Excursus, ii., p. 12) that the most southerly languages derived from the Sanskrit are the Kunkunan, spoken on the western coast, the Orissan, on the eastern coast, and the Mahratta, in the central parts; and he thinks that a line drawn from Chicacole on the Bay of Bengal towards the sources of the river Tapty, passing by the city of Beder near the sources of the river Kistna, and thence across the Ghauts to Goa on the western coast, would separate the northern languages from those which are unconnected with the Sanskrit.

The languages spoken in the countries bordering on the northern and north-eastern provinces of Hindustan have no connexion with the Sanskrit, but belong to an entirely different family of languages. Those which are spoken in the countries watered by the Indus are closely related to the Sanskrit. It is almost impossible to draw any line which shall separate the languages of Sanskrit origin from those which are derived from the Zend, the antient language of Persia.

The following list contains an account of the modern languages derived from the Sanskrit. The arrangement is taken, with a slight alteration, from Lassen's 'Prakrit Grammar.'

I. Languages spoken in the eastern provinces.

1. *Bengálí*. [BENGALI LANGUAGE.]

2. *Asamese*, spoken in Asam. This language has no literature; the New Testament was translated into it in 1819.

3. *Maithila*, or *Tirhutíya*, is 'the language used in Mithila (that is, in the Sircar of Tirhut) and in some adjoining districts, limited however by the rivers Cusi (Causici) and Ghandac (Ghandaci), and by the mountains of Nepaul. It has great affinity with Bengali; and the character in which it is written differs little from that which is employed throughout Bengal. In Tirhut too the learned write Sanskrit in the Tirhutiya character, and pronounce it after their own inelegant manner. This dialect has no extensive use, and does not appear at any time to have been cultivated by elegant poets.' (Colebrooke, *On the Sanskrit and Prakrit Languages; As. Res.*, vol. vii.; and *Miscellaneous Essays*, vol. ii., pp. 27, 28.)

4. *Orissan*, or *Uriyan*, spoken in Orissa Proper, or Cuttack, has a great resemblance to the Bengali, but is not much cultivated. We know of no original composition of importance in this language, except the epic poem called 'Kanji Kaviri Pothi,' which celebrates the conquest of Anjeveram; one of the most striking events in the modern history of the country. In Wilson's 'Descriptive Catalogue of the MSS. of Col. Mackenzie,' there is a list of several tales in this language relating principally to the passionate and mystical worship of Krishna. The whole Bible has been translated into the Orissan language, in 5 vols. 8vo. (Stirling on *Orissa Proper*, in *As. Res.*, vol. xv.)

II. Languages spoken in tho northern provinces.

5. *Népálese*, spoken in Nepaul. 6. *Kosalese*, spoken in Northern Kosal. 7. *Doguri*, spoken in the Himalaya Mountains between Cashmere and Almora. 8. *Cáshmírí*, spoken in Cashmere. Our knowledge of these languages is very limited. They do not appear to have auy literature. The New Testament has been translated into the Nepalese and Cashmiri.

III. Languages spoken in the western provinces.

9. *Panjabí*, spoken in the Panjab. 'The songs entitled Khéâls and Teppas, which are no doubt familiar to all who have a taste for the vocal music of India, are composed almost entirely in this dialect.' (Colebrooke's *Miscell. Essays*, ii., p. 33.) A Grammar of this language has been published by Dr. Carey, 8vo., Serampore, 1812.

10. *The Wuchí*, or *Multaní*, spoken in the provinces of the same name.

11. *Sindhí*, spoken in Sinde as far as the mouths of the Indus. A Grammar of this language has lately been published by W. H. Wathen, which we have not yet seen; but of which there is an account in No. 65 of the 'Journal of the Asiatic Society of Bengal,' May, 1837. The Sindhí is divided into two dialects, northern and southern.

IV. Languages spoken on the western coast.

12. *Kutchí*, spoken in the peninsula of Kutch, or Cutch.

13. *Gurjaratí*, or *Guzeratí*, spoken in Gujerat, and along the coast as far as Bombay. (See Drummond's *Illustrations of the Grammatical Parts of the Guzerattee, Mahratta, and English Languages*, fol., Bombay, 1808.)

14. *Kunkuna* begins where the Gurjaratí ceases to be vernacular: it is spoken at Bombay, and thence up the coast as far as Goa, where the Tuluva language begins.

V. Languages spoken in the central provinces.

15. *Bikanera*, or *Vikanera*; 16, *Marwar*; 17, *Jayapura*; 18, *Udayapura*. These four are the languages spoken by the Râjpoots. 19, *Hâruti*, called by the antient writers Sârasvatî, which was a dialect of the Prakrit. [SANSKRIT LANGUAGE.] 20, *Brâja Bhâkâ*, or *Vraja bhâshâ*, spoken in the Doab on the banks of the Yamuna (Jumna). This language is derived from the Sâurasení, one of the Prakrit dialects. The Brâja Bhâkâ contains a more than ordinary number of Sanskrit words, and appears to have been one of the dialects from which the Hindûstaní was formed. Mr. Colebrooke (*Misc. Ess.*, ii. p. 34) says that 'it derives its name from the cow-pens (*vraja*) and dairies in the forest of Vrindâ, where Krishna was educated among the wives and daughters of the cowherds. His amorous adventures with Râdhâ and the Gopis furnish the subject of many favourite songs in this language.' A Grammar of this language has been published under the title of 'General Principles of Inflection and Conjugation in the Brij Bhakha; composed by Shree Lulloo Lal Kuvi, Moonshee,' 4to., Calcutta, 1811. Some works in the Brâja Bhâkhâ have been published at the Education Press in Calcutta; and a translation into English of several tales in this language, entitled 'Bytal-Puchisi, or the Twenty-five Tales of Bytal,' was published at Calcutta in 1834.

21. *Malâví*, spoken in *Malwá*. 22, *Bundelakhandí*, spoken in Bundelcund. 23, *Mâgadha*, spoken in the southern part of Bahar.

24. *Mahârâshtra*, or *Mahrâtta*. The districts in which this language is spoken are accurately defined by Carey in the preface to his Mahratta Grammar: 'A line drawn across the peninsula in the latitude of Visiapore (Bejapore) will nearly express the southern limit of this language, and another at a small distance from Ujjayin (Oujein) about 24° N. lat. will nearly mark its northern limits. From east to west its extent is various, but it may in general be reckoned to be spoken from the mountains which separate Bengal, Bihar, and Orissa from the countries immediately west of them, to the western side of the peninsula and the province of Guzerate.' Colebrooke (*Miscell. Essays*, ii. p. 30) remarks, 'that the Mahrâtta, like other Indian tongues, contains much pure Sanscrit, and more corruptions of that language, intermixed with words borrowed from Persian and Arabic, and with others derived from an unknown source. The Mahrâttas possess many poems in their own dialect, either translated from the Sanscrit, or original compositions, in honour of Krishna, Rama, and other deified heroes. Treatises in prose too, on subjects of logic and philosophy, have been composed in the Mahrâtta dialect.' The political importance which the Mahratta nation once possessed rendered the study of their language important to Europeans. The first Grammar was published at Rome in 1778, under the title of 'Grammatica Marastta à mais vulgar, que se practica nos Reinos do Nizamaxà e Idalxà; Offerecida aos mintos reverendos padres missionarios dos dittos reinos;' another edition of this work appeared at Lisbon in 1805. See also Carey's *Grammar of the Mahratta Language*, 8vo., Scrampore, 1805; Carey's *Dictionary of the Mahratta Language*, 8vo., Serampore, 1810; *Dictionary, Murathee and English, compiled for the Government of Bombay*, by J. T. Molesworth, assisted by Thomas and George Candy, 4to., Bombay, 1831.

VI. *Hindustâní* is not limited to any particular district, but is spoken by almost all the natives in addition to their own dialects in the northern and central provinces of Hindustan. This language appeared to have been formed from the Brâja Bhâkâ and the Prakrit, which was spoken in the extensive empire in northern India, of which Kânyâkubja, or Canoj, was the capital. After the conquest of Mahmud this language was adopted as the means of communication between the Mohammedans and Hindus, in consequence of which a considerable number of Persian and Arabic words was introduced into the language. It was called by the Mohammedans *Urdû Zabân*, or 'camp-language,' and by the poets *Rekhta*, 'scattered,' on account of the variety of languages interspersed in it. The Hindustânî was very much cultivated under Akbar and the following emperors, and numerous poems, by Mohammedans as well as Hindus, were composed in this language. It was spoken at Delhi and Agra with the greatest purity, but since the downfal of the Mogul empire it has been principally cultivated at Lucknow. The Hindî is the same language as Hindustânî, but differs from it chiefly in retaining Sanskrit words, while the Hindustani substitutes for them words of Persian and Arabic origin. The Hindi is the dialect which is chiefly cultivated by Hindu poets. The intercourse of Europeans with uneducated natives has tended to corrupt the Hindustani, and thus a barbarous dialect has been produced which is commonly called Moorish or Moors. Grammars of this dialect have been published by Lebedeff, 'Grammar of the Mixed Indian Dialects, erroneously called Moorish or Moors,' 4to., Lond., 1801: and Hadley, 'Grammar of the Corrupt Dialect of the Jargon of Hindustan (commonly called Moors),' 8vo., Lond., 1809. The Mohammedans adopt the Arabic, but the Hindus generally prefer the Devanagari characters in writing Hindustani. 'The affinity of Hindi with the Sanscrit language is peculiarly striking; and no person acquainted with both can hesitate in affirming that Hindi is chiefly borrowed from the Sanscrit. Many words, of which the etymology shows them to be the purest Sanscrit, are received unaltered; many more undergo no change but that of making the final vowel silent; a still greater number exhibits no other difference than what arises from the uniform permutation of certain letters; the rest too, with comparatively few exceptions, may be easily traced to a Sanscrit origin.' (Colebrooke's *Miscell. Essays*, ii. p. 23.)

To Europeans who wish to commence the study of Hindustani the following works may be recommended:—'Grammar of the Hindustani Language,' by Shakespear, 4to., London, 1826; 'Rudimens de la Langue Hindoustani,' by Garcin de Tassy, 4to., Paris, 1829; 'Hindoostanee Interpreter, containing the Rudiments of Hindoostanee Grammar,' by W. C. Smyth, 8vo., London, 1824; 'Introduction to the Hindoostanee Language,' by W. Yates, 8vo., Calcutta, 1827; 'Muntakhabat-i-Hindi, or Selections in Hindustani, with Verbal Translations and a Grammatical Analysis,' by Shakespear, 2 vols. 4to., London, 1834—35; 'Les Adventures de Kamrup, par Tahcin-Uddi; publiées en Hindoustani,' par Garcin de Tassy, 8vo., Paris, 1835; 'Intikhab-i-Ikwan-us-Suffa, or Hindi Selections,' by J. Michael, 4to., London, 1829; 'Naklat-i-Hindi, or Hindi Stories,' by J. Michael, 4to., London, 1829; and the various elementary works published by Gilchrist. Dictionaries in Hindustani and English have been published by W. Hunter, originally compiled by J. Taylor, 2 vols. 4to., Calcutta, 1808; W. C. Smyth, abridged from Taylor and Hunter's work, 8vo., London, 1820: and Shakespear, 4to., London, 1834. An English and Hindustani Dictionary has been published by Gilchrist, under the title of 'Hindoostanee Philology,' 4to., Lond., 1825.

There are also many mountainous parts and forests in the northern provinces of Hindustan inhabited by numerous tribes, which do not profess the Brahmanical faith and which speak a language entirely unconnected with Sanskrit. These tribes, which are known by the names of Bhils, Gondas, and Puharees, inhabit the mountainous tracts in Candeish, Malwa, Rajpootana, Gondwana, and the Rajmahal hills in Bengal. See Sir J. Malcolm, in 'Transactions of Asiatic Society,' i. 65-91; 'Asiatic Researches,' iv. 31-108; v. 127-130; Heber's 'Journal,' i. 211, 257, 493; ii. 71. It is remarked by Ellis, in the preface to Campbell's 'Teloogoo Grammar,' that 'it is extraordinary that the uncivilized races of the north of India should in this respect bear any resemblance to the Hindus of the south: it is nevertheless the fact, that, if not of the same radical derivation, the language of the mountaineers of Rajmahal abounds in terms common to Tamul and Telinga.' If this be true, it would afford a strong presumption that the whole of Hindustan was inhabited, before the introduction of the Brahmanical faith and the Sanskrit language, by one race, which spoke a common language, and that the Bhils and other uncivilized tribes which are found in northern Hindustan are the descendants of the original inhabitants of the country.

Languages not derived from the Sanskrit.—Colebrooke, in his Essay 'On the Prakrit and Sanskrit Languages' (*Miscell. Essays*, ii. 28, 29), expressed his opinion that the languages spoken in the southern part of the peninsula were derived from the Sanskrit: but this is incorrect. Mr. Ellis, who possessed a greater knowledge of the dialects of southern India, informs us (*Preface to* Campbell's *Teloogo Grammar*) 'that neither the Telinga nor any of their cognate dialects are derivations from the Sanskrit; that the latter, however it may contribute to their polish, is not necessary for their existence; and that they form a distinct family of languages, with which the Sanskrit has in latter times especially intermixed, but with which it has no radical connection. The members constituting the family of languages which may appropriately be called the dialects of southern India are the high and low *Tamil;* the Telugu, grammatical and vulgar; *Carnâtaca*, or *Cannâdi*, antient and modern; *Mălăyâlma*, or *Malayâlam*, which, after Paullinus à St. Bartholomæo, may be divided into *Grantha-Malabarica* and *Common Malayâlam*, though the former differs from the latter only in introducing Sanskrit terms and forms in unrestrained profusion; and the *Tuluva*, the native speech of that part of the country to which in our maps the name of Canara is confined. Besides these there are a few local dialects of the same derivation, such as the *Côdugu*, a variation of Tuluva, spoken in the district of that name, called by us Coorg.'

The groundwork of all these languages is the same; and the remarks which Campbell makes respecting the Telugu applies equally to all the other dialects. 'It will be shown,' he says, 'that the declension of the noun by particles or words added to it; the use of a plural pronoun applicable to the first and second persons conjointly; the conjugation of the affirmative verb; the existence of a negative aorist, a negative imperative and other negative forms in the verb; the union of the neuter and feminine genders in the singular, and of the masculine and feminine in the plural of the pronouns and verbs; and the whole body of the syntax, are entirely unconnected with the Sanskrit.' (*Introduction to Teloogoo Grammar*, p. 22.)

1. *Tamul*, which occupies the most conspicuous place among the languages of the Deccan, and which possesses a literature of considerable interest, is spoken 'by a population of more than four millions, being current in the southern portion of the peninsula of India, throughout the Jaghire, the districts of South Arcot, Salem, Coimbatoor, Combaconum, Tanjore, Trichinopoly, Madura, Dindigal, and Tinnivelly, as well as in many parts of the extensive kingdom of Mysore. It is not derived from any language at present in existence, and is either itself the parent of the Teloogoo, Malayalam, and Carnarese languages; or, what is more probable, has its origin, in common with these, in some antient tongue, which is now lost or only partially preserved in its offspring. In its more primitive words, such as the names of natural objects, the verbs expressive of physical action or passion, the numerals, &c., it is quite unnected with the Sanskrit; and what is thence so largely borrowed, when the Tamuls, by intercourse with the more enlightened people of the north, began to emerge from barbarity, has reference to the expression of moral sentiments and abstract metaphysical notions, and is chiefly to be found in the colloquial idiom. In this remarkable circumstance, and also in the construction of its alphabet, the Tamul differs much from the other languages of the south, which are found to admit the Sanskrit more largely in literary and poetical compositions than in the ordinary dialect of conversation, and which adopt the arrangement of the Sanskrit alphabet with scarcely any variation. The higher dialect of the Tamul, on the contrary, is almost entirely free from Sanskrit words and idioms; and the language retains an alphabet which tradition affirms to have heretofore consisted of but sixteen letters, and which, so far from resembling the perfect alphabet of the Sanskrit, wants nearly half its characters, and has several letters of peculiar powers.' (Babington, *Preface to the Adventures of Gooroo Paramartan*, 4to., London, 1822, pp. 1, 2.)

It appears that the Tamul language was not cultivated before the emigration of the Brahmanical Hindus from the north. We find in the Greek writers that the names of cities, mountains, rivers, temples, &c., are all pure Sanskrit, such as Comorin, or Comari, Madura, Kaberis, or Caveri, &c.; and upon referring to the list of Tamul works in Wilson's 'Descriptive Catalogue of the Library of Col. Mackenzie,' we find that the greater number of them are nothing but translations or imitations of Sanskrit works. But the Tamul has also been independently cultivated with considerable success. This appears to have been in a great measure owing to the college established at Madura by the native princes for the purpose of promoting the cultivation of the Tamul language and literature. The father of Tamul grammar is supposed to have been the saint Agattiyan (the Agastya of the Ramayana), who is said to have invented the Tamul language. His own works are lost; but fragments of his grammar are preserved by different writers. The principal grammar now extant is ascribed to Pavanati. It is divided into five parts:—1. On Pronunciation and Orthography; 2. On words; the noun, verb, and other parts of speech; 3. On Syntax; 4. On Prosody and Versification; 5. On Tropes and Figures of Speech.

The original part of Tamul literature consists chiefly of histories of the Chola, Pandya, and Chera kingdoms, of dramatic and moral and didactic poems, and of treatises on philology and medicine. A considerable number of the historical treatises has been published in Tamul, with an English translation and notes, by W. Taylor, under the title of 'Oriental Historical Manuscripts in the Tamil language,' 2 vols. 4to., Madras, 1835. The moral poems are principally written by the Pariars, persons of the lowest class, and yet enjoy a very great reputation. One of the most popular of these writers is Avyar, a female. An account of her life and a translation of several of her writings are given by Dr. John, in the 'Asiatic Researches,' vol. vii., pp. 339-361. But the most celebrated of these poems is the 'Koral' of Tiruvalluvan, or the Divine Valluvan, which was published by Mr. Ellis at Madras, with a translation and a valuable commentary. This work we have not seen; but copious extracts from it are given by Wilson in the 'Descriptive Catalogue, vol. i., pp. 233, 234. Extracts from the 'Koral' are also given by Kindersley in his 'Specimens of Hindoo Literature,' pp. 53-82.

The Tamul language is divided into two dialects, named *Shen* and *Kodun*, or High and Low Tamul. Almost all the classical works in Tamul are written in the Shen dialect; which has ceased to be intelligible to the generality of the people. Both these dialects have been cultivated by European writers, and a grammar of each was composed by the celebrated missionary Beschi. His Grammar of the Shen dialect was never printed, but a translation of it from the original Latin was published by Babington under the title of 'A Grammar of the High Dialect of the Tamil Language, termed Shen-Tamil; to which is added, an Introduction to Tamil Poetry,' 4to., Madras, 1822. Beschi's Grammar of the Kodun dialect was published under the title of 'Grammatica Latino-Tamulica de Vulgari Tamulicæ Linguæ Idiomate,' Trang. 1738. Babington remarks that 'Beschi appears to have had a more perfect acquaintance with Tamil literature than any foreigner who ever undertook the study; perhaps than any native of modern times. His voluminous works, both in prose and poetry, composed in Tamil, as well as his translations from it, are held in great esteem; and it is a singular fact, that one of the best original grammars of that language now extant is the production of his pen.' (*Preface to Tamul Grammar*, pp. i., ii.) The Danish Missionary Walter also published a Grammar entitled 'Observationes Grammaticæ, quibus Linguæ Tamulicæ Idioma Vulgare illustratur,' Trang. 1739. The most modern grammar is by Anderson, 'Rudiments of Tamul Grammar, combining with the Rules of Kodun-Tamul, or the Ordinary Dialect, an Introduction to Shen-Tamul, or the Elegant Dialect of the Language,' 4to., Lond., 1821. Those who are commencing the study of Tamul will find the following work useful: 'Adventures of the Gooroo Paramartan, a Tale in the Tamul Language, accompanied by a Translation and a Vocabulary, by B. Babington,' 4to., Lond., 1822.

2. *Telinga*, or *Telugu*. 'This language is commonly, but improperly, termed by Europeans the Gentoo. It is the Andhra of Sanscrit authors, and in the country where it is spoken is known by the name of Trilinga, Telinga, Telugu, or Tenugu. The Telugu language is the vernacular dialect of the Hindus inhabiting that part of the Indian peninsula which, extending from the Dutch settlement of Pulicat on the coast of Coromandel inland to the vicinity of Bangalore, stretches northwards along the coast as far as Chicacole, and in the interior to the sources of the Tapti. This language is not unknown in the more southern parts of India, for the descendants of those Telugu families which were deputed by the kings of Vidyanagara to control their southern conquests, or which occasionally emigrated from Telingana to avoid famine or oppression, are scattered all over the Dravira and Carnataca provinces, and ever retaining the language of their forefathers, have diffused a knowledge of it throughout the peninsula.' (Campbell's *Teloogoo Grammar*.)

The literature of this language principally consists of translations from the Sanskrit; it also contains many original, historical, and biographical works, and some original poems and tales. According to Wilson (*Descriptive Catalogue*) 'tho oldest works extant are not of higher antiquity than the end of the 12th century, while its Augustan æra, the reign of Krishna Deva of Vigayanagar, dates in the beginning of the 16th.' The first attempt to reduce the usages of the language to rule is said to have been made at the close of the 13th century by Nannya Bhatta, a Brahman, who composed a Telinga Grammar in Sanskrit. Telinga, like Tamul, is divided into a high and a low dialect. The language of composition is so different from the colloquial dialect, that commentaries are necessary even to the learned in order to understand the best works.

To Europeans who wish to begin the study of the Telinga language the following works may be recommended. *Dictionary of the Teloogoo Language*, by Campbell, 4to., Madras, 1821; *Grammar of the Teloogoo Language*, by Campbell, 4to., Madras, 1820; *Grammar of the Telinga Language*, by Carey, 8vo., Serampore, 1814; *Teloogoo Selections, with Translations and Grammatical Analysis*, by J. C. Morris, fol., Madras, 1823.

3. *Carnataca*, or *Cannadi*. 'The northern limit of that extensive region in which the Carnataca is spoken commences near the town of Beder, in the latitude of 18° 45, about 60 miles north-west from Hyderabad; and sweeping to the north-west skirts the edges of the precipitous western Ghauts nearly as far north as the sources of the Kistna, whence following an eastern, and afterwards a north-eastern course, it terminates in rather an abrupt angle near Beder, already described as its northern limit.' (Wilson's *Descriptive Catalogue*, p. xli.) In the province denominated Canara by Europeans the Tuluva language is spoken.

The Carnataca language is divided into two dialects, antient and modern: the modern cannot be said to have any literature; but the ancient, called Hala Carnataca, possesses several historical documents relating to the kings of Mysore, and many poems and tales. The Hala dialect also contains a very curious class of works, written by the Lingamites, a branch of the Saiva sect, which relate to the actions and doctrines of the teachers and founders of the sect. These works 'are extravagantly absurd and mostly insipid; but many of them are highly characteristic, and indicate a state of religious practice and belief almost as foreign to the genuine Hindu creed as to common sense and sound morality.' (Wilson's *Descriptive Catalogue*, p. xliv.) This language appears to have been principally cultivated under the Balal or Valala dynasty of princes, who reigned at Dwarasamudra, the Dolsamander of Mohammedan historians, from the 11th to the beginning of tho 14th century.

4. *Tuluva*. 'In Cupam from Perumbuzhu near Mangalore to Pudupattanam near Nilesvaram, and in Tulu from Gocarnam to Perumbuzhu, which constitute the district on which in recent times the name of Canara has been imposed, the Tuluva, a distinct dialect, though of the same derivation as the Malayalma, prevails among the aborigines.' (Ellis, quoted by Wilson, *Descrip. Catal.*, p. xiv.)

5. *Malayalam*, or *Malayalma*, is called Kerala by Sanskrit writers, and usually Malabar by Europeans. 'The country of Malayalam, lying on the west coast of the Indian peninsula, is divided into four provinces. The most northern, commencing at Gocarnam and extending southward to Perumbuzhu near Mangalore, is called Tulurajyam, the kingdom of Tulu; from Perumbuzhu to Pudupattanam near Nilesvaram the country is called Cuparajyam; thence to Caneti near Collam (Quillon), Ceralarajyam; and thence to Canyacumari (Cape Comorin), Mushicarajyam. The

Malayalma is at present the language of the two last provinces. The Malayalma is, like the Kodun-Tamil, an immediate dialect of the Shen-Tamil; it differs from the parent language generally in the same manner as the Kodun in the pronunciation and idiom, but more especially in retaining terms and forms of the Shen-Tamil, which in the former are obsolete. But its most material variation from its cognate dialects is, that though deriving from a language superfluously abounding in verbal forms, its verbs are entirely devoid of personal terminations, the person being always indicated by the pronoun. It is this peculiarity which chiefly constitutes the Malayalma a distinct tongue, and distinguishes it in a peculiar manner from all other dialects of Tamil origination.' (Ellis, quoted by Wilson, *Descrip. Catal.*, p. xlv.) Dr. Buchanan also remarks that the Malayala and Kodun-Tamul 'are both branches of the same dialect, and that his Madras servants and the natives were to a certain extent able to understand each other. The accents are very different, and the Malayala language, containing a larger share of Sanskrit and of the *Paat* or poetical dialect than the language prevailing to the eastward, is generally allowed to be the more perfect. The character used in Malayala is nearly the same as that used among the Tamuls for writing poetry, and the poetical language of both people is very nearly the same.' (*Journey from Madras through Mysore*, &c., vol. ii., pp. 346-7.) The Malayalma has never been much cultivated. It contains some translations from the Sanskrit; but almost the only original work with which we are acquainted is entitled Kerala Uppati, and gives an account of the province of Kerala, or Malayalma, from the earliest times to the reign of Cheruman Perumal, who adopted the Mohammedan religion. An account of this work is given by Mr. Duncan in *Asiatic Researches*, vol. v., pp. 1-36. Buchanan remarks, 'This work is written in a pure and old dialect of the Ellacanum or poetical language. It is understood with great difficulty; many passages are interpreted in different ways; and some of the copies are said to differ essentially from others. The author is supposed to have been Sankara Acharya.' (*Journey from Madras through Mysore*, &c., vol. ii., p. 475.) A Grammar of this language was published by Drummond under the title of 'Grammar of the Malabar Language,' fol., Bombay, 1799.

Castes.—The division of the Hindus into classes or castes, with fixed occupations, existed from the earliest times: the word caste is derived from the Portuguese word *casta*, 'race,' or 'lineage;' in Sanskrit they are called *varnas*, that is, 'colours.' The most antient portion of the Vedas alludes to such a division; and in the laws of Manu, the Ramayana, the Mahabharata, and all the other Sanskrit works of the greatest antiquity, we find the system of castes fully developed. The Greeks who visited the country describe its inhabitants as distributed into certain classes. (Arrian, *Indic.*, c. 11, 12; Diodor. Sic., ii., c. 40, 41; Strabo, xv., c. 1, pp. 485-6, Casaubon; Pliny, *Hist. Nat.*, vi., c. 19.) We have no means of ascertaining the origin of this institution. Heeren supposes that it was founded upon conquest; the first three tribes being a foreign race, who subdued the aborigines of the country and reduced them to an inferior caste: while others trace it 'as the result of that fondness of perpetuating, like heir-looms, by descent from father to son, certain offices or the exercise of certain arts and professions, which is so peculiarly characteristic of almost all nations of the Indo-Germanic race.'

All the Hindu writings recognise only four pure castes: Brahmans, Kshatriyas, Vaisyas, and Sudras. Pliny (*Nat. Hist.*, vi. 19) appears to have heard of the same number; but Megasthenes, from whom Arrian, Strabo, and Diodorus Siculus derive their account, mentions seven classes:—1, philosophers; 2, agriculturists; 3, herdsmen and hunters; 4, handicraftsmen and artizans; 5, warriors; 6, public inspectors; 7, royal councillors. But Megasthenes has evidently separated into distinct classes individuals belonging to the same class; the public inspectors and royal councillors belonged without doubt to the Brahmanical class, as well as the philosophers; the agriculturists, herdsmen, and hunters to the Vaisyas; and the handicraftsmen and artizans to the Sudras.

The following extract from the 'Jatimala,' a Sanskrit work on Hindu castes, gives the common Hindu tradition respecting the origin of each caste. 'In the first creation by Brahma, Brahmanas proceeded, with the Veda, from the mouth of Brahma. From his arms Kshatriyas sprung; so from his thigh Vaisyas, from his foot Sudras, were produced: all with their females. The Lord of Creation viewing them, said, "What shall be your occupations?" They replied, "We are not our own masters; oh, God, command us what to undertake." Viewing and comparing their labours, he made the first tribe superior over the rest. As the first had great inclination for the divine sciences (*Brahme veda*), therefore he was Brahmana. The protector from ill (*Kshayate*) was Kshatriya. Him whose profession (*Vesa*) consists in commerce, which promotes the success of wars for the protection of himself and mankind, and in husbandry and attendance on cattle, he called Vaisya. The other should voluntarily serve the three tribes, and therefore he became a Sudra; he should humble himself at their feet.'

A strong line of demarcation is drawn between the first three castes and the Sudras. The former are allowed to receive instruction from the Vedas, and are considered to have been born again in a spiritual sense, whence they are called regenerate. The emblem of this second-birth is a peculiar kind of girdle or cord, which differs according to the caste; and with which a Brahman may be invested from his eighth to his sixteenth year, a Kshatriya from his eleventh to his twenty-second year, and a Vaisya from his twelfth to his twenty-fourth year; though in certain cases the investiture may be made in the fifth, sixth, or eighth year respectively. (*Manu*, ii., 36-38.) A Sudra on the contrary is not reckoned among the regenerate; and would, according to the antient Hindu law, be put to death for reading the Vedas.

The Brahmans possess the exclusive privilege of teaching the Vedas, and were in former times in the exclusive possession of all knowledge. Though the sovereign of the country was chosen from the Kshatriya class, the Brahmans possessed the real power, and were the royal councillors, the judges, and magistrates of the country. (*Manu*, viii., 1, 9, 11.) Their persons and property were inviolable; and though they committed the greatest crimes, they could only be banished from the kingdom. (*Manu*, viii., 380.) They were to be treated by sovereigns with the greatest respect; for 'a Brahman, whether learned or ignorant, is a powerful divinity.' (*Manu*, ix., 313-317.) The curse of a Brahman could consign even the gods to misery; and the Ramayana and Mahabharata contain numerous instances of the withering effects of such a curse.

The proper duty of a Brahman is to teach the Vedas, to perform sacrifices to the gods, and to meditate upon divine and holy objects. At an early age he is placed under the instruction of a Brahman, called a *Guru*, whose commands he is bound to obey, and whom he must reverence as a spiritual parent. When he arrives at years of maturity it becomes his duty to marry, and to lead a life of religious contemplation. He ought to be supported by the contributions of the rich, and not to be obliged to gain his subsistence by any laborious or useful occupation. But as all the Brahmans could not be maintained by the working classes of the community, it was found necessary to allow them to engage in other occupations; and it is accordingly provided in the laws of Manu, that a Brahman, unable to subsist by his religious duties, 'may live by the duty of a soldier, and if unable to get a subsistence by this employment, may subsist as a mercantile man, applying himself to tillage and attendance on cattle.' (*Manu*, x., 81, 82.) In seasons of distress a further latitude is given. The practice of medicine and other learned professions, painting and other arts, work for wages, menial service, alms, and usury, are among the modes of subsistence allowed to Brahmans. (Colebrooke, *On Indian Classes*, in *As. Res.*, vol. v.; *Miscell. Essays*, vol. ii., pp. 186-7.)

The Brahmans still hold the first rank in Hindu society, and are treated with great respect in all parts of Hindustan. But in consequence of the conquest of the country by foreign rulers, and the prevalence of many sects that have rejected their authority, they no longer possess the power they once enjoyed. The increasing acquaintance of the Hindus with the English language and literature, and the establishment of public schools, are tending still farther to diminish their influence.

The Brahmans are separated into two great classes, one of which occupies the countries towards the north, and the other the countries towards the south. The southern Brahmans 'hold in great contempt those from Kasi or Benares, as being men from the north; and would not even admit them to the honour of eating in their houses. The northern Brahmans are however at least as proud as those from the south, and allege several reasons for holding them in contempt; among which the most urgent is, that the women of the southern Brahmans are allowed to appear in public.' (Buchanan's *Journey from Madras through Mysore*, &c., vol. i., p. 308.) In the Deccan the Brahmans are also divided into Vaidikas, who subsist by charity, and dedicate their lives to study and devotion; Lokikas, who follow worldly pursuits; and Numbis, who officiate in temples and perform menial duties to the idols.

The Gurus, or spiritual advisers, hold the first rank among the Brahmans. In the Deccan many of these Gurus possess an authority which bears some resemblance to that of diocesan bishops in a Christian church. They possess authority over a certain district, in which they have jurisdiction in everything relating to religion and caste. They travel in great state, and receive large contributions from their disciples. The raja of Tanjore is said by Buchanan (*Journey from Madras*, &c., vol. i., p. 22) 'to give his guru 250 pagodas a-day (91*l.* 18*s.* 6½*d.*) when that personage honours him with a visit.'

The Kshatriya, or military class, is said by the Brahmans to be extinct; but the Rajpoots and the Nairs in the Deccan in all probability belong to this class, though the Brahmans assert that they are only Sudras. Buchanan informs us (*Journey from Madras*, &c., i. 253-4) that the people, who in the language of Karnata are called Chitrakaru, but who are better known by the Mohammedan appellation of Jinigar, or Jiligar, pretend to be of the Kshatriya class, but their pretensions are denied by all other castes. They allege that their ancestors, on account of some injury done to the Brahmans, were compelled to follow their present mechanical occupations. The decay of the Kshatriya class may have been owing to the peaceful habits of the people and their freedom from foreign invasion, and the consequent want of employment for a military class. But according to an antient tradition the Kshatriya caste was destroyed by Parasu Rama, the sixth incarnation of Vishnu, and their land bestowed upon the Brahmans. The laws of Manu appear to refer to the same tradition in a passage where a list of Kshatriyas is given, who, 'by the omission of holy rites and by seeing no Brahmans, have gradually sunk among men to the lowest of the four classes.' (x. 43, 44.)

The duty of the Sudra is servile attendance upon the higher classes, and especially the Brahmans, but he may also follow mechanical occupations, as joinery and masonry, and practical arts, as painting and writing; and although a man of a lower tribe is in general restricted from the arts of a higher class, the Sudra is expressly permitted to become a trader or a husbandman. (Colebrooke, *On the Indian Classes—Miscell. Essays*, vol. ii., p. 187.) The statements of Robertson, Mill, and many other writers, respecting the strictly hereditary nature of all trades and occupations in India, are considerably exaggerated. The liberty which is given to the Brahmans, even by the laws of Manu, has already been remarked; and a similar latitude is allowed to the Kshatriya and Vaisya classes. Mr. Colebrooke, whose opinion, from his extensive acquaintance with Hindu literature, and from his long residence in India, is entitled to the greatest respect, remarks, 'that almost every occupation, though regularly it be the profession of a particular class, is open to most other tribes; and that the limitations, far from being rigorous, reserve only one peculiar profession, that of the Brahmana, which consists in teaching the Veda, and assisting at religious ceremonies.' (*Miscell. Essays*, ii. 187.) Even as early as the compilation of the laws of Manu, Sudras had risen to royal power (iv. 61); and in the present day 'a real Kshatriya prince is not to be found; all the greater princes of India, excepting the Paishwa, a Brahmin, are base-born.' (Rickard's *India*, vol. i., p. 29.) The Brahmans, on the other hand, have been obliged to have recourse to almost every calling in order to support themselves. According to Ward, they have even condescended to cook the victuals of persons of an inferior class. 'Rich Sudras of every order employ Brahmans as cooks; even the Vairagi mendicants procure Brahmans to prepare the food at their feasts.' (*View, &c., of the Hindoos*, vol. i., p. 95. See *The Hindoos*, in the *Library of Entertaining Knowledge*, vol. i., pp. 136-8.) It is the opinion of some Europeans who have acquired an accurate knowledge of the manners and customs of the natives, that Europeans in general give too much credit to the assertions of the natives concerning the rules of their caste, which are commonly alleged as an excuse for declining any duty that is disagreeable. (Buchanan's *Journey from Madras*, &c., i., p. 294.)

A great portion of the population of India does not belong to any of the four pure castes. The individuals who form what is usually termed the impure or mixed classes, called in Sanskrit *Varna-Sankara*, i.e. 'mixture or confusion of classes,' are either the original inhabitants of the country who have never professed the Hindu faith, or persons who originally belonged to one of the four pure classes, and have either lost caste themselves, or are descended from those who had lost caste, or the offspring of marriages between persons of different castes. The faults which occasion a loss of caste, and for which no pardon can be given, are—'1, Sexual intercourse within the prohibited degree of consanguinity; 2, Sexual intercourse with any prohibited class; 3, Eating forbidden food, or drinking intoxicating liquors; 4, Stealing; 5, Slaying any animal of the cow kind, or of the human species; but a Brahman is permitted to kill his enemy in battle; 6, Eating in company with persons of another caste, or of food dressed by their impure hands; 7, Eating on board a ship food that has been dressed there; 8, Omitting to perform the ceremonies due to deceased parents.' (Buchanan's *Journey from Madras*, &c., vol. i., p. 306.) But the greater number of impure or mixed classes has arisen from the intermarriage of persons of different classes. It is not true, as has been frequently stated, that every individual is obliged to marry in his own caste; even by the laws of Manu (iii. 13-44) a Brahman is allowed to select his wife from any of the four castes; a Kshatriya from the Vaisya and Sudra castes in addition to his own; a Vaisya from his own and the Sudra castes; but the Sudra is not permitted to marry a woman of any other caste out his own. But though these marriages are legal, their offspring cannot be admitted into the caste of either of their parents.

As early as the compilation of the laws of Manu the number of mixed classes had become considerable. (See the tenth chapter, which is principally devoted to an enumeration of the mixed classes, with the respective occupations of each.) The most important of the mixed classes may be divided into two sets.

I. The classes which have sprung from the marriage of a man of an upper caste with a woman of an inferior caste.

1. *Mûrdhâbhishicta*, by a Brahman from a woman of the Kshatriya class. His duty is the teaching of military exercises.

2. *Ambastha*, or *Vaidya*, by a Brahman from a woman of the Vaisya class. His profession is the science of medicine.

3. *Nishâda*, or *Pârasava*, by a Brahman from a woman of the Sudra class. His occupation is catching fish.

4. *Mâhishya*, by a Kshatriya from a woman of the Vaisya class. His profession is music, astronomy, and attendance on cattle.

5. *Ugra*, by a Kshatriya from a woman of the Sudra class. His duty, according to Manu, is to kill or confine such animals as live in holes; but according to the 'Jatimala' he is an encomiast or bard.

6. *Carana*, by a Vaisya from a woman of the Sudra class. He is an attendant on princes, or secretary.

II. The classes which have sprung from the marriage of a woman of an upper caste with a man of an inferior caste. The offspring of these marriages, which are illegal, are considered inferior in rank to the classes enumerated under the first division.

1. *Sûta*, by a Kshatriya from a woman of the Brahman class. His occupation is managing horses and driving cars.

2. *Vaidêha*, by a Vaisya from a woman of the Brahman class. His occupation is waiting on women.

3. *Chândâla*, by a Sudra from a woman of the Brahman class. He is regarded as the most impure of all the mixed classes. His business is to carry out corpses and execute criminals, and to officiate in other abject employments for the public service.

4. *Mâgadha*, by a Vaisya from a Kshatriya woman. His profession, according to Manu, is travelling with merchandise, but according to the 'Jatimala' he is an encomiast or bard.

5. *Kshattri*, or *Kshatta*, by a Sudra from a Kshatriya woman. His occupation is said, by the 'Jatimala,' to consist in killing and confining such animals as live in holes.

6. *Ayogava*, by a Sudra from a woman of the Vaisya class, is a carpenter.

Colebrooke remarks (*Miscellaneous Essays*, ii., p. 187) that 'besides the particular occupations assigned to each of the mixed classes, they have the alternative of following that profession which regularly belongs to the class from which they derive their origin on the mother's side: those at least have such an option who are born in the direct order of the tribes, as the *Mûrdhâbhishicta*, *Ambashtha*, and others. The mixed classes are also permitted to subsist by any of the duties of a Sudra; that is, by a menial service, by handicrafts, by commerce, or by agriculture.'

Numerous other classes are formed from the intermarriage of the twelve mixed classes that have already been enumerated. The 'Jatimala' mentions the number of 42 mixed classes, springing from the intercourse of a man of inferior with a woman of superior caste. A further account of these classes is given in Mr. Colebrooke's Essay 'On Indian Classes.' One of the best known of the impure classes is that of the Pariahs, a corruption of the Tamul name *Parriar*, in the Deccan. They are called *Maliwunlu* in Telingana, and *Walliaru* in Carnata. Their numbers are very considerable, amounting, according to the Abbé Dubois, to one-fifth of the whole population of India (*Description, &c. of the People of India*, p. 454); but this statement must, we should think, be very greatly exaggerated. 'Most of them sell themselves with their wives and children to the farmers, who make them undergo the hardest labours of agriculture, and treat them with the utmost severity. They are likewiso the scavengers of the villages, their business being to keep thoroughfares clean, and to remove all the filth as it collects in the houses. Some of them who do not live in this state of servitude are employed to take care of the horses of individuals, or of the army, or of elephants and oxen. They are also the portors and run upon errands and messages. In some parts they are permitted to cultivate the lands for their own benefit, and in others they can exercise the profession of weavers.' (Dubois' *Description of the People of India*, p. 458.)

There are other tribes, which are considered inferior even to the Pariahs. Such are the *Pallis* and the *Pulias*, in the southern part of the Deccan; the *Curubarus*, the *Lambadis*, the *Dumbarus*, the *Chensu Carirs*, and many others; of which an account is given in Buchanan's 'Journey through the Mysore.'

The lower classes are also divided into left and right hand sides, or *Eddagai* and *Ballagai;* the former class containing nine, and the latter eighteen castes. A few subdivisions of the Vaisya and Sudra castes are also included in these sides. 'The different castes of which each division is composed are not united by any common tie of religion, occupation, or kindred; it seems therefore to be merely a struggle for certain honorary distinctions. The right hand side pretend that they have the exclusive privilege of using twelve pillars iu the *pundal* or shed under which their marriage ceremonies are performed; and that their adversaries in their processions have no right to ride on horseback, nor to carry a flag painted with the figure of *Hanumanta*. The left hand side pretend that all these privileges are confirmed to them by the grant of Kali; and that they are of the highest rank, having been placed by that goddess on her left hand, which in India is the place of honour. Frequent disputes arise concerning these important matters; and on such occasions not only mutual abuse is common, but also the heads of the divisions occasionally stir up the lowest and most ignorant of their followers to have recourse to violenco, and encourage them by holding out the houses and shops of their adversaries as proper objects for plunder.' (Buchanan's *Journey from Madras*, &c., i., pp. 79-80.)

Religion and Philosophy.—A knowledge of the religion of a people is always useful in assisting us in forming an estimate of their civilization. With regard to the Hindus, such a knowledge is indispensable, since every circumstance in the life of a Hindu, from the time of his birth to that of his death, is closely connected with religious observances; and the most insignificant as well as the most important acts cannot be performed without the observance of some religious rites or without a referenco to some sacred doctrinos. It is erroneous to suppose, as often has been done, that the Hindus have always professed the same faith. The sects into which the Hindus are divided in the present day are of modern origin; and tho system of theology taught by these sects differs very much from the antient religion of the people. It is proposed in the following remarks to give a brief account of the antient religion of the Hindus (which is still the faith of the majority of the Brahmans and of the educated part of the community); and afterwards to mention the principal religious and philosophical sects into which the Hindus are at present divided.

The whole of Indian theology is professedly founded on the Vedas, which are four in number; the Rig-, Yagur-, Sama , and Atharvana- Veda. The present arrangement of the Vedas, which are supposed to have been composed by inspired writers, is attributed to the sage Vyasa. Only a small portion of them has hitherto been known to Europeans; and our principal information about them is a dis sertation by Mr. Colebrooke, in the eighth volume of the 'Asiatic Researches.' A few of the hymns of the Rig-Veda were published, with a Latin translation, under the title of 'Rig-Vedæ Specimen,' by tho late Dr. Rosen, Lond., 1830; and the whole of the Rig-Veda, accompanied with a Latin translation, which Dr. Rosen was employed in editing at the time of his death, will, it is expected, be shortly published by the Oriental Translation Committee. 'Each Veda,' Mr. Colebrooke remarks, 'consists of two parts, denominated the *Mantras* or prayers, and the *Brahmanas* or precepts. The complete collection of the *Mantras* (or hymns, prayers, and invocations) belonging to one Veda is entitled its *Sanhita*. Every other portion of Indian Scripture is included under the general head of divinity (*Brahmana*). This comprises precepts which inculcate religious duties, maxims which explain those precepts, and arguments which relate to theology.'

The original worship of tho Hindus appears to have been addressed to the elements. In the Mantras or prayers, which form the principal portion of the Vedas, Indra, or the firmament, fire, the sun, the moon, the air, the spirits, the atmosphere, and tho earth, are the objects most frequently addressed. The mythology of the Vedas personifies the elements and the planets, and thus differs from the more recent legendary poems, which inculcate the worship of deified heroes.

The Vedas undoubtedly teach the belief of one supreme God. Mr. Colebrooke remarks that 'the deities invoked appear, on a cursory inspection of the Veda, to be as various as the authors of the prayers addressed to them; but according to the most antient annotations on the Indian Scriptures, these numerous names of persons and things are all resolvable into different titles of three deities, and ultimately of one God. The Nighantu, or glossary of the Vedas, concludes with three lists of names of deities: the first comprising such as are deemed synonymous with fire; the second with air; and the third with the sun. In the last part of the Niructa (a treatise on the Vedas), which entirely relates to deities, it is twice asserted that there are but three gods. The further inference that these intend but one deity is supported by many passages in the Veda, and is very clearly and concisely stated in the beginning of the index to the Rig-Veda, on the authority of the Niructa and of the Veda itself.' The name of this supreme deity, omnipotent, omniscient, and omnipresent, is *Brahmă*, who is no longer an object of worship, but merely of devout contemplation. His attributes are represented by the three personified powers of creation, preservation, and destruction, which, under the respective names of Brahmâ, Vishnu, and Siva, form the *trimurti* (that is, 'three forms'), or triad of principal Hindu gods. These deities are sometimes represented singly with their respective attributes, and sometimes with one body and three heads. It would be impossible in our limits to give any account of the numerous inferior deities, which are said by Ward (*View of the Hindoos*, p. xviii., 6, Serampore, 1815) to amount, according to the computation of the Hindus, to 330 millions. Tho most important of these inferior deities are the *Lokapalas*, that is, 'guardians of the world,' who are the eight gods next in rank to the *Trimurti* :—1. *Indra*, the god of Heaven, of the thunder and lightning, storm and rain; 2. *Agni*, the god of fire; 3. *Yama*, the god of the infernal regions; 4. *Surya*, the god of the sun; 5. *Varuna*, the god of water; 6. *Pavana*, the god of the wind; 7. *Kuvera*, the god of wealth; 8. *Soma*, or *Chandra*, the god of the moon. Many other deities were afterwards included in the list of *Lokapalas*, of whom a list is given in a note to Wilson's translation of the *Vikramorvasi*. (*Hindu Theatre*, vol. i., 219.) Those who wish for further information respecting the Hindu deities, may consult with advantage Moor's 'Hindu Pantheon,' Lond., 1810; Coleman's 'Mythology of the Hindus,' Lond., 1832; and Rhode, 'Ueber Religiöse Bildung, Mythologie und Philosophie der Hindus,' Leip., 1827.

The worship of these gods, as well as of numerous others, which was once very popular in Hindustan, has almost entirely disappeared, in consequence of the exclusive worship which is paid to Vishnu, Siva, Sakti, and a few other deities, by the religious sects of the Hindus of the present day. The exclusive worship of these deities does not appear to have arisen much earlier than the tenth century of the Christian æra. Each sect maintains that the god which it worships unites in his person all the attributes of the deity. The exclusive worshippers of Vishnu, Siva, &c., must not be confounded with the orthodox worshippers of these deities. Few Brahmans of learning will acknowledge themselves to belong to any of the popular divisions of the Hindu faith; they acknowledge the Vedas, Puranas, and Tantras, as the only orthodox ritual, and regard all practices not derived from these sources as irregular and profane. Some of these sects appear to have arisen in great measure in opposition to the Brahmanical order; their teachers are frequently chosen from the lower castes, and the distinction of caste is in a great measure lost in the similarity of schism. (Wilson, *On the Religious Sects of the Hindus*, in *Asiatic Researches*, vol. xvi.) The following is a list of the principal sects:—

1. *Vaishnavas*, who worship Vishnu, or rather *Rama*, *Krishna*, and other heroes connected with the incarnations of that deity. This sect has numerous followers in Bengal and Orissa, and is distinguished generally by an abstinence from animal food, and by a worship which is less cruel than that of the Saivas. But it must be recollected that the Vaishnavas are subdivided into numerous sects, which often agree only in maintaining that Vishnu is Brahma, that is, the deity. A long and interesting account of these sects is given by Wilson in the sixteenth volume of the 'As. Res.' One of the most important of the Vaishnava sects is the *Kabir Panthis*, founded by Kabir in the beginning of the fifteenth century. No one, with the exception of Nanak Shah, has produced a greater change in the popular belief than Kabir. He assailed the whole system of idolatrous worship, and ridiculed the learning of the Pandits and the doctrines of the Sastras. Though the immediate effect of his doctrines was considerable, their indirect influence has been still greater. Several of the popular sects are little more than ramifications of the *Kabir Panthis*, and Nanak Shah appears to have been principally indebted to him for the doctrines he promulgated among the Sikhs. This sect is included among the Vaishnavas because they pay more respect to Vishnu than to any other deity; but it is no part of their faith to worship any Hindu deity, or to observe any of the rites or ceremonies of the Hindu religion.

2. *Saivas*, who worship Siva, are more numerous than any other sect. Siva is usually represented by the Lingam, which the Saivas worship, some figuratively, others literally. The sectarial mark by which the Saivas are distinguished consists in three horizontal lines on the forehead with ashes, obtained, if possible, from the hearth on which a consecrated fire is perpetually kept; and thus differs from the sectarial mark of the Vaishnavas, which consists in perpendicular lines, of which the number differs according to the sect to which the individual belongs.

3. *Saktas*. The Hindu mythology has personified the abstract and active powers of the divinity, and has ascribed sexes to these mythological personages. The Sakti, or active power of God, is female, and is considered the consort of the abstract attribute. The Saktas, who may perhaps be regarded as only a subdivision of the Saivas, worship the Sakti of Siva, which is usually represented by the female organ, as the counterpart of the phallic personification of Siva.

4. *Sauras*, the worshippers of Surya, the sun.

5. *Ganapatyas*, the worshippers of Ganesa, the god of wisdom. The Sauras and Ganapatyas are not numerous.

Most of these religious sects are divided into two classes, which, for want of a better name, may be called clerical and lay. The priests may also be divided into two classes, the monastic and secular clergy, of which the majority belong to the monastic order, since the preference is usually given by the lay part of the community to teachers who lead an ascetic life. These ascetics usually spend the greater part of their life in travelling from one holy place to another, subsisting by alms or merchandise; and when they are no longer able to pursue this wandering mode of life, they generally settle in some of the numerous *maths*, or monasteries, which are scattered over the whole country. These maths, Mr. Wilson remarks, 'vary in structure and extent, but they generally comprehend a set of huts, or chambers, for the *Mahant*, or the superior, and his permanent pupils; a temple, sacred to the deity whom they worship, or the *Samadh*, a shrine of the founder of the sect, or of some eminent teacher; and a *Dharma Sala*, one or more sheds or buildings for the accommodation of the mendicants or travellers who are constantly visiting the math. Ingress and egress are free to all. (*Asiatic Researches*, vol. xvi., p. 39.)

The sects which have already been enumerated profess to follow the authority of the Vedas in all matters which relate to religion and philosophy, though their opinions are in many points quite at variance with the doctrines of these books. But there are other sects which entirely disavow the authority of the Vedas, and which are therefore regarded as forming no part of the Hindu church. The most important of these sects are the Buddhists [BUDDHA], the Jainas, and the Sikhs. The Buddhists have long since been expelled from Hindustan; but it is evident, from the existence of large architectural remains clearly referrible to this sect, from the account of the Brahmans themselves, and from other circumstances, that the Buddhists were once very numerous in all parts of the country.

The sect of the Sikhs was founded by Nanak Shah, who was born A.D. 1469, at a small village called Talwandi, in the district of Bhatti, in the province of Lahore. He attempted to reconcile the religion of the Mohammedans and Hindus, by recalling them to the consideration of the tenet in which they both believed, namely, the unity of God. 'I am sent,' he said, 'to the Mohammedans to reconcile your jarring faiths; and I implore you to read the Hindu scriptures, as well as your own; but reading is useless without obedience to the doctrine taught: for God has said no man shall be saved except he has performed good works. The Almighty will not ask to what tribe or persuasion he belongs; he will only ask what he has done.' (Malcolm's *Sketch of the Sikhs*, in *As. Res.*, vol. xi., p. 275.) Nanak gained many proselytes, and his doctrines continued to spread in peace for two centuries. But in the beginning of the seventeenth century their numbers excited the jealousy of the Mohammedan government; and from that time the Sikhs may be considered as an armed people. A series of bloody contentions ensued; in which the Sikhs were at first entirely crushed; but Gura Govind gave a new character to the religion of the followers of Nanak, by the complete abolition of the system of castes, wisely judging that the only means by which he could ever hope to oppose the Mohammedan government with success was by admitting individuals of every caste to the profession of arms. His plan succeeded to a greater extent than might have been expected; immense numbers of the lower castes joined his ranks; and on the downfal of the Mogul government the Sikhs obtained possession of the greater part of the northern and north-western provinces of Hindustan. Malcolm describes the present faith of the Sikhs as 'a creed of pure deism, grounded on the most sublime general truths; blended with the belief of all the absurdities of Hindu mythology and the fables of Mohammedanism.' The Sikhs reject the authority of the Vedas, Puranas, and all other religious books of the Hindus; eat all kinds of flesh, except that of cows; willingly admit proselytes from every caste; and consider the profession of arms the religious duty of every individual. An interesting account of this sect is given in Malcolm's *Sketch of the Sikhs*. (*Asiatic Researches*, vol. xi., pp. 197-292.)

A belief in the transmigration of souls forms an important tenet in the Hindu faith. It is the great object of Hindu worship to obtain a deliverance from future existence, which is supposed to be effected by a reunion of the spiritual nature of man with that primitive spirit which pervades all nature, and which receives the souls of men, when they have been purified, into its essence. The prevailing notion of the means by which an individual may accomplish this object is, by subjecting the body to sufferings and privations, and withdrawing from all intercourse with mankind. It is expressly commanded in the laws of Manu (vi., 2, 3), that a Brahman, when his children havo attained maturity, should retire from the world and take refuge in a forest. He is required to spend his time in studying the Vedas and in performing penances 'for the purpose of uniting his soul with the divine spirit.' (*Manu*, vi., 29.) Many of these hermits appear in former times to have also studied the abstract sciences with great success; and they have always been considered by the orthodox Hindus as the wisest and holiest of mankind. The Greeks gave to them the name of *Gymnosophistæ*, or 'naked philosophers,' since most of these ascetics dispensed almost entirely with the use of clothes, and many of them went entirely naked. After remaining in the woods for several years, they at length arrived at the dignity of *Sannyâsis*, that is, 'those who have abandoned all worldly concerns;' which is the most perfect state of existence which a Brahman can attain, in which state 'he is not to wish for death, he is not to wish for life; but he is to expect his appointed time, as a hired servant expects his wages.' (*Manu*, vi., 45.) He must entirely detach his affections from all worldly desires; for should he cherish in his heart the slightest wish for any earthly object, the fruits of his previous penance and all his holiness would be lost. This doctrine is inculcated in the 'Bhagavad-Gîtâ,' a philosophical poem, forming an episode of the 'Mahâbhârata,' which has been translated into English by Wilkins (Lond. 1787), and into Latin by Schlegel, who has also edited the Sanskrit text (Bonn, 1823). But the term Sannyasi is used in the present day with a wider signification, to designate all the wandering mendicants of the different Hindu sects. These mendicants are also frequently called *Vairâgis*, that is, 'persons who have subdued all their passions and desires;' and *Yogis*, that is, 'persons who perform worldly actions and ceremonies without regard to their results, and who keep their minds fixed upon Brahma or God alone.' (Wilson's *Sanskrit Dict.*, under 'Yogin.')

The Hindus have various philosophical systems which they consider to be orthodox, that is, in accordance with the theology and metaphysics of the Vedas; and others which are deemed heretical, as incompatible with the doctrines of their holy books. The professed design of all these schools is 'to teach the means by which eternal beatitude may be attained after death, if not before it.' The most orthodox of these schools are the two *Mîmânsâs*, of which the former, *Pûrva Mîmânsâ*, said to have been founded by Jaimini, teaches the art of reasoning with the express view of interpreting the practical part of the Vedas, that is, the ritual of religion and devotion, including also moral and legal obligations. (Wilson's *Sanskrit Dict.*, under 'Mîmânsâ.') The latter, *Uttara Mîmânsâ*, commonly called *Vedânta*, said to have been found by Vyâsa, treats of the spiritual worship of the Supreme Being, or soul of the universe; and 'deduces from the text of the Indian scriptures a refined psychology, which goes to a denial of a material world.' 'The two together,' Mr. Colebrooke remarks, 'comprise the whole system of interpretation of the precepts and doctrine of the Vedas, both practical and theological. They are parts of one whole. The latter Mîmânsâ is supplementary to the former, and is expressly affirmed to be so; but differing on many important points, though agreeing on others, they are essentially distinct in a religious as in a philosophical view.' There are three other schools of philosophy, the *Sânkhya*, *Nyâya*, and *Vaiseshica*, which, though not strictly orthodox, are respected by very rigid adherents of the Vedas.

The *Sânkhya* system of philosophy, which derives its name from a word signifying reason or deliberation, because precision of reckoning is observed in the enumeration of its principles, maintains that true knowledge can alone secure perfect deliverance from evil; and that this knowledge 'consists in rightly discriminating the principles, perceptible and imperceptible, of the material world, from the sensitive and cognitive principle, which is the immaterial soul.' The Sankhya philosophy is divided into three schools; of which the first, founded by Patanjali, recognises the existence of a supreme God, and is therefore denominated 'theistical' (*Seswara Sânchya*); the second, founded by Capila, acknowledges no supreme ruling providence, and is therefore called 'atheistical' (*Nirîswara Sânchya*); the gods of Capila are beings superior to man, but like him subject to change and transmigration; the third school, which has not many followers, may be called 'mythological' (*Purânica Sânchya*), because the cosmogony contained in several of the Purânas agrees with this system.

The *Nyâya* and *Vaiseshica* systems, said to be founded respectively by Gotama and Canâde, may be taken generally as parts of one system. The first is chiefly occupied with the metaphysics of logic, whence it derives its name of *Nyâya*, that is, 'reasoning;' the second, with physics, that is, with 'particulars' or sensible objects, whence it derives its name of *Vaiseshica*, 'particular.' These schools concur with other schools of psychology in promising beatitude or (*nihsreyas*) final excellence, and (*mocsha*) deliverance from evil, as the reward of a thorough knowledge of the principles which they teach, that is, of truth, meaning the conviction of the soul's eternal existence separable from the body.

An interesting account of the philosophical tenets of these sects is given by Mr. Colebrooke in his essay 'On the Philosophy of the Hindus,' in the 'Transactions of the Royal Asiatic Society,' vol. i., pp. 19-43; pp. 92-118; pp. 439-361; vol. ii., pp. 1-39; reprinted in his 'Miscellaneous Essays,' vol. i., pp. 227-325: to which we are indebted for the greater part of the preceding remarks. See also Kennedy on the 'Vedanta System,' in the 3rd volume of the 'Transactions of the Royal Asiatic Society.'

Laws.—Works on law form an important branch of Sanskrit literature. Of these the most celebrated is the code generally known under the title of the Institutes of MANU, to which the reader is referred for an outline of the antient Hindu laws. Those who are desirous of further information on this subject may also consult Halhed's 'Code of Gentoo Laws,' London, 4to., 1776; 8vo., 1777, which was compiled under the administration of Mr. Hastings by a set of the most experienced lawyers selected from every part of Bengal. 'They picked out sentence by sentence from various originals in the Shanscrit language, neither adding to nor diminishing any part of the antient text. The articles thus collected were next literally translated into Persian, under the inspection of one of their own body, and from that translation were rendered into English, with an equal attention to the closeness and fidelity of the version.' (*Preface to Code of Gentoo Laws*, p. x.) Several other works on Hindu law have been published at Calcutta, of which the most important are:—'Dâyâ Bhâga, a Treatise on Inheritance,' 1814; new edition 1829; 'Dayâ-Crama-Sangraha, an original Treatise on the Hindoo Law of Inheritance, with an English Translation by P. M. Wynch,' 1818; 'Dâyâ Tatwa, a Treatise on the Law of Inheritance, by Raghunandana Bhattâchârya,' 1828; 'Two Treatises on the Hindu Law of Inheritance, from the Dâyâ Bhâga, and the Mitakshara, translated by H. T. Colebrooke,' 1810. An interesting account of the composition of an Indian court of justice, conformably with the antient Hindu institutions, is given by Mr. Colebrooke in his Essay 'On Hindu Courts of Justice,' in the 'Transactions of the Royal Asiatic Society,' vol. ii., pp. 166-196: and a curious instance of a trial of a criminal cause in a Hindu court occurs in the Sanskrit play of 'Mrichhacati,' or the 'Toy-cart,' translated in Wilson's 'Theatre of the Hindus,' vol. i., pp. 143-159.

Arithmetic, Algebra, Astronomy, and Geometry.—The reader is referred to the articles ARITHMETIC; ALGEBRA; ASTRONOMY; GEOMETRY; SURHYA SIDDHANTA; TIRVALORE, TABLES OF; and VIGA GANITA, in this work.

Medicine.—Professor Wilson remarks (*Oriental Mag.*, Calc., Feb., 1823) 'that there is reason to conclude, from the imperfect opportunities of investigation wo possess, that in medicine, as in astronomy and metaphysics, the Hindus once kept pace with the most enlightened nations of the world; and that they attained as thorough a proficiency in medicine and surgery as any people whose acquisitions are recorded, and as indeed was practicable, before anatomy was made known to us by the discoveries of modern times. It might easily be supposed that their patient attention and natural shrewdness would render the Hindus excellent observers; whilst the extent and fertility of their native country would furnish them with many valuable drugs and medicaments. Their *Nidan*, or Diagnosis, accordingly appears to define and distinguish symptoms with great accuracy, and their *Druvyabhidhana*, or Materia Medica, is sufficiently voluminous. They have also paid great attention to regimen and diet, and have a number of works on the food and general treatment suitable to the complaint, or favourable to the operation of the medicine administered. This branch they entitle *Pathapathya*. To these subjects are to be added the *Chikitsa*, or medical treatment of diseases, on which subject they have a variety of compositions, containing much absurdity, with much that is of real value, and the *Rasavidya*, or pharmacy, in which they are most deficient.'

The medical writings of the highest antiquity and authority are collectively called the 'Ayur Veda,' and are supposed to be a portion of the fourth or 'Atharva Veda.' The 'Ayur Veda,' which originally consisted of 100 sections, of 1000 stanzas each, is divided into eight parts:—1. *Salya*, which means 'a dart,' is the art of extracting extraneous diseases, whether of metal, bone, grass, wood, earth, &c., violently or accidentally introduced into the human body. 2. *Salakya*, is the treatment of external organic affections, or diseases of the eyes, ears, nose, &c. 3. *Kaya Chikitsa*, the science of medicine: the two preceding divisions constitute the surgery of modern schools. 4. *Bhutaridya* is the restoration of the faculties from a disorganized state, induced by demoniacal possession. 5. *Kaumara Bhritya*, on the diseases of women and children. 6. *Agada* is the administration of antidotes. 7. *Rasayana* 'is chemistry, or more correctly alchemy; as the chief end of the chemical combinations it describes, and which are mostly metallurgic, is the discovery of the universal medicine, the elixir, that was to render health permanent and life perpetual.' 8. *Bajikarana*, professes to promote the increase of the human race.

The most celebrated parts of the 'Ayur Veda' are the treatises of Charaka and Susruta. Part of the work of Susruta has been published at Calcutta, 1835. Professor Royle, in an essay 'On the Antiquity of Hindoo Medicine,' and a writer in No. 15 of the 'Journal of Education,' p. 176, inform us that a variety of medical treatises were translated from the Sanskrit into Persian and Arabic, and give many reasons for believing that the Arabs derived their principal knowledge of surgery and medicine from the Hindus. In the present day surgery is not studied by the Hindus; but Wilson remarks that 'the disappearance of surgery from among the Hindus is evidently of comparatively modern occurrence, as operative and instrumental practice forms so principal a part of those writings which are undeniably most antient, and which, being regarded as the composition of inspired writers, are held of the highest authority.' The Hindus must at a former period have possessed a considerable knowledge of surgery, since many difficult operations, such as those of lithotomy and the extraction of the fœtus ex utero are mentioned in Sanskrit works. The reader will find in the essay of Professor Royle above referred to much valuable information on the subject of Hindu medicine.

Arts, &c.—It is evident from the most antient Sanskrit works, as well as from the testimony of the Greeks who visited the country, that the useful and fine arts had attained a considerable degree of perfection among the Hindus in very early times. The Ramayana contains numerous proofs of the progress they had made in working metals. The art of smelting iron-ore and of manufacturing steel is undoubtedly of great antiquity (Ctes., *Indic.*, c. 4); and their skill in the manufacture of gold and silver ornaments is evident from the descriptions of the Ramayana. The antiquity of their coinage is more doubtful, but they possessed a gold coinage in the time of Arrian, who mentions, in his 'Periplus,' gold coins under the name of Kaltis, and probably at a much earlier period. Major Tod gives an account in the 'Transactions of the Royal Asiatic Society,' vol. i., pp. 340, 341, of several gold coins which he considers to be of a great antiquity. The Hindus must also have been acquainted with the art of working diamond mines at a remote period, since Arrian informs us, in his 'Periplus,' that diamonds and precious stones of every kind were brought from the interior to the port of Nelcunda. Ear-rings of ivory are mentioned by Arrian (*Indic.*, c. 16); and the pearl fishery was known to the companions of Alexander (Arrian, *Indic.*, c. 8).

The degree of perfection to which the Hindus carried the art of weaving in antient as well as modern times is well known. Their country has always been distinguished for the number and excellence of the substances which it contains for dyeing colours: and the beauty and brilliancy, as well as durability, of their colours were as celebrated among the Greeks and Romans as among ourselves. (Ctes., *Indic.*, c. 21; Strabo, xv., pp. 1018-1024; Pliny, *Nat. Hist.*, xxxv., c. 6.) Silk also, as already remarked, was probably manufactured in India in very early times.

The art of obtaining intoxicating liquors by distillation is mentioned in the Ramayana and the laws of Manu. In the laws of Manu (xi. 95) three kinds are specified; 'that extracted from dregs of sugar, that extracted from bruised rice, and that extracted from the flowers of the Madhuca.'

In painting the Hindus appear never to have attained much proficiency: their artists draw with great accuracy, but they have no knowledge of perspective. With regard to music their instruments are numerous; but their compositions are confined to a few simple melodies, 'many of which possess,' according to Sir W. Ouseley, 'the plaintive simplicity of the Scotch and Irish, and others a wild originality pleasing beyond description. Counterpoint seems not to have entered at any time into the system of Indian music.' (*Oriental Collections*, vol. iii., p. 298.) An account of Hindu music is given by Sir William Jones in his essay 'On the Musical Notes of the Hindus' (*As. Res.*, vol. iii., pp. 55-87). The Hindus lay claim to the invention of the game of chess. [Chess, vol. vii., p. 52.]

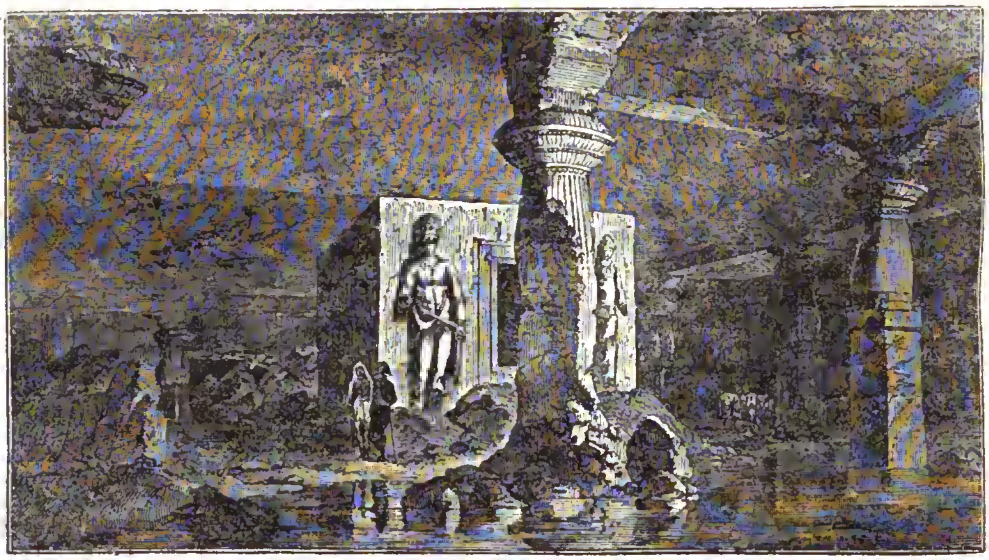
With respect to the present state of the arts among the Hindus, Bishop Heber remarks (*Journal*, vol. iii., pp. 251-2), 'Nor is it true that in the mechanic arts they are inferior to the general run of European nations. Where they fall short of us (which is chiefly in agricultural instruments and the mechanics of common life), they are not, so far as I have understood of Italy and the south of France, surpassed in any great degree by the people of those countries. Their goldsmiths and weavers produce as beautiful fabrics as our own; and it is so far from true that they are obstinately wedded to their old patterns, that they show an anxiety to imitate our models, and do imitate them very successfully. The ships built by native artists at Bombay are notoriously as good as any which sail from London or Liverpool. The carriages and gigs which they supply at Calcutta are as handsome, though not as durable, as those of Long Acre. In the little town of Monghyr, three hundred miles from Calcutta, I had pistols, double-barrelled guns, and different pieces of cabinet-work brought down to my boat for sale, which in outward form nobody could detect to be of Hindoo origin; and at Delhi, in the shop of a native wealthy jeweller, I found broaches, ear-rings, snuff-boxes, &c., of the latest models, and ornamented with French devices and mottos.'

Most of the subjects treated of in this article are discussed with considerable learning by Bohlen in his 'Das Alte Indien,' Königs., 2 vols. 8vo., 1830; and in a more popular manner in the 'Hindoos' published under the superintendence of the Society for the Diffusion of Useful Knowledge, 2 vols. 12mo. 1834-35.

Hindu Architecture.—Much yet remains to be done before we possess precise information in regard to a style of architecture which has not yet been studied by professional men, they being indebted for what they know of it solely to the accounts of travellers and antiquaries, which, again, either consist of merely verbal descriptions, or if accompanied with drawings, are not illustrated by delineations of the kind indispensable for obtaining exact and accurate ideas of the structures themselves. Till we shall be furnished with accurately measured plans, elevations, and sections, not only general but particular, so as clearly to express every circumstance of detail, our knowledge must be very imperfect; and even with such aid very much would still have to be left to the imagination, since the most accurate drawings or models could, in regard to dimensions, effect no more than words themselves, it being utterly impossible for them to convey the impression caused by actual magnitude and colossal bulk, which, as much as their forms, characterise the edifices both of Egypt and India.

After the difficulties which we have just stated attending the subject, it cannot be supposed that we here pretend to do more than offer a sketch which must be very slight and imperfect. Nevertheless a few observations in regard to it seem preferable to omitting it altogether; nor perhaps can we commence them more suitably than by calling attention to some of the resemblances and distinctions existing between Hindu and Egyptian architecture; since the obvious affinity existing between them will afford means of direct comparison, while such comparison will greatly facilitate explanation. In the article on Egyptian Architecture we referred rather to points of difference and contrast between that style and the Grecian, than to anything of positive similitude, they being separated from each other by an exceedingly wide interval as to all that regards feeling and taste. The Egyptian and Hindu styles, on the contrary, seem absolutely to come in contact with each other, agreeing most in those points wherein they most differ from Grecian and from modern taste. If there existed no other resemblance between the architecture of the two regions, there would be a decidedly strong one in their hypogæa, or subterraneous cavern-structures hewn out of solid rock, works therefore more properly of exstruction than of construction, and to which, no doubt, ought to be ascribed the chief peculiarities of the styles originating in them, namely, extraordinary massiveness of bulk and proportions coupled with no less singular capriciousness of form. Where the forms are produced by cutting away instead of putting together and building up, they may be shaped quite arbitrarily, moulded according to fancy alone, because they still belong to one naturally coherent mass: whereas were the same forms worked out of separate pieces of material, not only would they frequently be at variance with security and stability, but would occasion an enormous waste both of material and labour; the difference between the process of exstruction and that of construction being, that in the former the solids are only left after the operation of taking away, while in the latter they are produced by what is built up. This, in our opinion, goes far towards accounting for the various capricious, not to say unmeaning shapes we meet with in many of the columns of the cavern-temples of India; and these, again, account for the similar taste which was afterwards manifested in works of construction, a taste so remote from our own that the two can hardly be said to have any sympathies in common.

Of these subterraneous or grotto edifices, whose antiquity at the most moderate computation extends to several centuries before the Christian æra, and is by some carried back to periods lost in the obscurity of fable, the most remarkable are those on the Island of Elephanta near Bombay [ELEPHANTA], at Kennereh, in that of Salsette; those at Ellora near Dowletabad; at Perwatam on the Kistna; those near the pass of Ajanti, and those at Carli, about 30 miles north-west of Poonah. Many of those excavations are of prodigious extent, being composed of a series of apartments and recesses cut out of the rock, amounting in some instances to an almost incredible number, it being said that in the mountains of the Soubah of Cashmere there are no fewer than twelve thousand. Merely as monuments of human labour and perseverance the works of this class would be truly astonishing, but it is their stupendousness combined with magnificence, barbaric and frequently monstrous, that imparts to them a character almost supernaturally sublime and awful. As if to imitate nature in her most minute as well as her grandest productions, while colossal statues and sculptures display themselves within these cavern-temples and on their walls, elaborate embellishments of detail are frequently given to the columns, which appear composed of fragments capriciously put together, it being impossible to determine where their pedestals terminate and their shafts commence, or how much of these latter belong to the capitals. In fact, what is sometimes described as pedestal supporting the column, might with as much propriety be termed its lower portion, although square or polygonal, while the rest of the shaft is circular. In this respect the Hindu style, at least this earliest class of it, differs materially from that of the Egyptians, where the shafts of the columns have no pedestals, and scarcely any thing amounting to a distinct base, and where, however much the column itself may be ornamented, the capital is plainly distinguishable from the rest. The forms themselves are so singular as to baffle all attempt at verbal explanation or even comparison, and so varied, that to illustrate them by drawings would be laborious. As far however as a solitary example can be of assistance for such purpose, some idea respecting them may be obtained from those in the temple at Elephanta; which, if the square part is to be considered as a distinct pedestal, are remark-



Temple of Elephanta.

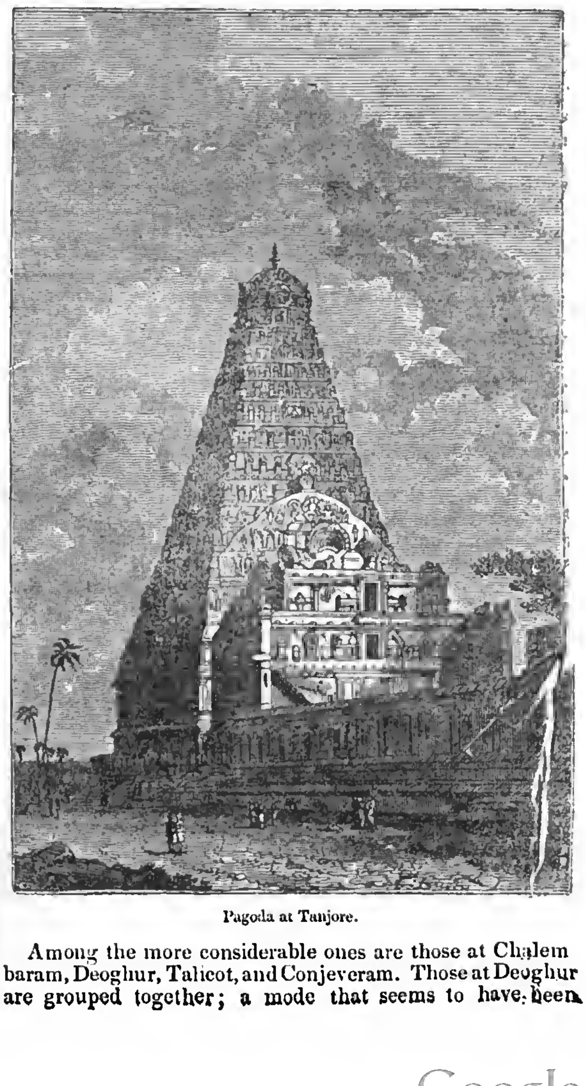
ably short, whether compared with that or with their own diameter.

It will be seen too that the pillars partake as much of the square as of the circle in their plan, and have quite as much of the baluster as of the column, both in their shape and proportions. Another circumstance to be noticed, as in this instance constituting a striking point of difference from the practice of the Egyptians, is, that they are placed so far apart, so very stragglingly, as to resemble only occasional props, instead of a continued colonnade. In this respect however there appears to have been no fixed system, for in other examples the columns are placed so close together that the parts of their capitals almost touch. This is the case with those in one of the temples on the Island of Salsette, which have flattened globular bases and capitals, and plain polygonal shafts of less massive proportions than usual; owing to which the architecture has a more regular and uniform appearance, a close file of pillars on each side, leaving a lengthened vista between them. Although therefore there is no positive evidence to show which are the earliest works of this description, it is but reasonable to infer that those which display greater architectonic symmetry in their arrangement and forms belong to a later period than those which are fashioned more after the manner of natural grottos, in regard both to the number and disposition of their columns and the forms given to these latter. Neither have we anything beyond conjecture to inform us as to either the time it must have taken to execute such prodigious excavations or the mode of operation pursued. Equally matter of conjecture is it whether advantage was taken of natural cavities in the rock, which were extended and hewn into more regular shape, or whether such works were entirely artificial and the result of human labour. Probably the latter was the case in some instances, the former in others.

If it be difficult to form any sort of classification, either architectural or chronological, there is one obvious distinction observable in these excavated temples, namely, that in some of them the ceiling is quite flat, as at Elephanta; in others, hollowed out so as to resemble more or less a regular vaulting. Of this last-mentioned kind is the temple of Kenereh, Kenneri, or Canarah, in Salsette, which is exactly on the same plan as that at Carli, and the principal object or idol is alike in both, and consists, as Moor describes it, 'of a vast hemisphere of stone resting on a round pedestal of greater diameter, having its convexity surmounted by a sort of canopy or umbrella of peculiar construction.' The ground-plan of an arched temple of Buddha at Ellora is exactly similar, but there is here a figure of Buddha himself in front of the cylindrical pedestal and hemisphere just mentioned. 'In neither of these three arched caves,' says Moor, 'will, I think, be found sculptures referring to the gods of the Brahmans; and these three are the only caves I have ever seen or heard of constructed with an arched roof. And I presume to hazard an opinion that they are of modern origin relatively with other excavations at Ellora and at Elephanta, containing, with and without Buddha, many of the deities now worshipped by the Brahmans.' If the examples just referred to are singular, as being the only instances of vaulted roofs in excavated temples, it is not at all less singular that such form should not have been the very earliest of all adopted, it being in itself the most obvious, and that furnished by natural rock-caverns and grottos. Afterwards this form of roof appears to have been elaborated with great industry and skill, for that of the temple of Mahadêva at Nadone exhibits a perfect model of the most antient style of dome in the East, and probably anterior to any thing of the kind in Roman architecture. The stones are placed so as gradually to project one beyond the other, the apex being closed by a circular key-stone. The principle therefore is that of a horizontal instead of a radiating pressure, and the edges of all these projections being rounded off, the spectator sees, on looking up, a vault composed of gradually diminishing circles or annular courses of masonry.

In this respect then even the earlier Hindu style presents a marked difference from that of the Egyptians, whose edifices are all covered with flat horizontal ceilings. On the other hand, the affinity between the architectural taste of the two people is strongly marked by the prevalent use we observe, in the edifices of both, of colossal statues placed against piers or walls, sometimes quite attached to or sculptured on them; and which may therefore be considered quite as much to constitute part of the general embellishment, as to be specific objects of worship. In both too we find frequent use of Caryatid figures, or such as serve as columns; and either entire figures or the upper parts of them, both human and animal, enter abundantly into the composition of Hindu columns and capitals. A strong similarity of system also observable in the general disposition of the sacred buildings of the Hindus and Egyptians is, that the former, like the latter, have generally an open or unroofed court before them (sometimes formed by clearing away the rock itself), leading to a vestibule, nave, and sanctuary, progressively diminishing in size. Neither is it uncommon to meet with, in the excavated temples, a series of chambers or small chapels along their sides, increasing their otherwise strong similarity of plan to those of Egypt. The profusion of inscriptions and symbolic sculptures on the walls affords also another characteristic point of resemblance.

On proceeding to consider another class of Hindu works, namely, those of construction, that is, edifices erected above ground, we can hardly avoid being struck by the prevalence of pyramidal masses and forms, as exhibited in pagodas or towers. Whether the Egyptian pyramid originated in the purpose of constructing an artificial rock containing sacred chambers and sepulchres similar to those excavated in natural ones, is merely hypothesis; neither can we pretend to say that structures of similar outline, among the Hindus, are evidently derived from and imitation of towering masses and pinnacles of rock. Resemblances of this kind afford no positive evidence of intention, being in themselves too indefinite, and depending chiefly on the fancy of the spectator. Still we may be permitted to observe, there is nothing very extravagant in the notion that the forms alluded to were derived from such natural prototypes. In the infancy of art it is probable that stones were rudely piled up one above the other, converging to an apex, as being of all forms the most stable; or else a monolithic fragment of rock was reared up to serve as a monumental record and object of superstitious veneration; and in these we may be allowed to recognise the first advances towards the pyramid and obelisk. At the same time it must be admitted that the Egyptian structures of this kind bear a much closer resemblance to such prototypes than do those of the Hindus. The gopuras or pagoda towers erected over the gateways leading to temples are indeed pyramidal in their general form, but infinitely more complex than, not the pyramid alone, but any thing else we meet with in Egyptian architecture; being divided into a succession of stories, sometimes to the number of twelve or even more, with doors or rather windows in each, adorned with balconies and pillars. Neither do they terminate in a point or mere platform, but have generally a great deal of ornament bestowed on their summit, which sometimes assumes, not inelegantly, the form of a crown, as that of Deo at Bahar; and there are also instances (of course comparatively modern ones) of their being surmounted by a bulbous dome. Besides this they differ from the pyramid in being of far loftier proportions. As is remarked in the article on Egyptian architecture, in the pyramids the height measures less than the side of their base; but in these Hindu structures it greatly exceeds the width at the lowest part, being frequently twice as much, or even more. Of a domical termination, if not exactly a dome, we have an example in the great pagoda at Tanjore, which is considered one of the finest specimens of the kind in India, and from the annexed representation of which their general character may be understood.



Pagoda at Tanjore.

Among the more considerable ones are those at Chalembaram, Deoghur, Talicot, and Conjeveram. Those at Deoghur are grouped together; a mode that seems to have been practised on other occasions, for at Benares there is a group of several pagodas, four of which are now standing quite in the river, two upright, and two in a slanting position; and at Bindrabund on the river Jumna there exists another group of lofty polygonal structures, whose faces, which are ornamented with sunk panels, are neither graduated nor flat, but curved in such manner that their section is not unlike that of a sugar-loaf: the angles between these faces are cut out and ornamented with a series of columns or ribs inserted in them. These however are not divided into stories like the usual pagodas, in some of which such divisions are very strongly marked, each story being considerably less than that upon which it stands; so that they bear no small resemblance to those of the Chinese. And here it may be remarked that Hindu architecture seems to have some resemblance to that of the people just referred to, as well as to that of the Egyptians.

Besides the two varieties above described, there is another class of Hindu monuments which calls for some remark, namely, the temples erected by the Jainas, or chief sect of the Buddhists. Some of these were erected long prior to the Christian æra, and are distinguished alike by chasteness and beauty of design, by rich and exquisite finishing; in short, according to one traveller, they evince the perfection of art, and in symmetry, beauty of proportion, and unity of splendid ornament, they rival the noblest productions of classic Europe. That at Ajmeer, which is said by Tod to be, with the exception of the cave-temples, probably one of the oldest now existing in India, is remarkable for the elegance and slenderness of its columns, so very different in their character from those in the excavated works, and which might therefore be thought to indicate a totally different period of art. They are about forty in number, and partake somewhat of a candelabrum shape, although no two are exactly alike. The ceiling is highly enriched with square panels or coffers, containing others in the form of lozenges, enriched with foliage and sculpture, in style not very much unlike the *cinquecento* of the Italians. This temple is surrounded by a superb screen of Saracenic architecture, assigned by Tod to the first dynasty of the Ghorian Sultans. The entrance arch is of that wavy outline characteristic of the Saracenic style, and is pronounced by Tod to be Hindu. The same writer dwells upon the analogy observable between the details of the columns in this temple and the ornaments of Gothic buildings.

We should also refer to the great temple at Bareilly, as a structure of most complicate and exquisite workmanship. Although placed within an area about 250 yards square, the body of the temple, or sanctuary (*mindra*), over which rises a pyramidal *sikr*, or roof, is only 21 feet square, but the addition of the domed vestibule (*munduf*) and the projecting portico composed of four superb columns makes the whole 44 feet by 21. The ceilings are elaborately worked, and that of the portico consists of a single block. Facing this temple is another splendid edifice, called the Séngár-chaomi, or Nuptial Hall, a square of about 40 feet with a double range of pillars on each side forming open colonnades. Its *sikr* is the frustrum of a pyramid, each stone of which is elegantly carved, and gradually decreasing in size to the *kullus* or ball.

In some of the older Hindu edifices (not excavations, but constructions) there is a decided Egyptian physiognomy; and the ruins of Bheems Chaori in the Mokundra are considered by Tod to exhibit the link between the two styles, which, though they have very much in common, have also no little that is peculiar to each. Not only do they assimilate in employing the pyramidal form, which of itself creates a wide distinction between them and the classical styles of antient Europe, but the religious edifices of both people have very marked and important features in common, with which Grecian architecture offers us nothing at all corresponding in character, although occasionally something analogous in purpose. It is true, when we compare them together we are as much struck by the specific differences as by the generic resemblance between the *propyla* of the Egyptian and the pagodas or entrance towers of Hindu temples. For besides being divided into stories, the latter are otherwise far more varied and complex, and display a lavish prolixity of detail and subdivision of parts far exceeding what has yet been met with in the most elaborate Egyptian structures, and certainly not to be found in those of the same class as the one here referred to. In fact, however highly enriched many Egyptian buildings may be, the mode of decoration employed in them is not of a kind to interrupt the simplicity of the outline, it being almost entirely *superficial*, that is, merely enriching surfaces, as a pattern wrought upon them would do; whereas the Hindus seem frequently to have affected the extreme both of massiveness and lightness in the same design, attaching very slender and merely ornamental pillars to enormous piers, which are the real supports. Of this we have instances in the padoga at Chalembaram, and in some degree in the choultry at Madura; at which latter place there is also another very remarkable monument of Hindu architecture, namely, the great temple, with its four gigantic porticos, each surmounted by a lofty pyramidal tower of ten stories, whose faces have projecting breaks; consequently they deviate still more from the simple pyramid form. The Kheenat Khumb, pillar, or rather tower, of victory at Cheetore, for it consists of nine stones, is octagonal in plan, and the breadth of each side 35 feet at the base, and 17½ immediately below the cupola. Each story has doors or balconies adorned with pillars, so as to resemble small porticos.

Here we must close this imperfect sketch of the subject, without touching upon that later style introduced into Hindustan after the Mohammedan conquest at the close of the 10th century. Still we cannot forbear adverting to the very close resemblance which this latter bears in some of its features to our own pointed architecture. Hodges refers us to the mosque at Chunar Gur on the Ganges, as a proof of the 'perfect similarity of the architecture of India brought thither from Persia by the descendants of Timur, and that brought into Europe by the Moors of Spain.' 'All the minuter ornaments,' he says, 'are the same, the lozenge square filled with roses, the ornaments in the spandrels of the arches, the little panellings and their mouldings; so that a person would almost be led to think that artists had arrived from the same school, at the same time, to erect similar buildings in India and in Europe.' Unfortunately his own plates do not enable us to verify his statement, since the details, so far from being distinctly shown, can hardly be made out at all. Yet we have sufficient proof in other representations of other buildings in the same style, which exhibit a much nearer approach to the pointed arch of what is called Gothic, than do the Moorish edifices of Spain. But in both we recognise one characteristic peculiar to the latest style of our English Gothic, namely, the arch being enclosed within a large square-headed pannel. There are however many features in Mohammedan Hindu architecture which stamp it distinctly from the Moorish style in the west of Europe. Among these are its numerous bulbous domes, which are frequently applied even to minarets; and the projecting galleries given to these latter, to which may be added the use of very projecting balconies, supported on massive cantilevers or consoles. One of the most splendid and perfect examples of this later style is the celebrated Taje Mahal near Agra, erected by Shah Jehan, as a mausoleum for his wife, in the 17th century. 'It stands,' says Bishop Heber, 'in a square area of about 40 English acres, enclosed by an embattled wall with octagonal towers at the angles, surmounted by open pavilions, and four very noble gateways of red granite, the principal one of which is inlaid with white marble and has four high marble minarets. The space within is planted with trees and divided into green alleys leading to the principal building, which is a sort of solid pyramid surrounded entirely with cloisters, galleries, and domes, diminishing gradually, till it ends in a square platform of white marble, surrounded by a most elaborate lattice-work of the same material, in the centre of which is a small altar tomb also of white marble, carved with astonishing delicacy and beauty.' From the description Forbes gives us of a Dewal, or temple, not long erected when he saw it, consisting of two edifices, the farthermost of which was surmounted by 'a lofty spire composed of cupolas gradually diminishing to the summit, with appropriate ornaments,' it would appear that the Hindus of the present day are no mean architects.

The Essay 'On the Architecture of the Hindus,' Lond., 1834, by Râm Raz, is curious as giving the technical rules, derived from antient treatises, but they are so dry in themselves, and so mingled with nonsensical superstitious practices, as to throw very little light upon the subject, either historically or artistically.

HINNITES. M. Defrance gave this name to a few fossil species of conchifera monomyaria, which occur in supracretaceous strata; one (H. Dubuissonii, of Sowerby) is found in the English crag.

HINZOUAN. [ANZOUAN.]

HIPPA, HIPPA TRIBE, *Hippides* of Latreille, *Hippians* of M. Milne Edwards, the latter of whom thus describes these crustaceans belonging to his family of *Pterygura*. The tribe is composed of a small number of anomurous crustaceans which appear to be especially framed for burrowing in the sand, and which present extraordinary forms. The *carapace* is longer than it is wide, and very convex transversely, presenting always on each side a great lamellar prolongation, which more or less covers the base of the feet; it is truncated posteriorly, and appears to be continuous with the anterior portion of the abdomen, which is very wide and lamellar laterally. One of the pair of *antennæ* is always very long. The *external jaw-feet* do not present a conformation like that which is observable in the greater part of the crustaceans treated of in the prior part of M. Edwards's system; they have neither *flagrum* (fouet) nor palp, and their three last joints are very well developed. The *sternum* is linear, and the *feet* are imperfectly extensile; those of the first pair are monodactylous, or subcheliform, and those of the two or three succeeding pairs are terminated by a lamellar joint proper for burrowing. The posterior feet are filiform, semimembranous, recurved forwards, and hidden between the lateral parts of the carapace and the base of the preceding feet. The penultimate ring of the abdomen is always furnished with a pair of false feet, terminated by two more or less oval ciliated blades or laminæ; but these appendages have a forward curvature, and are not applied against the seventh segment so as to form with it a fan-shaped caudal-fin, as in the *Macrura*. The *vulvæ* are on the first joint of the third pair of feet. The *branchiæ* are disposed on a single line and inserted by a peduncle which rises near the lower third of their internal surface.

This tribe is divided into three *genera*, which M. Milne Edwards distributes as follows:—

TRIBE OF HIPPIANS.		*Genera.*
External antennæ large, short and terminated by a multi-articulate rudimentary filament.	Anterior feet subcheliform.	Remipes.
	Anterior feet cylindrical, monodactylous, and not at all subcheliform.	Albunea.
External antennæ very large, and terminated by a stout and very long filament.		Hippa.

Albunea. (Fabricius.)

Most analogous of any of the tribe to the *Raninæ*, as well by their general form as by the disposition of their feet. Their *carapace*, which is straight from before backwards, and convex transversely, is only a little prolonged above the base of the feet; it is terminated anteriorly by a nearly straight border, which occupies its whole width; it is of an oval shape, posteriorly and strongly notched for the insertion of the abdomen. A small mesial point represents the rostrum. The *ocular peduncles* are large and lamellar, whilst the eyes, situated on their external border, are extremely small. The *internal antennæ* are very large, and they are terminated by a single multi-articulate filament longer than the body, slightly flattened and ciliated on its edges. The *external antennæ*, inserted nearly on the same line as the internal, are large, short, and terminated by a small stem composed only of from seven to eight small joints. The *external jaw-feet* are more or less pediform; their second and third joints are almost cylindrical, and the terminal portion formed by the three last joints is sometimes as long, and almost as large, as the basilary portion. The feet are short; the first pair are terminated by a large hand rather subcheliform than cheliform, the moveable finger applying itself to its anterior border, the lower angle of which scarcely projects, and consequently does not really constitute an immoveable finger. The three following pairs are nearly of the same form, and terminate in a falciform joint. The posterior feet are almost filiform. The first ring of the *abdomen* is small, and received in a notch of the carapace; the second is, on the contrary, very large, and presents on each side a considerable lamellar prolongation, which rides a little on the carapace. The third and fourth abdominal segments diminish progressively, but are nearly of the same form as the second; while the fifth, sixth, and seventh are very narrow, and present no lateral prolongation; the sixth supports a pair of false natatory feet, terminated by two oval laminæ; and the seventh has the form of a nearly circular lamina. (M. Edwards.)

Example, *Albunea Symnista*. Length of carapace 10 lines.

Locality, the seas of Asia.

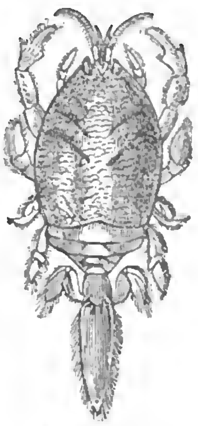
Albunea Symnista.

Remipes. (Latreille.)

Carapace nearly regularly oval, convex, and less than once and a quarter as long as it is wide. *Front* rather large and truncated. *Orbits* semicircular, and their external angle much more projecting than the front. The ophthalmic ring is covered above by the front, but is not surrounded by the carapace; the ocular peduncles are composed of two moveable portions, one basilary, which is stout and short, the other terminal, cylindrical, slender, carrying at its extremity a very small imperfectly retractile cornea; the eyes, in fact, can scarcely be turned backwards, as in the greater part of the Decapods, but advance and recede a little by the motion of the basilary portion of their peduncle. The *internal antennæ* are inserted below the base of the ocular peduncles, and are very large; their basilary portion is composed of three joints nearly of the same size, and their terminal portion consists of two long filaments which are multi-articulate, stout, and directed forwards. The *external antennæ* are inserted within the internal, nearly on the same line, and under the latero-anterior edge of the carapace: they are short but very large; their first joint is much wider than it is long; the second and the third are nearly of the same dimensions, and the succeeding joints diminish rapidly in volume. The *buccal frame* is not closed anteriorly. The external *jaw-feet* are wide and short; their first joint is nearly globular, and carries neither palps nor flagrum; the second joint, which is so large in the *Brachyura*, is rudimentary here; and it is the third, which, become very large and nearly oval, constitutes solely the species of operculum formed ordinarily by the second and third joints united; the three last joints form a sort of large claw, which applies itself against the anterior border of the third joint. The jaw-feet of the second pair are equally destitute of the flagrum, but have a flabelliform palp; it is the same with the anterior jaw-feet; their palp is lamellar, dilated anteriorly and disposed nearly as in the Oxystomes. The *jaws* of the second pair present nothing remarkable; those of the first pair are very small. The mandible, which is strongly dentilated, is furnished with a palp composed of two small lamellar joints, separated from the body of the mandible by a large membranous furrow. The *sternum* is linear. The anterior *feet* are long; their second and third joints are enlarged; but the three last are cylindrical; and the last, which is nearly as long as the preceding one, is slightly flattened, pointed, and incapable of being bent back upon it. The two following pairs are large, and terminated by a large hastiform lamina; the fourth pair are held by a small nearly conical joint. The fifth pair are slender, long, and membranous, and are bent back upon the lateral prolongation of the carapace. The last thoracic ring, which supports these appendages, is complete above, moveable, and not covered by the carapace, so that it might be easily taken for the first abdominal segment. The *abdomen* is very large, and presents on each side a lamellar oval prolongation which rides upon the carapace; its anterior border is notched for the lodgement of the second abdominal ring, which is oval; the third and fourth segments diminish progressively in volume; the fifth and sixth are equally small, but are soldered together; and the seventh has the form of a great triangular lamina, the length of which exceeds that of all the rest of the abdomen. The three first rings in the female are furnished with simple oviferous filaments; the fourth and fifth rings are without appendages, while the sixth ring carries a very large pair of false natatory feet, terminated by two raised oval plates which are ordinarily bent forwards. (M. Edwards.)

Example, *Remipes testudinarius.* Length of carapace about 15 lines.

Locality, the coast of New Holland.



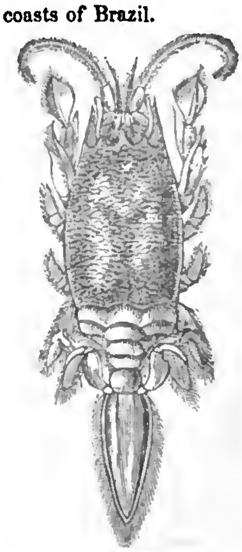
Remipes testudinarius.

Hippa. (Fabricius.)

When Fabricius established the genus it was much more extensive in its limits, and at present it only contains those Hippians whose external antennæ are terminated by a long and stout multi-articulate filament. *Body* oval, or rather ellipsoïd, being rather less wide forward than backward. *Carapace* truncated posteriorly, very convex transversally, and presenting towards the middle a transversal curved furrow which indicates the posterior tenuity of the stomachal region; its latero-anterior border is concave, but its latero-posterior border is very convex. The *rostrum* is small and triangular, and on each side of its base is a notch which exposes the insertion of the ocular peduncles and the internal antennæ, and which is bounded externally by a projecting tooth which advances above the internal edge of the great antennæ. The *ophthalmic ring*, which is covered in its mesial part by the rostrum, is of a horse-shoe shape, and its two extremities are exposed; the *ocular peduncles*, inserted at its extremity, are composed of three pieces, and of these the two basilar, which are very short, are bent under the carapace in the form of V, and the last, which is slender, cylindrical, and very long, advances between the internal and external antennæ, and terminates by a small pyriform enlargement which carries the cornea. The *internal antennæ* are of moderate size, and their basilary joint, which is cylindrical and a little curved downwards, is hardly larger than the succeeding one, which is furnished on the external side with a strong tooth directed forwards; the third joint is short, and gives insertion to two multi-articulate stemlets (tigelles). The *external antennæ* are very large, but easily escape observation, for they are ordinarily bent backwards and hidden almost entirely between the mouth and the external jaw-feet. The first joint of their peduncle is small and but little apparent; the second is large and armed anteriorly with two spiniform teeth, the external of which is much the strongest; the two succeeding joints are small, and form by their union a globular mass, whence springs a last peduncular joint, which is cylindrical, and supports in its turn the multi-articulate terminal filament, which last is very large, nearly of the length of the carapace, and fringed externally with a double row of long hairs. The *external jaw-feet* are of considerable size and operculiform, but their two first joints are very small, and it is the third only which presents that disposition; the three last joints form a long, delicate, and lamellar appendage, which is inserted in a notch of the external angle of the preceding joint, and is bent back under its internal edge, but does not constitute a claw as in *Remipes.* The palp of the two pairs of succeeding jaw-feet is terminated by a lamellar enlargement. The *feet* are short, and hidden under the carapace; the first pair are stout and applied against the mouth, terminating with a ciliated nearly oval lamina. The tarsus of the two succeeding pairs of feet is lamellar and hastiform, and that of the fourth pair is stout, conical, and very short. The posterior feet, which are long, membranous, and very slender, are bent back between the lateral part of the carapace and the base of the preceding feet. The last thoracic ring is not free and exposed as in *Remipes;* but the first joint of the *abdomen* is nearly of the same form, and the succeeding rings present also the disposition already noticed in these crustaceans. (M. Edwards.)

Example, *Hippa Emerita.* Length from 1 inch to 15 lines.

Locality, the coasts of Brazil.



Hippa Emerita.

HIPPA'LIMUS, a genus of zoophyta proposed by Lamouroux. Goldfuss supposes that it may be included in his genus Scyphia. It is fungiform and pediculated, with pores on the upper surface only, and a deep central pit. From the blue marls of the department of Calvados.

HIPPARCHUS, the first astronomer on record who really made systematic observations, and left behind him a digested body of astronomical science. He was born, according to Strabo, at Nicæa in Bithynia, and was alive, as appears from his observations preserved by Ptolemy, in the interval 160—125 B.C.; but neither the year of his birth nor that of his death is recorded. His astronomical observations were probably commenced in Bithynia, and certainly continued at Rhodes; whence he is called by some authors the Bithynian, and by others the Rhodian, and some even suppose two astronomers of the same name, which is certainly incorrect. He is also supposed to have observed at Alexandria; but Delambre, comparing together such passages as Ptolemy has preserved on the subject, is of opinion that Hipparchus never speaks of Alexandria as of the place in which he resided; and this opinion of Delambre appears to us to be correct.

The proper place for an account of the discoveries of Hipparchus is the article on the SYNTAXIS of Ptolemy, or the Almagest, and for this reason, that the loss of the writings of Hipparchus has left us without any specific account of his discoveries, except that contained in the Syntaxis. And since it is a matter of very great doubt whether Ptolemy made observations himself to any extent, and since it is also certain that he drew his catalogue of stars, and nearly all the observations on which his theory is founded, from Hipparchus, the article just alluded to would necessarily contain all that is to be said on the subject. We shall therefore here content ourselves with citing the works which Hipparchus is said to have written, and the resumé of his labours given by Delambre.

The titles of the writings attributed to Hipparchus, on whom Ptolemy has fixed the epithet of *φιλόπονος καὶ φιλαλήθης* ('the lover of labour and truth'), have been collected by Fabricius, and are to be found in Weidler, as follows:—1. *περὶ τῶν ἀπλανῶν ἀναγραφαί*; 2. *περὶ μεγεθῶν καὶ ἀποστημάτων*; 3. De XII. Signorum Ascensione; 4. *περὶ τῆς κατὰ πλάτος μηνιαίας τῆς σελήνης κινήσεως*; 5. *περὶ μηνιαίου χρόνου*; 6. *περὶ ἐνιαυσίου μεγέθους*; 7. *περὶ τῆς μεταπτώσεως τῶν τροπικῶν καὶ ἰσημερινῶν σημείων*; 8. Adversus Eratosthenis Geographiam; 9. Τῶν Ἀράτου καὶ Εὐδόξου φαινομένων ἐξηγήσεων βιβλία γ. The only one of these which has come down to us is the last and least important, the commentary on Aratus, written probably when Hipparchus was young, since he does not mention any of his subsequent discoveries, and the results of observation are not so correct as those of his catalogue. This work was published by Peter Victorius, Florence, 1561, and by Petavius in his 'Uranologion,' 1630. Hipparchus also wrote a work, according to Achilles Tatius, on eclipses of the sun; and there is also recorded a work with the following title: Ἡ *τῶν συνανατολῶν πραγματεία*.

The following summary is from the preface to Delambre's History of Antient Astronomy, in which work will be found the most complete account of the labours of Hipparchus. The bias of this historian seems to be, to add to Hipparchus some of the fame which has been generally considered due to Ptolemy, for which he gives forcible reasons. [SYNTAXIS.] 'Let no one be surprised at the errors of half a degree which we attribute to Hipparchus, seemingly with reproach. It must be remembered that his astrolabe was nothing but an armillary sphere, of no great diameter, and with very small subdivisions of a degree; as well as that he had neither telescope, vernier, nor micrometer. What should we do even now if deprived of these helps, and if we knew neither the refraction nor the true altitude of the pole, on which point, even at Alexandria, and with armillæ of every sort, an error of a quarter of a degree was committed? At this day we dispute about a fraction of a second: they could not then answer for any fraction of a degree, and might be wrong by a whole diameter of the sun or moon. Let us rather think of the essential services which Hipparchus rendered to astronomy, of which science he is the true founder. He was the first who gave and demonstrated methods of solving all triangles, whether plane or spherical. He constructed a table of chords, of which he made nearly the same use as we now do of our tables of sines. He made many more and much better observations than his predecessors. He established the theory of the sun in such a manner that Ptolemy, 263 years afterwards, found nothing to change. It is true that he mistook the inequality of the sun's motion: but it can be shown that his mistake arose from an error of half a day in the time of the solstice. He himself avows that he may have been wrong by a quarter of a day; and we may always safely suppose that, without impeachment of an author's integrity, his self-love may halve the error which he is really liable to commit. He determined the first inequality of the moon (the equation of the centre), and Ptolemy found nothing to change in his result: he gave the mean motion of the moon, and that of the apogee and nodes, in which the corrections made by Ptolemy were slight, and of more than doubtful goodness. He had a sight of the second inequality (the evection); it was he who made all the observations necessary for a discovery of which the honour was reserved for Ptolemy; a discovery which he had not perhaps time to finish, but for which he had prepared everything.* He showed that all the hypotheses of his predecessors were insufficient to explain the two-fold inequality of the planets; he predicted that none would be successful which did not combine the two hypotheses of the excentric and epicycle. He had not the proper observations, because they require more time than the duration of the longest life: but he made them ready for his successors. We owe to his catalogue the important knowledge of the retrograde motion of the equinoctial points. We might, it is true, have derived this knowledge from much better observations, made within the last hundred years; but we should then have had no proof that this motion remains sensibly the same through a long course of ages; and the observations of Hipparchus, by their number and their antiquity, and in spite of the errors which we are obliged to admit, give important confirmation to one of the fundamental points of astronomy. It is to him that we owe the first discovery of this phenomenon. He also invented the planisphere, or the method of describing the starry heavens upon a plane, and of deducing the solution of problems in spherical astronomy by a method often more exact and convenient than that of the globe itself. He is also the father of real geography, through the happy idea of marking the position of towns in the same manner as that of the stars, by circles drawn through the pole perpendicularly to the equator, that is, by latitudes and longitudes. His method, by means of eclipses, was for a long time the only one by which the longitude could be determined; and it is by means of the projection of which he was the author that we now make our maps of the world and our best geographical maps.'

* The bias above alluded to peeps out here a little too much.

HIPPIANS. [HIPPA.]

HI'PPIAS, HIPPARCHUS. [PISISTRATUS.]

HIPPO. [ALGIERS.]

HIPPOCA'RCINUS. [HOMOLIANS.]

HIPPOCEPHALOI'DES. By this name Plott and other writers understood the inner casts of certain equivalved conchifera, especially Trigonia.

HIPPOCHRENES. (Conchology.) [STROMBIDÆ.]

HIPPOCRATEA'CEÆ, a small natural order of Exogenous plants remarkable for the presence of three monadelphous stamens in a pentapetalous flower. The fruit consists of from one to three cells, and is frequently extended at the back in a membranous manner, so as to resemble the samara, or key, of the ash-tree. The species are woody, and often climbers; they inhabit Africa, the Mauritias, and the tropical parts of America; in general they are of no importance for economical or medical purposes; one species bears an eatable fruit, and another has oily seeds with a sweet taste. The order hardly differs from Celastraceæ.

Hippocrateaceæ.

1, a flower expanded; 2, a section of the same, showing the ovary.

HIPPOCRA'TEA, a genus of the natural family of Hippocrateaceæ, so named after Hippocrates, and which might therefore be expected to contain many useful or medicinal plants. But it is not so. The species consist of moderate sized trees, which are found in the hot parts of the world, as in the tropical parts of America, in Sierra Leone, the warmer parts of India, and the island of Timor. The genus is characterized by having the calyx 5-leaved, but very small. Petals 5, usually hooded at the apex. Stamens 3, anthers one-celled, opening transversely at the apex. Carpels 3, samaroid, bivalved, valves keeled and compressed. Seeds winged from the funiculus being widely expanded. The fruit of some of the plants of the family is eatable; but the seeds of one species only of Hippocratea are mentioned as being of any use; those of H. comosa, being oily and sweet.

HIPPO'CRATES was born at Cos, B.C. 460. His family followed the pursuit of medicine for near three hundred years, and produced seven physicians, who attained considerable celebrity, and who are supposed to have written the numerous treatises which are commonly attributed to Hippocrates alone. Before their time the knowledge of medicine was either confined to the priests, who employed their skill in maintaining their influence over the people, and carefully concealed the little knowledge they possessed, or was merely followed as a subordinate pursuit by the philosophers of the day. It is to the Asclepiadæ that the science of medicine is indebted for a separate existence, and the great progress which it made in their hands after this separation sufficiently proves the wisdom of their proceeding.

The most celebrated of the family was the subject of the present notice, Hippocrates, the son of Heraclides and Phænarete, who is supposed to have been the author of this important revolution in medicine. It would have been extremely interesting to give some details of his personal history, but unfortunately we possess but few authentic materials for this purpose, except some fragments contained in his life by Soranus. His medical studies were pursued under the superintendence of his father and of Herodicus; and he is said to have had for his masters in philosophy Gorgias of Leontini, the celebrated sophist, and Democritus of Abdera, whose cure he afterwards effected. We are told that he spent some time at the court of Perdiccas, king of Macedonia, and visited Thrace and Scythia; and it is probable that these statements are true, as mention is made in his writings of several towns in Thrace (Suidas, Ἱπποκράτης). Soranus states that he delivered Athens from the ravages of a dreadful plague which was raging in the city: but this can hardly be the one which occurred in the second year of the Peloponnesian war, of which such a graphic description is given by Thucydides; for though Thucydides suffered from the disease himself, and was a witness of its ravages, he makes no mention of the name of Hippocrates, but on the contrary declares that medical skill was of no avail against it.

We have already observed that many of the works usually attributed to Hippocrates were in reality the productions of various members of his family. This circumstance alone would render it impossible to determine accurately the amount and value of his contributions to the science of medicine. But this difficulty has been still further increased by the manner in which his writings were mutilated, and fresh passages interpolated by later editors. This confusion is supposed to have been introduced into his writings at the time when the Ptolemies were forming their celebrated library at Alexandria, for the high value which was set upon antient writings by these monarchs induced men to collect and forge copies of antient authors, which they passed off for the genuine works of those to whom they were attributed. It appears that in the time of Galen they were able in some degree to distinguish the genuine writings of Hippocrates from those falsely attributed to him. All the writings assigned to Hippocrates are written in the Ionic dialect, but he does not adhere so closely to its forms as Herodotus.

The principles of Hippocrates were those of rational empiricism. He did not attempt to form his theories from *à priori* reasoning, but he observed the phenomena of nature and deduced from them such conclusions as these phenomena would justify. That he adhered to this principle in all cases however is not to be supposed. He taught that the body is composed of four primary elements—fire, water, earth, and air; that these elements, variously combined, produce the four cardinal humours, and these again the different organs of the body. These doctrines are principally developed in the treatise 'On the Nature of Man;' and Galen asserts that he was the author of this theory, which was afterwards adopted and more generally promulgated by the genius of Plato. His knowledge of anatomy seems to have been very limited. The superstitious respect which was paid to the remains of the dead among the Greeks prevented him from acquiring any knowledge on this subject by dissection of the human body. He gives such descriptions of the bones as show that he had indeed studied the subject, but not acquired any very accurate knowledge. The muscles are described under the general term of *flesh* (σάρκες), and though some explanation is given of them in the treatise 'On Art,' this is probably spurious. The term *phlebs* (φλέψ) is applied indiscriminately to the veins and arteries, while *arteria* (ἀρτηρίη) is confined exclusively to the trachea. His description of the vessels is confined to the course of some of the larger ones, without expressing any opinion as to their origin. He does not seem to have supposed that they originate either in the heart or liver. These views were first propounded in the school of Alexandria. Under the term *nerves* (νεῦρα) he confounds all the white tissues of the body, the nerves, properly so called, the tendons, and ligaments. According to Hippocrates the brain is glandular and secretes the pituita, or mucus. In his pathology he confines himself principally to the investigation of the remote causes of diseases, without entering into many speculations on their nature. However he explains inflammation by the passage of blood into those parts which did not previously contain it. In this case we still require to be informed how the blood passes into these parts. He paid great attention to the effects of changes in the external conditions of life, namely air, warmth, moisture, food, upon its phenomena, and those of disease. He recommended that particular attention should be paid to the constitution of the seasons.

Among the doctrines of Hippocrates, that of critical days, upon which he supposed the evacuation of the morbific matter when concocted to take place, is the most remarkable. In his 'Prænotiones' he says, fevers come to their crises on the same days, both those which turn out fatally and those which turn out well. These days are the fourth, the seventh, the eleventh, fourteenth, seventeenth, and twentieth. The next stage is of thirty-four days, the next of forty, and the next of sixty. It appears very doubtful how far this theory was borne out by actual observation, but it is possible that it may have been more nearly true under the treatment of Hippocrates, which was not usually very active, than under the more energetic treatment of modern physicians. Of the indications to be drawn from examination of the pulse Hippocrates was not aware, and the word *sphygmus* (σφυγμὸς) is usually employed by him to denote some violent pulsation only. It is however upon the accuracy with which he observed the leading features of disease, and his vivid descriptions of them, that the fame of Hippocrates is principally and justly founded. Nowhere is the peculiar power of the Greeks in expressing their conceptions more strikingly shown. We have extracted one or two of the most marked descriptions from his Prognostica. 'If the appearance of the patient be different from usual, there is danger. If the nose be sharp, the eyes hollow, the temples collapsed, the ears cold and contracted, and the lobes inverted, whilst the skin of the forehead is hard, dry, and stretched, and the colour of the face pale or black or livid or leaden, unless these appearances are produced by watching or diarrhœa, or under the influence of malaria, the patient is near death.' This description has obtained the title of Facies Hippocratica. Again how well does he recommend us to observe the position of the patient in bed! 'If he lies upon his side with the neck and arms and legs slightly bent, and the whole body in a flexible state, since such is the position of health, it is well; but if he lies on his back, with the legs and arms extended; and still more if he keeps sinking towards the bottom of the bed, or tosses his arms and head into unusual positions, our anticipations must be most unfavourable.' And 'If in an acute disease the hands are waved before the face, as if seeking something in the air, or brushing and picking motes from the walls or bed-clothes, the prognosis must be unfavourable.' In the remainder of this treatise he goes through the different evacuations from the bladder and the bowels, by vomiting and by expectoration, describing their characters and appearances, and the conclusions that may be drawn from them. Thus he observes the change in the appearance of ulcers before death, that they become pale and dry or livid and dry; and of pus, he says that it is best when white and uniform and smooth, and with as little bad odour as possible; remarks, the truth of which has been fully supported by experience. His directions for the examination of a patient supposed to be labouring under empyema present an example of sound and cautious investigation. 'If there is empyema on one side of the chest, we must turn the patient, and learn whether he has pain in one side, and if one side be hotter than the other; while he is lying on the sound side, we must ask if he feels any weight hanging from above. For if this be the case, the empyema is on that side on which he feels the weight. We may recognise the presence of empyema by these general signs:—if the fever does not remit, but is moderate during the day and increased at night, and considerable perspirations occur, and there is great inclination to cough and but little expectoration; while the eyes become hollow, the cheeks are flushed, the finger-nails curved, and the fingers hot, especially the tips, and the feet swell, and pustules are formed over the body—these symptoms denote chronic empyema, and may be greatly relied on.' We must not forget that Hippocrates asserts that auscultation may be employed to distinguish between the presence of pus and serous fluid in the cavity of the pleura. No attention seems to have been paid to this remarkable statement until the time of Laennec's great discovery, by whom the passage is noticed and referred to. The statement of Hippocrates is in itself incorrect, but the fact of his having actually practised auscultation is no less interesting.

Hippocrates appears also to have introduced some valuable improvements in the treatment of disease. During health he recommends that the diet should not be too exact, lest any unavoidable change should bring on disease. Of wine he says it must not be taken pure during the summer, but in the winter he allows a more liberal use of it. In his treatise 'On Diet' he claims to have been the first to recognise the importance of diet in the treatment of disease, which had been neglected by all previous physicians; and in this statement he is in some measure borne out by the authority of Plato (*De Rep.*, iii. 14), who praises the antient physicians for having neglected it; whereas the modern ones, by this system, convert life into a tedious death. However he attributes the introduction of the new system to Herodicus. In fevers and acute diseases he confined his patients to a liquid diet, but not so strictly as some other physicians, whom he charges with starving their patients to death. In his general treatment he employed purgatives, some of which were of the most violent character, as the black and white hellebore and elaterium, which generally produce excessive vomiting at the same time. He mixed up a little theory with his treatment; for he would not allow purgatives to be employed unless the humours were duly concocted. To relieve the head in certain diseases he was accustomed to make use of sternutatories. In acute affections, when the disease was violent, he employed bleeding, and recommended that blood should be taken from as near the affected part as possible. This was the origin of the doctrine which recommendod bleeding in pleurisy from the arm on the side affected. He also made uso of cupping-glasses, with and without scarification. Certain diuretic and sudorific medicines also entered into his pharmacopœia, and he was not ignorant of the virtues of the poppy.

In the time of Hippocrates the distinction between medicine and surgery had not been made, as we find among the works usually attributed to him, and contained in tho list of Erotian, treatises on fractures, on ulcers, and on wounds of the head. In the latter he was in the habit of employing tho trephine, and gives directions for its use. However, in the oath of Hippocrates the pupil is made to swear that he will not attempt the operation of lithotomy, but give it up to those whose business it is to perform it. In the treatise 'On Injuries of the Head' he remarks that convulsions usually take place on the side of the body opposite to the injury.

We find that consultations were not unknown in the time of Hippocrates, for in the latter part of the 'Præcepts' he says that a physician ought not to be ashamed to call in the assistance of another, if he finds himself at a loss in the treatment of his patient. The oath which he administered to his pupils shows tho high sense he had of the duties and responsibilities of a physician. The pupil is made to swear 'that ho will reverence his teacher as a father, and his descendants as brethren; that he will use his art to the benefit of his patients, and never to their injury or death, even if requested by them; that he will nevor attempt to procure abortion, that he will be chaste, and never divulge any professional secrets. Similar sentiments are expressed in the treatise 'On the Physician,' but it is doubtful whether this is a genuine production of Hippocrates. As we have remarked above, Hippocrates wrote in the Ionic dialect, though the island in which he was born was originally colonized by the Dorians. His style is remarkably concise, so as to render his meaning at times somewhat obscure, and it would appear that he occasionally makes his statements too general, in order to avoid loading his writings with exceptions. The high estimation in which his works have been held is proved as well by the general reputation of his name, as more especially by the numerous commentaries upon them which have been published in all ages. It will be sufficient to mention the names of Asclepiades, of Rufus Ephesianus, of Celsus, and of Galen, who have all commented upon his writings. Galen declares that we ought to reverence them as the voice of the Deity, and that if ho has ever written too concisely or somewhat obscurely, ho has never written anything which is not to tho purpose. His knowledge of anatomy and physiology, and of the processes which go on in the body during health and disease, was extremely deficient, but in the accuracy with which he observed the symptoms of disease and in the fidelity of his descriptions he has rarely, if ever, been surpassed. It is upon these grounds that he has justly obtained the title of 'the Father of Medicine,' and will at all times continue to command the respect of his medical descendants.

Hippocrates is said to have died at a very advanced age at Larissa in Thessaly. The essays of which he is the reputed author are 72 in number, but the best commentators on them do not allow more than 15 or 20 to be genuine. The most esteemed of them are the essays on Air, Water, and Locality; the first and third books of that on Epidemics, the Aphorisms, the Essay on Prognostics, that on Wounds of the Head, and that on the Diet in Acute Diseases. The best editions of his works are those of Foesius, Frankf., fol., 1595, which was reprinted several times; of Linden, 2 vols. 8vo., Amsterdam, 1665; and of Mack, 2 vols. fol., Vienna, 1743—1749. They have been most voluminously commented on. From a list which Foesius gives of all the works published upon them previous to 1595, it appears that 137 authors had written upon the 'Aphorisms' alone, and the commentaries and criticisms upon the rest of his essays would be sufficient by themselves to form an extensive library. Many of the treatises have been edited separately. There is a complete German translation of Hippocrates by J. F. C. Grimm, Altenb., 1781—1792, 4 vols. 8vo.

(Sprengel, *Histoire de la Medicine*, tom. 1.)

HIPPO'LYTE, the name of a genus of crustaceans belonging to tribe of *Palemonians*. [PALEMONIANS.]

HIPPO'MANE MANÇANILLA, the manchineel-tree, is a plant which has as bad an American reputation as that of the upas-tree in the Indian Archipelago. It is a treo of very considerable size, and of a handsome aspect, belonging to the natural order Euphorbiaceæ, and among the most poisonous of all known vegetable productions. The leaves are alternate, ovate, acute, serrated, and shining, with a roundish depressed gland between the blade and the petiole. The flowers are small, unisexual, and arranged on slender axillary spikes, the lowermost only being female, all the others male. The male flowers grow in clusters, and have each a small calyx of two sepals, containing a tetrandrous column of stamens. The females have a calyx of three sepals, a round ovary crowned by six or seven reflexed stigmas, and containing as many cells. When the fruit is ripe it is a fleshy yellowish-green round body, very like a European crab-apple. The tree is common in the West India Islands, although pains have been taken to extirpate it. In some places it forms thick woods, as upon Sandy Island, near Tortola, to the exclusion of all other vegetation, for not a blade of grass will grow beneath its branches. The whole plant abounds in a milky juice of the most venomous description; dropped on the skin it produces a sensation of severe burning, followed by a blister; and the fruit, when bitten, causes dangerous inflammation of the mouth. This is denied by some of the West Indian settlers, but is undoubtedly true, according to the elder Jacquin, and to the more recent testimony of Mr. Schomburgk, who suffered severely from having tried the experiment of eating the fruit. Jacquin however asserts that to sleep beneath the shade of the manchineel-tree is not dangerous, as is commonly reported. But Mr. Schomburgk says that if rain passes through the branches and drops upon the skin of a person below them, it produces severe inflammation, and that the dew which falls at night causes the same effects, as he saw in certain cases which came beneath his own observation; but he adds that it acts differently upon different persons, he himself not suffering any inconvenience from rubbing the juice on the skin. But while the dangerous qualities of this tree are thus undoubted, it is very uncertain whether the poisonous quality which, it is believed in the West Indies, the land-crabs acquire from the manchineel-tree is really owing to that cause. Jacquin denies it, and Mr. Schomburgk could obtain no proof that it is so; all that is certain is, that land-crabs are frequently found under the shade of manchineel woods, and that those animals are often poisonous. The wood of this tree is represented to be of fine quality, handsome, and well suited for cabinet-makers' purposes.

Hippomane Mançanilla.

1, a ripe fruit; 2, a transverse section of the same; 3, a male flower; 4, a female flower; 5, an ovary.

HIPPO'NÖE, a genus of Dorsibranchiate Annelids, considered by MM. Audouin and Milne Edwards to approach the genus *Amphinome*. *Hipponöe* is deprived of a caruncle and has only a single packet of bristles to each foot and a single cirrhus.

HIPPO'PODA, a genus established by MM. Quoy and Gaimard for a marine floating mollusk which M. De Blainville considers identical with *Protomedea* of Lesueur's MSS., and places under his (M. De B.'s) *Physograda*.

HIPPOPO'DIUM, a genus of Conchifera Dimyaria proposed by Mr. J. Sowerby in the 'Mineral Conchology of Great Britain.' It includes only one British species, H. ponderosum, which is found in the lias.

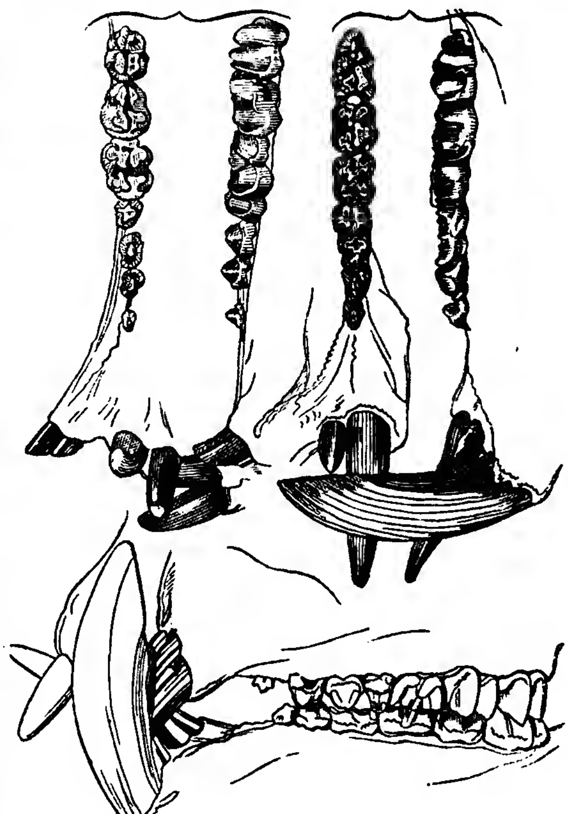
HIPPOPO'TAMUS, the Roman name for the River-horse (Ἵππος ποτάμιος of the Greeks), and retained by modern zoologists as the generic appellation of the animals of that Pachydermatous form.

Dental Formula:—Incisors $\frac{4}{4}$; Canines $\frac{1-1}{1-1}$; Molars $\frac{7-7}{6-6}$: $=38$.

Cuvier remarks that there is no animal that requires to be more studied at different ages than the Hippopotamus, in order to acquire a perfect knowledge of the molar teeth, which change their form, their number, and their position; and in his *Ossemens Fossiles* he goes into minute details of those changes.

In the *upper-jaw* the first incisor is conical, straight, and a little worn on its internal side; the second is equally conical, but curved inwards. The canine-tooth is short, and cut, as is were, obliquely, in consequence of its abrasion against its opposite. The four molars which succeed the canine are strictly false molars. The first is very small, is shed as the animal advances in age, and is not reproduced it is separated by an interval from the rest of the molar teeth. These, nearly of the same size, are also shed during the youth of the animal, are replaced by others, and the first teeth are more complicated than the second. When these, the true and permanent molars, are worn by use, they exhibit the form of a trefoil on their crowns. The three last resemble each other generally: they are composed of four large tubercles approximated in pairs, and conical before the points are worn by attrition consequent on mastication. After the first effects of abrasion, they each present, by the contour of the enamel, the figure of a trefoil, or, in other words, three-lobes disposed more or less regularly in the form of a triangle; but as the abrasion proceeds and the tooth is farther worn down, they exhibit the form of a cross with a disk in the middle.

In the *lower-jaw* the first incisor is long, subcylindrical, terminated in a point, and a little worn on its external side. The second is of the same form as the first, but much smaller. The canines are enormous tusks sharpened into a somewhat chisel-like edge, the polished and abraded internal surface of which presents a shape inclined to elliptical. The molars form a continuous series; the first and the second are false molars, the first being the smallest, and dropping as the animal advances in age, never to be replaced. The four succeeding teeth exhibit the same general forms as those of the upper-jaw. The first, which is smaller than



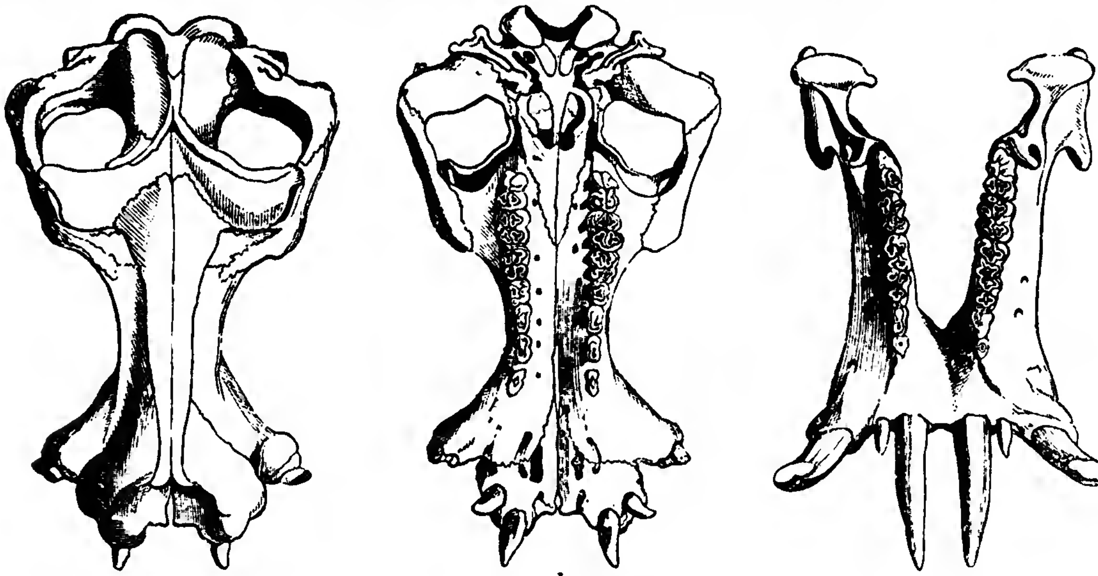
Teeth of Hippopotamus. (F. Cuvier.)

the others, has an anterior isolated tubercle: the succeeding teeth are nearly of the same size, and have also an isolated tubercle, hut it is posterior. (Hippopotamus of S. Africa.)

Cuvier makes the first section of his second family of Pachydermatous Mammifers (*Ordinary Pachyderms*) consist of those which have four, three, or two toes; and these he separates into two great genera, the Hippopotami and the Hogs [SUIDÆ]. The *Hippopotamidæ* are further characterized generically as having on all their feet four *toes*, which are nearly equal and terminated by small hoofs (sabots), an immensely massive body destitute of hair, very short legs, a belly trailing against the ground, an enormous head, terminated by a large tumid muzzle which encloses their great anterior teeth, a short tail, and small eyes and ears. Their stomach is divided into many compartments. They live in rivers, on roots and other vegetahle suhstances, and are ferocious and stupid. The genus is placed by Linnæus among his *Belluæ*, between *Equus* and *Sus*. Mr. Gray brings it under the *Elephantidæ*, his third family of his fifth order, *Ungulata*, as a genus of his subfamily *Hippopotamina*, and inquires whether the form be not allied to the *Halicoridæ*. (*Annals of Philosophy*, 1825.)

ORGANIZATION.

Skeleton.—The skeleton of the *Hippopotamidæ* approaches that of the ox and of the hog; but it presents differences which distinguish it from that of any other animal. The skull, whilst in the connexion of the bones and the arrangement of the sutures, it bears great similitude to that of the *Suidæ*, has its own peculiarities, which render its form extraordinary.

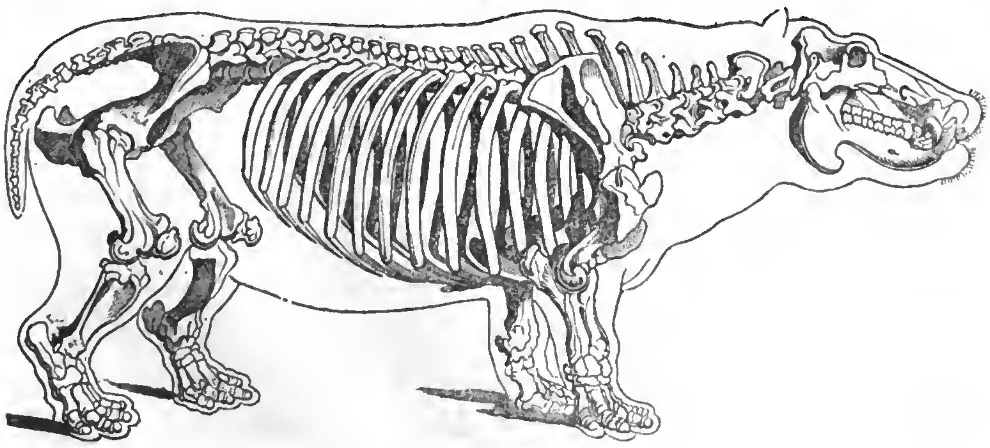


a b c

Skull of Hippopotamus.

a, seen from above; *b*, seen from below; *c*, lower-jaw seen from above.

The number of vertebræ are 7 cervical, 15 dorsal, 4 lumbar, 7 sacral, and 14 coccygial = 47. The atlas and the axis, besides the ordinary articular facets, have each two others also towards their dorsal aspect; but taken as a whole, the cervical vertebræ approach nearest to those of the hog. There is nothing very remarkable about the rest of the vertebræ, except that their hodies are rather flat. There are 7 true and 8 false rihs of a side = 30, nearly as much arched as those of the Rhinoceros, hut distinguishable from them, as well as from those of the Elephant, in as much as they are much wider and flatter at the part nearest to the vertebræ than at the opposite end. The anterior part of the sternum is compressed into a ploughshare-like shape and very much prolonged into an obtuse point below the first rib. The rest is depressed, and the number of pieces is seven. The scapula may be easily distinguished from those of the Rhinoceros and Elephant, being larger than that of the first and less than that of the second, and also differing in form. In its general aspect this bone reminds the observer a little of the scapula of the Hog, but approaches nearer to that of the Ox in the more essential characters of the spine and articulating surface. The humerus bears a singular resemblance to that of the Ox; while there is some similitude to that of the Hog, which is however less in proportion towards the bottom. The radius and ulna are anchylosed at an early age, leaving on the outside only a rather deep furrow which occupies only three-fourths of the length of the radius, and on the inside a simple aperture towards the upper fourth part. These bones of the fore-arm resemble those of the Ox very much, but those of the latter are more elongated, and the articular facets of the lower head of the bone are, in the last-named animal, less oblique. There are in the carpus points of resemblance to the Hog; hut its characters distinguish it both from that quadruped and the Ox. In the metacarpus all comparison with that of the Hog ceases. The pelvis is



Skeleton of Hippopotamus.

easily distinguishable from those of the Elephant and Rhinoceros, from the smaller width of the ilia in the Hippopotamus and other differences. The Ox perhaps approaches it more closely in these parts; hut, besides other discrepancies, the lower part of the pelvis and especially the oval holes are much more elongated in the Hippopotamus. The sacrum is very large, hut the hones of the pubis project but very little. The femur, which possesses a ligamentum teres, is well-shaped and straight, the shaft nearly equal throughout, regularly cylindrical anteriorly. The great trochanter, which is compressed laterally, does not exceed the height of the head of the hone; the small trochanter is moderate: there is no third, as in the Rhinoceros, the Tapir, and the Horse. But its principal resemblance is to the femora of the great ruminants; though the upper head of the hone is much more detached and more spherical, and the lower head is much wider, especially hehind. These differences will assist in distinguishing it from the femur of the Ox: that of the Giraffe, which, being of the same size, might more readily he mistaken for it, may be known by its more approximated upper head, its relatively larger condyles, and the more elevated and projecting internal edge of the lower articulating surface. The femur of the Hog more resembles that of the Hippopotamus in the upper part, but much less below; and its dimensions prevent the possibility of a mistake. The tihia is short and stout, almost beyond that of any other quadruped, especially at the extremities. It approaches nearest to that of the Ox, but the latter is more elongated, and differs in other respects. The tibia of the Hog is also more elongated in comparison, and offers other discrepancies. The fibula is very slender, and is throughout very distant from the tihia, except at the two extremities. The malleolar bone is anchylosed to the lower extremity. The tarsus is framed principally on the plan of that of that of the *Suidæ*.

Digestive Organs.—From the structure of the teeth we are led to the inference that the quantity of vegetable substance submitted to the action of the digestive organs of the *Hippopotamidæ* must be very great in proportion to the nourishment extracted from the mass. The principle on which the jaws and teeth are constructed seems to be a principle for rudely tearing and dividing, but not comminuting, the hard and tough vegetables which form the staple food of the animal. The jaws are so constructed that the process executed by them is more a bruising than a grinding process. The food therefore when transmitted to the stomach has undergone but little alteration, and that organ is employed in extracting from the coarse and ill-prepared load the greatest amount of nutritive matter. The stomach of a full-grown Hippopotamus is said to be capable of containing five or six bushels, and the largo intestine is of a size commensurate with such a capacity, for it is stated to be eight inches in diameter. The Hippopotamus mentioned by Mr. Burchell ('Travels in South Africa') was considered to be only half grown, but three bushels, at least, of half-chewed vegetables were taken from its stomach and intestines.

Reproduction, Food, Habits.—The time of gestation is stated to be nine months; but this does not seem to be accurately ascertained. The birth takes place on the land; and on the slightest alarm both parent and young take to the water. Thunberg, during his visit to Caffraria (1773) was assured hy an eye-witness that he, having watched, when on a hunting party, one of these animals which had gone up from a neighbouring river to calve, lay still with his company till the calf was produced, when one of the party fired and shot the mother dead. The Hottentots immediately rushed from thoir hiding-place to take the calf alive, but its instinct saved it, for it made for the river, and escaped. The food of the Hippopotamus consists of water-plants and those which grow on the banks of the rivers which it haunts. The time of feeding is principally in the night, and these enormous animals, when in the neighbourhood of cultivated lands, do incalculable damage, not only from the quantity that they actually consume, but the still greater quantity that they spoil and lay waste hy their crushing bulk. As they are able to remain heneath the surface of the water for some time, there must be some muscular arrangement for closing the nostril, such as wo see in the Seals. Hasselquist, on the authority of 'a credible person' who lived twelve years in Egypt, states: '1. That the hide of a full-grown Hippopotamus is a load for a camel. 2. That the River-horse is an inveterate enemy to the Crocodile, and kills it whenever he meets it. 3. That the River-horse never appears below the cataracts in Egypt,* wherefore the inhabitants of Upper Egypt only can give any account of it. The Egyptians, he adds, very seldom bring the hide of it to Cairo; and, he continues, it is impossible to bring thither the living animal. 4. The River-horse does much damage to the Egyptians, in those places he frequents. He goes on shore, and in a short space of time destroys an entire field of corn or clover, not leaving the least verdure as he passes; for he is voracious and requires much to fill his great belly. They have a curious manner of freeing themselves, in some measure, from this destructive animal: they remark the places he frequents most, and there lay a large quantity of peas; when the beast comes on shore, hungry and voracious, he falls to eating what is nearest him, and filling his belly with the peas, they occasion an insupportable thirst; he then returns immediately into tho river, and drinks upon these dry peas large draughts of water, which suddenly causes his death; for the peas soon hegin to swell with the water, and not long after the Egyptians find him dead on the shore, blown up, as if killed by the strongest poison. 5. The oftener the River-horse goes on shore, the better hopes have the Egyptians of a sufficient swelling or increase of the Nile. 6. The Egyptians say, they can almost distinguish the food of this animal in his excrements.' Some parts of this relation (that regarding the peas, for instance) may be considered as hordering upon the marvellous, but there are others which there seems to be no good reason for doubting. The alleged enmity to the Crocodile can hardly he considered to be well founded.

In Professor Smith's Journal (Tuckey's *Narrative of an Expedition to explore the River Zaire, usually called the Congo, in South Africa*) we find it stated that they 'landed in a beautiful sandy cove at the opening of a creek behind a long projecting point. It is called Sandi-Sundi. An immense number of Hippopotami were seen here. In the evening a number of alligators were also seen.' This association would be hardly consistent with hostility. Captain Tuckey also says, 'The Hippopotamus and Alligator appear to be numerous.' The usual mode of capturing the animal is by a pitfall, by the natives at least, hut the colonists near the Cape use the rifle. The two killed by Zerenghi, in the year 1600, frequented tho neighbourhood of the Nile, near Damictta. He stationed men upon the Nile, who, having seen two of these animals go out of the river, made a large ditch in the way through which they passed, and covered it with thin planks, earth, and herbage. In the evening, when returning to the river, they both fell into the ditch. Zerenghi immediately hastened to the place with his janizary, and they killed both the beasts by pouring three shot into the head of each with a large arquebus. They almost instantly expired, he adds, after uttering a cry which had more resemblance to the bellowing of a buffalo than to the neighing of a horse. Captain Tuckey observed Hippopotami with their heads above the water, 'snorting in the air.' In another part of his 'Narrative' he says, 'Many Hippopotami were visihle close to our tents at Condo Yanga, where we were obliged to halt and to wait some time for a canoe to pass. No use firing at these animals in the water; the only way is to wait till they come on shore to feed at night. During the night they kept a continual grunting like so many hogs, but none of them came on shore, though we had a constant watch on the beach.' Sparrman, who gives a ludicrous account of the terror which seized him and some of his companions on the rush of one of these animals towards him from the river, thus describes the noise made by one of these 'sea-cows' at Great Fish River:—'At half an hour after eight, it being already very dark, a sea-cow began at intervals to raise its head above the water, and utter a sharp, piercing, and, as it were, very angry cry, which seemed to be between grunting and neighing. Perhaps this cry may he best expressed by the words *hëurh, hurh, heoh-heoh:* the two first being uttered slowly, in a hoarse but sharp and tremulous sound, resembling the grunting of other animals; while the third, or compound word, is sounded extremely quick, and is not unlike the neighing of a horse. It is true, it is impossihle to express these inarticulate sounds in writing to any great degree of perfection; but perhaps one may make nearer

* That it was found in Lower Egypt in the year 1600, appears by Zerenghi's account above given. Hasselquist travelled in the years 1749—52. See also p. 248.

approaches to it than one can to the gutturopalatial sounds of the Hottentot language.' Le Vaillant had an opportunity of watching the progress of a hippopotamus under water at Great River. 'This river,' says he, 'contained many hippopotami; on all sides I could hear them bellow and blow (mugir et souffler.) Anxious to observe them I mounted on the top of an elevated rock which advanced into the river, and I saw one walking at the bottom of the water (marcher et se promener au fond de l'eau). But I remarked that its colour, which when it is dry is greyish, and which when it is only humid and moist appears bluish, seemed then to be of a deep blue. I killed it at the moment when it came to the surface to breathe. It was a very old female and my people in their surprise, and to express its size, called it the grandmother of the river.' (*Second Voyage.*) Mr. Barrow, in his journey into the interior of Southern Africa, when he reached the mouth of the Great Fish River, saw towards the evening a vast number of Hippopotami (Sea-Cows of the Dutch) with their heads above the surface. Several paths made by these animals led from various parts of the river to a spring of fresh water about a mile distant. To this spring they went in the night to drink; the water of the river for some distance from the mouth being salt. According to Dampier and others, the Hippopotamus, when wounded or irritated, is violently ferocious, and has been known to sink a boat by its bite.

History.—For a long time it was considered that there was but one species of living Hippopotamus; but the better opinion now seems to be that there are at least two. Before we enter into this part of the subject it may be expected that we should give a slight sketch of the history of the Hippopotamus from the time of the antients.

If the Hippopotamus be the Behemoth of *Job* (ch. xl.), we must refer to the well known verses 10 to 19, both inclusive, as the earliest description of the animal. But the identity is by no means satisfactorily ascertained. The vulgate uses the term Behemoth, and the Zürich version translates the word by 'Elephas.' In the edition of the Bible, 'imprinted at London by Robert Barker, printer to the King's most excellent Majestie' (1615), Behemoth is the word in the text, with the following annotation:—'This beast is thought to bee the elephant, or some other which is unknowen.' Bochart, Ludolph, Scheuchzer, and many others, hold that the Hippopotamus is the animal meant; while not a few of the learned have written in support of the elephant. Cuvier and others think that though we may believe with Bochart that the Hippopotamus is intended, the description in the book of Job is too vague to characterize it. Good comes to the conclusion that some extinct pachydermatous genus was probably represented by the term; and some have lately even gone so far as to contend that Behemoth and the *Iguanodon* of geologists are identical!

Herodotus (ii. 71) gives a most incorrect description of what must be regarded, from the context and other evidence, as the Hippopotamus. This description is borrowed almost entirely by Aristotle, who has not however given to the animal a horse's tail, which Herodotus bestowed upon it, adding, correctly enough, that its size was that of the largest oxen.

Aristotle (*Hist. Anim.*, book ii., chap. vii.) thus describes the Hippopotamus:—'The Hippopotamus of Egypt has a mane like a horse; a bifurcated hoof like the ox; a flat visage or muzzle; an astragalus like the animals with cloven feet; projecting teeth which do not show themselves much; the tail of a hog; the voice of a horse; and in size it resembles an ass. Its skin is of such a thickness that spears are made of it.' Now, though there is enough in this curious description to lead to the conclusion that Aristotle meant no other than the Hippopotamus, there is also quite sufficient to show that he never saw the animal, and that he trusted to the wild accounts of others. We trace however the descriptions of Herodotus and Aristotle in many of the figures of the animal which were published after the revival of letters; for it is worthy of remark that notwithstanding the highly erroneous descriptions of antient authors, some of whom must, one should think, have had an opportunity of seeing the animal, the portraits of it by antient artists on coins, &c., are, almost without exception, far from bad representations of the animal. But to return to the antient authors.

Diodorus (book i.) comes much nearer to the truth in his description, at least as to the size of the Hippopotamus; for he says that it is five cubits in length, and in bulk approaches to that of the elephant. The teeth are not badly characterized by the same author; but he still leaves to the animal the cloven hoof and the horse's tail.

Pliny says of it (book viii., c. 25), after treating of the Crocodile and *Scincus*, 'Major altitudine in eodem Nilo belua hippopotamus editur,' and he gives it the bifid hoofs of the ox, the back, mane, and neigh of the horse, a flattened muzzle, the tail and teeth of the boar, adding, that though they are hooked they are less noxious—'ungulis bifidi quales bubus, dorso equi, et jubâ, et hinnitu, rostro resimo, cauda et dentibus aprorum, aduncis, sed minus noxiis.' In short he seems to have followed with very little exception the account given by Aristotle, without attending to that of Diodorus. Pliny adds, that helmets and bucklers are made of its skin, which are impenetrable unless they are softened by moisture, and he speaks of its feeding on the crops 'depascitur segetes,' and its caution in avoiding snares. In his ninth book and twelfth chapter, on the covering of aquatic animals ('Tegmenta Aquatilium'), the varieties of which he enumerates, he says, 'Alia corio et pilis teguntur, ut vituli et hippopotami;' thus making it hairy like the seals, which we take to be meant by 'vituli;' and yet, with all this monstrous error, he himself (book viii., c. 26) speaks of M. Scaurus as being the first who had shown the hippopotamus, together with five crocodiles, at Rome, during his ædileship; finishing the account however by making the former animal a master of one department in the art of healing, in consequence of his habit of letting blood by pressing the vein of his leg against some very sharp stake when his obesity requires such relief. We know moreover that Augustus exhibited one of these animals on occasion of his triumph over Cleopatra. (Dion., book li.) Not to weary the reader with the descriptions of the antients, we shall only further refer to that of Achilles Tatius (book iv., c. 2), which is, notwithstanding some errors, perhaps the most correct; and shall proceed to notice that, under the later emperors, a considerable number of hippopotami were introduced into the Roman shows. Thus Antoninus exhibited some, with crocodiles, tigers, and other animals. Commodus showed five on one occasion, and killed some of them with his own hand. Heliogabalus and the third Gordian also exhibited hippopotami. These demands seem to have produced their effect; for according to Marcellinus Ammianus (book xxii., c. 15) and others, the race of hippopotami had disappeared from Egypt since the time of the emperor Julian. Favourable circumstances however must have operated to restore it, as we collect from the account of Zerenghi above alluded to and others. That the animal was sacred, in some parts at least, appears from Herodotus (book ii., 'Euterpe'): 'Those which are found in the district of Papremis are sacred, but in other parts of Egypt they are not considered in the same light.'* Sonnini (*Travels in Upper and Lower Egypt*), who quotes this passage, and also one from Pausanias (book iv. 33), goes on to state that these animals laid waste whole countries by ravages as fearful as their size was enormous, and that they were equally formidable to man with the crocodile. From the terror which they inspired, they were, he asserts, generally looked upon as the symbol of Typhon, that giant who had spread death and destruction among the deities which were worshipped in that quarter; they were, he adds, of course the emblem of mischance and of cruelty, and the particular worship of them at Papremis must have been practised solely with the view of appeasing or averting their rage.

We have mentioned that with few exceptions, if not with one only, the representations of the antient artists have been found faithful to nature when compared with the description of antient naturalists and authors. The exception is the figure copied by Hamilton (*Ægyptiaca*, pl. xxii.), from one of the caves of Beni-Hassan, in which the feet are represented as cloven, and the lower tusks are so enormous as to render it impossible that they should be covered by the lips, whereas the largely developed muzzle and its consequent concealment of the tusks are portrayed upon most of the antient figures and coins. We do not consider the figure found by Belzoni as an exception, because, as the author of

* The following is the entire passage:—'Hippopotami are held sacred in the Nome of Papremis; but they are not held sacred by the rest of the Egyptians. Their nature and form are these: the animal is four-footed, bisulcated, with hoofs like those of an ox, a flat nose, a horse's mane, prominent teeth, and the tail and voice of a horse. In size it is as large as the greatest ox. The skin is so thick that when dried the shafts of darts are made of it.'

the amusing book on Egyptian Antiquities observes, the designer sometimes placed on one animal a part taken from another, and that mentioned by Belzoni was a calf with the head of a hippopotamus. Though the details of the teeth and feet are not correct in the figure on the plinth of the statue of the Nile formerly in the Vatican, and afterwards taken to the French Museum, its general contour is good; and the animal occurs in other sculptures and in mosaics very characteristically represented. Some of these, that of the Vatican above mentioned, for instance, may have given rise to the story of the enmity borne towards the crocodile by the hippopotamus, which in that sculpture holds a crocodile in its mouth. On medals and coins of the Roman emperors the hippopotamus often appears, sometimes with the crocodile, sometimes without. Those of the emperors Trajan, Hadrian, and Philip, or rather of Marcia Otacilia Severa, Philip's wife, will occur to some of our readers.

In more modern times we have the descriptions of Isidore of Seville, Vincent de Beauvais, Albertus Magnus, James of Vitry, and all more or less fabulous; but Abdallatif gives a very good account of the animal. Belon and Gillius however seem to have been the first among the moderns who actually saw, or at least who have recorded that they saw, the animal alive. They both saw it at Constantinople, and perhaps they saw the same. Sonnini seems to doubt whether the animal which Belon saw was a hippopotamus (*Travels in Upper and Lower Egypt*, vol. iii.), and quotes Matthiolus, who speaks very slightingly of Belon; but a perusal of that accurate observer's account will, we think, satisfy the most scrupulous that he saw a living hippopotamus; he even alludes to the differences between the figures of that animal on antient works of art and the specimen which he had before his eyes, and rectifies the error in the figure on the plinth of the statue of the Nile, which has five toes instead of four. Of the teeth indeed he only remarks that they approach to those of a horse. Gesner does little but quote Belon, and without detaining the reader with the descriptions of Zerenghi, who is above alluded to, which were good, or the compilation of Aldrovandus, who did not use the figure of Zerenghi, but another sent to him from Padua (Cuvier thinks, by Prosper Alpinus), or the good description and more accurate representation given by Fabius Columna, we come to Ludolph, who in his 'History of Ethiopia' gives an entire figure on a large scale. This is the best which had been hitherto published; but the teeth are exaggerated, and a great deal too much exposed, and the ears are rather long. Below this is a figure of 'the sea-horse, putting up his head above the water; thence called the river-horse by the Greekes.' The head and neck alone are visible; but the exaggeration and exposure of the teeth are continued, and the draftsman, by lengthening the neck, head, and ears, has given a much more horse-like character to the figure. Thevenot, in his 'Voyage to the Levant,' very fairly describes an individual killed in his time (1658) near Girgeh, and taken to Cairo.

The date of the last of these authors is 1689, but in 1735 the work of Prosper Alpinus was published, and obscured the subject again by giving a representation of two stuffed skins, the one of a large female animal, and the other of her fœtus, which he had seen in the house of the Pacha of Cairo. These were the skins of two Hippopotami, but the skulls had been withdrawn, and the absence of the projecting teeth led Prosper to the conclusion that he had at last found in this, which he took for a distinct creature, the animal represented by the antient artists, forgetting, or more probably not knowing, that when the Hippopotami of the present day keep their mouths closed no tooth is visible.

We need not detain the reader with a reference to the figures and descriptions given by other zoologists,* but shall come at once to Linnæus, and this will bring us to the question of the geographical distribution of the genus, and of the number of species.

Linnæus, in his last edition of his 'Systema Naturæ,' gives only one species, *Hippopotamus amphibius*, and places its *habitat* 'in Nilo et Bambolo Africæ, et ad ostia fluviorum Asiæ.' First we will advert to the

Geographical Distribution.—Africa appears to be the only quarter of the globe in which this form exists; and though Onesicritus (Arrian, *Indic.*, c. 6) places the Hippopotamus in the Indus, Strabo (690, 707, Casaub.) seems to prefer the testimony of Aristobulus in contradiction of the fact, and Pausanias (iv. 34) agrees with Strabo. Cuvier, who has collected almost all the learning on this subject, well observes that no traveller of credit has reported that it has been found on the continent of India. He remarks that Buffon gave no credence to the testimony of Michael Boyn, who states China to be one of the localities. he observes that it is nearly without authority that Linnæus supposes the animal to occur at the mouths of the rivers of Asia, and is of opinion that M. Faujas appears to be well authorized in denying that it is to be found on the continent of India.

Marsden includes the Hippopotamus among the animals of the islands of Sumatra and Java; but Cuvier ('Ossemens Fossiles') enters into an interesting discussion, well worthy of the perusal of the reader, to show that Marsden is mistaken; and, in addition to his arguments, he brings forward the fact that MM. Diard and Duvaucel, who travelled over a considerable part of Java and Sumatra in different directions, could not find a Hippopotamus, though they succeeded in obtaining two species of Rhinoceros and a Tapir. Upon the whole evidence at present known, it seems to be established that the geographical distribution of this pachydermatous form is confined to the great rivers and lakes of Africa.

Species.—It remains to be considered how many species of Hippopotamus at present exist.

M. Desmoulins (*Journal de Physiologie, &c.*, par F. Magendie, tome v.) gives osteological reasons, drawn principally from the differences in the skull, for distinguishing at least two species of Hippopotamus. And upon the whole it must be allowed that he appears to be borne out in his position that the distinctions between the two species, one of which he designates as the Hippopotamus of the Cape (*Hippopotamus Capensis*), and the other as the Hippopotamus of Senegal (*Hippopotamus Senegalensis*), are as strong as those on which Cuvier founded his specific separation of the fossil Hippopotamus from that of the Cape. M. Desmoulins is further of opinion that it is not impossible that the Hippopotamus of the Nile differs specifically from the other two. The external differences do not appear to be considerable, if any. M. Desmoulins indeed remarks, that of forty Hippopotami seen by M. Caillaud in the Upper Nile, two or three were bluish-black, all the others reddish; and M. Desmoulins even hints that there may be two species in that river. The latter adds, that of the two Hippopotami of the Cape possessed by the Paris Museum, one is black, the other reddish; but he considers that the numerical disproportion observed between the individuals of the two colours in the Nile can hardly admit of a sexual solution. We have examined several skulls of Hippopotami, and some of them certainly present many striking differences; but it should be remembered that safe inferences as to specific distinction can only be drawn from a very extensive examination of skeletons, combined with unquestionable data as to the locality, age, and sex of the subjects examined.

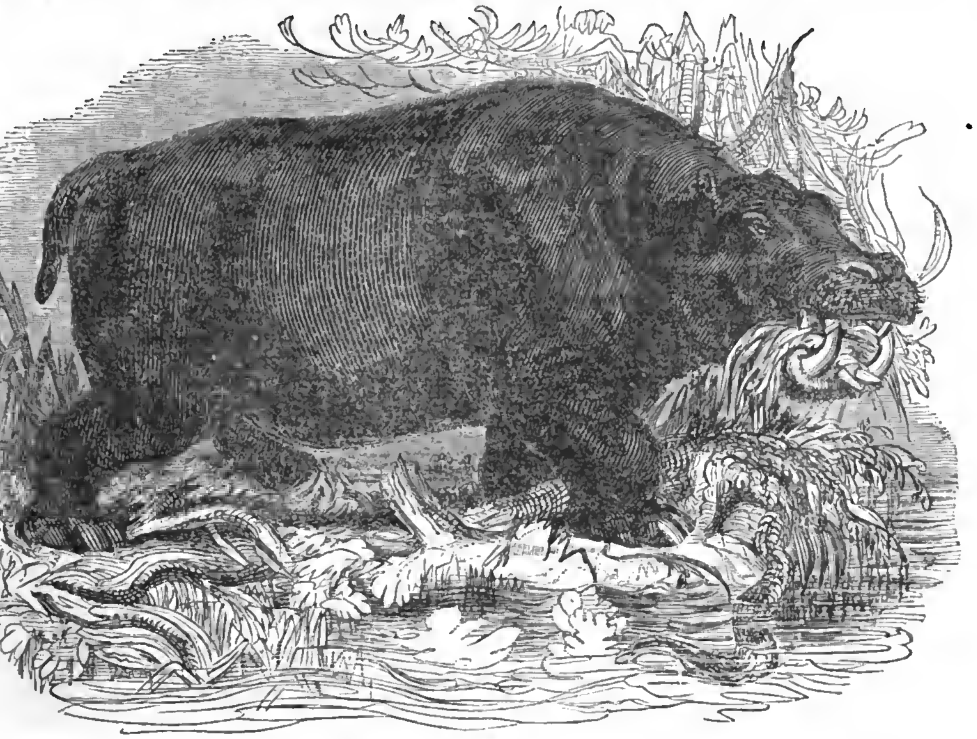
With regard to the supposed two Nilotic species we, with all due submission, have our doubts; nor do we give much weight to the alleged difference of colour. The animal in the water and out of it presents a very different appearance; and, to say nothing of the possibility of a difference in the case of sex, there is every probability that some change in the colour may take place as the animal advances in age. We have seen the remark of Le Vaillant as to the difference of colour when the skin is dry, when it is only moist, and when the animal, in full life, is walking at the bottom of the river.

It need hardly be observed that the Romans must have derived their Hippopotami from Northern Africa; and as we have given Sparrmann's description, among others, of the noise made by the southern animal, we may be excused perhaps for remarking that Burckhardt (*Travels in Nubia*) describes the voice of the Hippopotamus as a harsh and heavy sound, like the creaking or groaning of a large wooden door. This noise, he says, is made when the animal raises its huge head out of the water, and when he retires into it again. We may also add, with regard to the alleged disappearance of the Hippopotamus from Lower Egypt, that, as Cuvier remarks, the French Savans attached to the expedition to Egypt, who ascended the Nile above Syene, did not meet with one.

Utility to Man.—We have adverted to the damage done by the Hippopotamus to cultivated grounds; but when we

* Grew, A. Jussieu, Daubenton, Pallas, Buffon, &c.

look at the enormous ripping, chisel-like canines of the lower jaw, and the lower incisors formed for uprooting, we cannot but think that such an animal must be an active agent in clearing rivers from the greater water-plants which might in time, if left undisturbed, go far to convert the running stream into a sluggish swamp. With regard to minor details, the flesh of this *Wasser Ochs* is much esteemed as an article of food. In the first catalogue of the African Museum we read that it is much in request both among the natives and the colonists, and that the epicures of Cape Town do not disdain to use their influence with the country farmers to obtain a preference in the matter of *Sea Cow's Speck*, as the fat which lies immediately under the skin is called when salted and dried. Nor are the whips which are made of the skin of the Hippopotami of the Nile thought lightly of in the neighbouring countries. They are said to be made by cutting the fresh skin into triangular strips some five or six feet in length: one extremity of the strip is pointed, and it gradually widens till the breadth at the opposite extremity is equal to the intended circumference of the bulk of the whip. The strip is then rolled up so as to form a sort of conical pipe, is firmly tied to keep it in place, and dried in the sun. When all is finished a light and elastic whip is produced. But there is no part of the Hippopotamus in more request than the great canine teeth, the ivory of which is so highly valued by dentists for making artificial teeth. No other ivory keeps its colour equally well;* and these canine teeth are imported in great numbers to this country (where more are sent in the first instance than anywhere else perhaps) for this purpose, and sell at a very high price. From the closeness of the ivory, the weight of the teeth, a portion only of which is available for the artificial purpose above mentioned, is heavy in proportion to its bulk, and the article fetches, or did fetch, upon an average, about thirty shillings, more or less, per pound. One of the specific distinctions pointed out by M. Desmoulins is the comparative abrasion of the canines in the supposed two species; and we would call the attention of the curious who deal in these teeth to this circumstance and the papers above quoted.



Hippopotamus.

Fossil Hippopotami.

The remains of fossil Hippopotami occur abundantly in the tertiary series. They are most common in the Pliocene period of Lyell, and are frequently met with in the superficial beds of gravel, clay, and sand, termed by some diluvial, in the ossiferous caverns, osseous breccia, &c. They are also found in some of the beds of the Miocene period. The following species are named: *Hippopotamus major* (Nesti and Cuv.); *Hippopotamus minutus* (Cuv.); *Hippopotamus medius* (Cuv.); and *Hippopotamus dubius*, (Cuv.).† A comparatively small species was detected by Mr. Clift among the fossil remains found on the left bank of the Irawaddy, and presented to the Geological Society by Mr. Crawfurd. Remains of Hippopotamus were also abundantly present in the large collection of bones obtained by Captain Cautley among the ruins of fallen cliffs, and partly *in situ* in the sandstone of the Sewalik mountains, at the southern foot of the Himalayas, between the Sutlej and the Ganges. (*Geol. Proc.*)

HI'PPOPUS. [Tridacnidæ.]

HIPPOTHE'RIUM, the name of an extinct quadruped allied to the horse, found and described by Professor Kaup, from the strata of sand at Epplesheim, near Altzey, about twelve leagues south of Mayence, referrible to the second or Miocene period of the tertiary formation.

* Pausanias (viii. 46) mentions the statue of Dindymene whose face was formed of these teeth instead of elephant's ivory.

† This is the catalogue of M. Hermann von Meyer. M. Lesson gives the following list of fossil species: *Hippopotamus antiquus* (Cuv.); *Hippopotamus minor* (Cuv.); *Hippopotamus medius* (Cuv.); and *Hippopotamus minimus* (Cuv.).

HIPPO'THÖE (*Lamouroux*), a small celluliferous coralline attached to marine plants in the Mediterranean. It is capillary and branched, the branches articulated; the articulations are single fusiform cells, with a round polypiferous opening near the summit. (*Tableau Méthodique.*)

HIPPURIC ACID. When the urine of horses and cows is mixed with muriatic acid in excess, a precipitate is obtained, which, when purified by boiling with cream of lime, a little chloride, and with animal charcoal, is rendered nearly inodorous. The solution is again to be mixed with hot muriatic acid, from which hippuric acid separates in prismatic crystals on cooling, which are perfectly white.

Hippuric acid is analogous in its characters to benzoic acid, and was at first supposed to be that acid modified by the presence of animal matter; but it is stated by Liebeg that it is distinguishable from benzoic acid by the nature of its salts, which are less soluble in water, and also in containing azote, which benzoic acid does not.

It is composed of

Nine	equivalents of	hydrogen	9
Twenty	„	carbon	120
Six	„	oxygen	48
One	„	azote	14
		Equivalent	191

It is stated that this acid, when scented by subliming with a little benzoic acid, is substituted as an article of commerce for benzoic acid.

HIPPURITES (in Zoology), a name given by Knorr and Schroeter to a fossil coral (Cyathophyllum ceratites, Goldfuss) of the Eifel transition limestone. Guettard also used this title for a lamelliferous coral.

By Lamarck, Defrance, and other writers, this name is given to a somewhat problematical group of fossils found in limestones of the oolitic age which flank the Alps in the Untersberg, near Salzburg, at Regensburg, &c., in the chalk of Perigord, Alct, &c.

Lamarck places hippurites with belemnites and orthoceratites, among the cephalopoda. ('Conchyliologie,' *Nouv. Dict. des Sciences Nat.*) Latreille takes nearly the same view as Lamarck. ('*Familles Naturelles' du Règne Animal.*) Rang, referring to batolites and raphanistes of Montfort, and amplexus of Sowerby (which is certainly a lamelliferous coral), introduces the genus among the acephalous rudista, according to the views of De Blainville.

The structure of the rudista has been studied by M. Ch. Des Moulins and M. Deshayes, and the location of hippurites in that group may, on their competent authority, be definitively adopted. Considered as a bivalve shell, whose valves are excessively unequal, one may be described as cylindrical, conical, or curved; the other as flat, or tumid externally, and operculiform. The laminæ of the large valve are sometimes separated, as in some spondyli, and subject to such convolutions on one part of the circumference as to cause the appearance of longitudinal siphons immersed in the shell. These are arguments, and very insufficient ones, for comparing hippurites with cephalopoda. The shell is fibrous, or rather formed of prismatic cells, of a six-sided figure, in a longitudinal direction, which have been compared to the cellular structure of the shells of Balanus. The shells are sometimes attached side by side, as two portions of a coral. The internal cavity is far from corresponding to the external figure of the shell, and the cast in this cavity has been called Birostrites.

The abundance of these fossils in certain calcareous bases of the chalk or top of the oolitic formation in the Pyrenees, the Untersberg near Salzburg, the Bellunese, &c., is extraordinary, so that particular strata receive from the circumstance the name of Hippurite Limestone.

HI'PTAGE, a genus of plants of the family of Malpigheaceæ, better known by the name Gærtnera, given it by Schreber in honour of the celebrated Gærtner; though the name assigned by himself, as prior, is now alone admitted. The genus contains only two species: one, H. Madablota, figured by Sonnerat under the latter name (*Voy.* ii., t. 135), which is common in the forests of many parts of India; the other, H. obtusifolia, is found in China, but commonly cultivated as an ornamental plant in India. Both species are remarkable for their great size as climbers, ascending to the tops of the loftiest trees, and hanging down in elegant festoons of white flowers.

HIPUDÆUS. [LEMMING.]

HIRCIN, a principle similar to butyrine, which exists in goat's fat and in mutton suet, combined with olein; its name is derived from *hircus*, and it is obtained from the fat of the goat by a process similar to that by which butyrine is procured, from which it appears to differ by yielding hircic acid, by treatment with the caustic alkalis.

HIRE, LA. [LAHIRE.]

HI'RTIUS, AULUS, born of a patrician Roman family, applied early to the study of rhetoric, and became intimate with Cicero, who speaks highly of his oratorical talents. There is a letter of Hirtius to Cicero in *Ep. ad Att.*, xv. 6. Hirtius served with distinction under Cæsar in the Gallic War. He is generally supposed to be the author of the eighth book of the Commentaries (Suetonius, *Life of Cæsar*, c. 56), as well as of the books of Cæsar's Alexandrian and African campaigns, which are avowedly written by the same person as the eighth book of the Commentaries. With regard to the book 'De Bello Hispanico,' it appears to be written by a different and an inferior hand, and it has been attributed by some to C. Oppius, another friend of Cæsar. (Vossius, *De Historicis Latinis.*) Hirtius remained attached to Cæsar till his death, after which he took the part of the senate against Antony, and was named consul with C. Vibius Pansa. The two consuls had an engagement with Antony, whom they defeated near Mutina (Modena), B.C. 43, but Hirtius was killed in the battle

HIRUDI'NIDÆ. [LEECHES.]

HIRUDINE'LLA, a name given by M. Bory to a genus of *Microzoaria*.

HIRUNDI'NIDÆ. [SWALLOWS.]

HI'SPALIS. [SEVILLE.]

HISPA'NIA. [SPAIN.]

HISPANIO'LA, HISPAÑO'LA, ESPAÑO'LA (*i. e.* Little Spain), known also under the names of SAINT DOMINGO and HAITI, is one of the Great Antilles or larger islands of the West Indies. It extends from the Mona Passage, which separates it from Puerto Rico, to the Windward Passage, which lies between it and Jamaica and Cuba, from 68° 30′ to 74° 30′ W. long. Its length is therefore about 360 miles. It lies between 18° and 20° N. lat.; but a promontory on the southern coast projects about 20′ beyond 18° N. lat. Its surface is about 25,000 square miles, or nearly the extent of Ireland. It is four times as large as Jamaica.

Hispaniola is justly considered the most fertile island in the West Indies. Its surface exhibits a great variety on rather a large scale. Near the centre of the island, but somewhat nearer the northern than the southern shores, there is a mountain-knot, called Cibao, whose elevation has not been determined, but it is thought that its highest summits do not fall short of 8000 feet. From this point a range runs southward, and terminates on the southern coast in a broad and rugged promontory opposite the rocky island of Alta Vela. Three ranges branch off from the western side of these mountains towards the west. The two northern are immediately connected with the mountains of Cibao. The most northern gradually approaches the northern coast, which it skirts at a short distance from Cap Français, or Cap Haïtien, and then continues near the shores to Cap St. Nicolas. The middle chain diverges to the south-west, and then turns west, continuing in that direction until it nearly attains the bay of Gonaves, when it runs along the shore to its termination at Cap S. Marc, south of the bay of S. Marc. The most southern chain is an offset of the mountain-mass of Mount Bahoruco, which occupies the centre of the peninsula opposite the island of Alta Vela. It runs along the southern shore at a short distance from it, through the whole length of the south-western peninsula, as far as Capes Tiburon and Dame Marie. These ranges, which may rise from 2000 to 5000 feet, perhaps occupy more than half the surface of the island, but contain between them two extensive valleys, or rather plains. In the eastern part of the northern plain are extensive savannahs, or natural meadows; but towards the west there is a fruitful soil, which may be irrigated by the waters of the river Artibonite; and hence it is called the Plain of Artibonite. The southern plain is called Cul de Sac. At its eastern extremity is the lake called Laguna de Henriquillo, which is 50 miles in circuit. The water is salt, and has no outlet. The surrounding country is exceedingly picturesque. West of it, at no great distance, is a smaller lake of fresh water, called Saumache. The country round these lakes is not cultivated, and abounds in game. The western district of this plain, which reaches to Port au Prince, is exceedingly fertile. Besides these two great plains several level tracts occur between the mountains and the shores, which are very fertile, but not of great extent.

The connexion of the eastern ranges is not well known. It seems that east-south-east of the Cibao Mountains there is a very rugged and mountainous tract, which is almost uninhabited and rarely visited. With this tract seems to be connected the range which runs along the northern shores from the bay of Monte Christi, on the west, to Vieux Cap Français, on the east, and descends to the coast with a steep declivity. Between this range and the Cibao Mountains there is a wide and very fertile valley, called the Plain of S. Iago. It is watered by the river Yaguc. The remainder of the eastern part of the island is occupied by two large plains, lying east and west, with a range of low mountains between them, which issues from the uninhabited mountain-tract, and terminates at the most eastern promontory of the island, Cap Engaño. On the north of this range is a plain, La Vega, noted for its great fertility, though it has never been well cultivated. This plain is above 50 miles in length, with an average width of 25 or 30 miles. The rivers Cotuy and Yuna, which drain it, fall after their union into the bay of Samana under the latter name. The southern plain, called Los Llanos, extends from the town of St. Domingo to that of Higuey, about 80 miles in length, with a width of 30 miles; but it is only a savannah adapted for pasture-ground, the rank grass of which being burnt in the dry season, whilst the cattle take to the forests or the mountains, serves as a manure to the new grass, which springs up in the rainy season.

The coast, which is about 1200 miles in length, has a great number of harbours, which admit vessels of moderate size: some of them are spacious, deep, and safe. Near Cape St. Nicolas is the port of St. Nicolas, which is 6 miles long, and capable of holding an immense fleet. Ships of the largest size may safely ride at anchor, sheltered from all winds, the harbour being surrounded on every side by mountains of considerable elevation. The harbour of Cape Français is spacious, and though not so well sheltered, offers good anchorage. At the eastern extremity of the island is the bay of Samana, which is very capacious, and affords excellent anchorage. The island of Samana, which lies to the north of it, and which is united by a low neck of land to Hispaniola, is low and swampy, and on that account nearly uninhabited. The harbour of the town of St. Domingo is a very indifferent one, being too much exposed to the southern winds; but the ground is good for holding. In the bay of Gonaves are the ports of Port au Prince and Gonaïve. Port au Prince has two harbours, formed by some islets, which offer good and safe anchorage. The port of Gonaïve is rather large, and excellent in point of security, being formed by a little island, which leaves a narrow channel, but with sufficient depth of water.

The climate of Hispaniola differs considerably from that of the other Antilles, the rainy season occurring in different parts of the year on the southern and northern coasts. On the southern it agrees with the rainy season of Jamaica, beginning with gentle showers from the south at the end of April. These showers continue for three weeks or a month, and are followed by dry weather, which lasts six weeks or two months. In July begin the abundant rains, which continue through August, September, and October, and cease in November. The quantity of rain which falls in this season is not exactly known, but it is supposed to be from 60 to 70 inches. The winter is rather cool, the thermomoter rarely exceeding 70° and still more rarely descending below 60°. The northern coast has only showers during August, September, and October, and in November the rains cease for a [illegible]ime, but in December and January they descend in [illegible]: afterwards they are moderate, and cease entirely [illegible]. The heat of the summer is moderated by the [illegible]g northern winds. Hurricanes are as frequent on [illegible]ern coast as in Jamaica, but they occur rarely on the [illegible]ern shores.

Fifty years ago Hispaniola was noted for its extensive plantations of sugar, coffee, and cotton, but they have now almost entirely disappeared, except those of coffee, which are much reduced. The present population having few wants, and valuing their ease more than anything else, employ only about two hours daily in productive labour. They cultivate maize, millet, cassava, plantains, sweet potatoes, &c. Besides cocoa-nuts and pine-apples, their gardens produce the fruits of the south of Europe, as figs, oranges, pomegranates, and almonds. The principal commercial wealth of the island is derived from the forests which cover the greatest part of the mountains. The timber consists chiefly of mahogany-trees and different kinds of dye-woods, which are exported to the United States, England, and other parts of Europe. Numerous herds of cattle pasture on the plains in the eastern districts of Hispaniola, and their hides and jerked beef likewise make an article of export. The horses are small, but the asses and mules are large and strong. Game abounds in the forests. At the arrival of the Spaniards gold was collected near the mountains of Cibao; but this branch of industry was soon abandoned.

The aborigines are now extinct, though it is stated that in 1717 there still existed about 100 individuals. But a considerable part of the present population consists of their descendants, mixed with the blood of Europeans and negroes. The number of mulattoes, or descendants of Europeans and negroes, is still greater; indeed they may be considered as constituting the nation, the negroes of pure blood not being numerous; and the creoles, or descendants of Europeans, being still fewer in number. The population according to a census of 1824 amounted to 935,000, but in 1826 it was stated to be not less than 1,200,000 souls. Before 1791 it was thought not to exceed 700,000 souls. It is remarkable that though the commerce of the island has decreased considerably since that date, its population has continually been on the increase; but this circumstance is easily explained when we consider the abundance of fertile land which is still unoccupied, the limited wants of the people, and the facility with which the bare means of existence are obtained.

Port au Prince, the capital and the seat of government, is situated between the large plain of Cul de Sac and a more narrow one extending along the southern shores of the Bay of Gonaves to Leogane and farther, both of which are very fertile, but badly cultivated. The streets of the town are straight and sufficiently wide and commodious, but the houses are low and mean, with the exception of a few built by the French, which outlived the revolution and the fires. Its commerce with the United States and with Jamaica is considerable. The population is estimated at about 30,000. On the same Bay of Gonaves are Leogane and Goave, two small but thriving places. On the northern coast is Cap Haïtien, formerly Cap Français, with about 12,000 inhabitants: it carries on some trade with the United States. S. Domingo, on the southern coast, is the oldest European establishment in America, having been built by Columbus in 1504; the town of Isabella, which was erected on the northern coast in 1493, was abandoned. The population of S. Domingo is about 15,000 souls; and it formerly carried on a considerable trade with the Spanish colonies on the mainland and with Cuba, especially in jerked beef; but its trade is now very limited.

Hispaniola was discovered by Columbus in his first voyage, at which time it received this name. The Spaniards formed settlements, first at Isabella and then at S. Domingo. For nearly half a century these settlements received much attention, and rose to great prosperity, until different parts of the American continent were discovered and conquered. From that time Hispaniola was neglected, and as the natives had been nearly extirpated, the island soon became depopulated, and the northern and western districts were nearly a desert. The Buccaneers now settled on the island of Tortuga, opposite Cap Français, and also on the coast. Perceiving that they would be driven away by the Spaniards, they voluntarily submitted to France, and Lewis XIV. sent them a governor. In 1697 the Spaniards were obliged to give up the western districts, or nearly one-third of the island to France. The French, who considered their portion of Hispaniola as the most valuable of all their foreign settlements, began to cultivate it with great care. In 1791 the agricultural produce of the French portion only was valued at more than eight millions of pounds sterling. In 1794 the negro slaves were declared free by the National Convention, a declaration which was followed by a general insurrection of the negroes and mulattoes, who compelled all the white inhabitants to emigrate who had not been massacred. One of their chiefs, Toussaint L'Ouverture, established in 1801 a kind of republic, but was obliged to submit to a French army sent out by Bonaparte in 1802. After he had been treacherously taken prisoner and sent to France, the negroes rallied under Dessalines, and expelled the French in 1803. Dessalines gave the island the name of Haïti. In 1804 he followed the example of Bonaparte and called himself emperor: in 1806 he was murdered. After his death the French portion of Hispaniola was divided into two states; the northern coast was formed into a negro republic under Christophe, who in 1811 also took the title of emperor: the plains about the Bay of Gonaves became a mulatto republic under Petion. Continual war was carried on between these two republics. After the death of Petion (1813) he was succeeded as president of the republic by Boyer. Christophe having killed himself on the breaking out of an insurrection in 1820, Boyer united the whole under his authority. In the meantime the Spanish part of Hispaniola had been ceded to France in 1795, but was reoccupied by the Spaniards in 1808. The following year however it declared its independence of the Spanish government, and remained in an unsettled state until 1822, when it was subjected to the authority of Boyer. France recognised the independence of Haïti in 1825. According to the constitution promulgated in 1816, Haïti is a republic governed by a president, chosen for life, and assisted by a legislature consisting of two houses, a senate and a house of representatives. It ought perhaps to be considered as a despotism, the chief being chosen by the army, but some republican forms have been added. The government is anxious to promote education, and to encourage the settlement of whites; but they do not enjoy the same privileges as the coloured people. The French language prevails in the western districts, but we do not know if it has been introduced into that part which formerly belonged to the Spaniards. According to Mackenzie the island is divided into six departments, 66 communes, and 33 parishes. Since the year 1791 the commerce and agriculture of the island have greatly decreased, though its population, as already observed, appears to be on the increase.

The number and tonnage of vessels that arrived at and departed from the different ports of the republic in 1836, with the value of their cargoes, were as follows:—

	Arrived.			Departed.		
Ports.	Ships.	Tons.	Value of Cargoes.	Ships.	Tons.	Value of Cargoes.
Port-au-Prince .	120	17,869	£243,490	138	20,283	£401,106
Cap Haitien .	73	10,794	131,955	74	10,801	184,550
Jacmel	39	4,588	32,248	43	5,082	105,198
Aux Cayes . .	51	7,675	38,436	50	7,443	147,361
Gonaives . . .	44	5,532	13,076	43	5,398	63,970
Porto Plata . .	42	4,122	15,577	37	3,478	19,151
	369	50,580	£474,782	385	52,485	£921,336

The part of this trade which was carried on under the British flag, was—

	Arrived.	Departed.
Ships . . .	84	90
Tons . . .	12,807	15,127
Value of Cargoes	£192,262	£367,398

The quantities of the principal articles of produce exported from the island in each of the two years 1835 and 1836 were—

	1835.	1836.
Coffee . .	48,352,371 lbs.	37,662,674 lbs.
Cotton . .	1,649,717 „	1,072,555 „
Cocoa . .	397,321 „	550,444 „
Tobacco .	2,086,606 „	1,222,716 „
Mahogany .	5,413,316 feet.	4,954,944 feet.
Logwood .	13,293,737 lbs.	6,767,902 lbs.
Wax . .	10,993 „	15,620 „

(Bryan Edwards's *History of St. Domingo*; Rainsford's *Historical Account of the Black Empire of Hayti*; James Franklin's *Present State of Hayti*; Mackenzie's *Notes on Hayti.*)

HISTORY. The notion that is contained in the word History appears to be often conceived both indistinctly and incompletely. If we trace the word to its original (ἱστορία), which simply means 'inquiry' or 'search' after facts, and includes the notion of recording them, we obtain a notion which, though distinct as far as it goes, will not enable us to distinguish history from annals [ANNALS]; and if we examine a series of works which bear the name of histories, we shall find many of them deficient in every characteristic which shall be sufficient to distinguish them from bare records of events arranged in chronological order.

In modern times a popular use of the word history has obtained, which may help us in arriving at a more precise notion of what is included in the term. Such expressions as a 'History of the Steam-Engine,' a 'History of Printing,' &c., are in common use, and are understood to signify a statement, arranged in chronological order, of the original discovery, and of the various steps and processes by which such discovery has been perfected, and the art, which is the subject-matter of the history, has been brought to its present state. Such a history then is nothing more than the explanation of the present condition or state of any given thing, by connecting it with an explanation of all the previous states of the same thing. But whatever propriety there may be in such an application of the word history, it is obvious that a bare narrative, however complete, of the successive mechanical contrivances by which the steam-engine and the printing-machine have advanced from their first rude beginnings to their present perfection, cannot fully satisfy the desire of knowledge when it is once called into action. If the description of such successive mechanical improvements were not connected with social progress, the scientific exhibition of such development, though it might interest the few, would not command the attention nor excite the sympathies of the many. And this leads at once to the conclusion that the various steps and processes by which every art and science has been brought to its present state, cannot be viewed simply by themselves, without relation to each other, and without relation to their effects on the happiness of mankind. All such special history then is viewed by us, though often unconsciously, as nothing more than an exhibition of the progress and perfecting of certain elements or ingredients which help to make up that entirety which is called society—a word which expresses an aggregate of human beings and the infinite relations which unite them.

Another example of history in a limited sense, and one which brings us a step nearer to a proper conception of the subject, is the life of an individual. That branch of the historical art which treats of the life of an individual has long since obtained the specific name of biography. The reason why this species of composition has always given so much pleasure, and often conveyed so much instruction, is clear. To desire to know the past, to ascertain how that which now is became what it is, and the successive steps of its development, is an active principle in our intellectual and moral composition. It is this which stimulates the geologist to his minute investigations into the phenomena which present themselves on the surface of this globe. He labours, if not with the hope of finally attaining a complete view of the successive stages which have determined the actual state of things, yet with the reasonable certainty of learning something, and of being rewarded by a more exact and comprehensive view of the whole present condition of the earth. Such is the interest which some few individuals can create for themselves in branches of investigation which to mankind in general are distasteful or repulsive. But everything which concerns a human being excites the universal sympathies of mankind, and when we hear of those who have greatly dared or suffered, of those who by their talents and virtues have been the benefactors of mankind, or by their vices have inflicted misery on thousands of their own and succeeding generations, we desire to know all the minutest circumstances of the parentage, education, and life of such individuals. We desire to know how they finally became possessed of that character which distinguishes them from other men, and how they finally accomplished that for which their names are remembered. The history of an individual is so far like the history of a nation, that it involves a progress from a beginning to a certain definite point; and though the life of an individual cannot be viewed detached from that of his age and country, it possesses for all the purposes of instruction a sufficient analogy to the life of a nation. The commencement of the national life is generally hidden in the obscurity and the meanness of its origin; its termination also is not marked by any event so distinct as that of an individual death, but its condition at any one stage, like that of an individual, is to be deduced only from a full comprehension of all the preceding circumstances of its existence.

We may then conclude that the history of any nation is a statement in chronological order of the various actions and events by which the society which constitutes that nation has attained and is in its actual state; meaning by its actual state (so far as such a term is capable of definition), its aggregate means of happiness. But though such a statement as we have just mentioned of actions and events, when they are judiciously arranged, will of itself indicate the general principles which from time to time have more or less affected the condition of society, the purpose of the historian is distinguished from the labour of the annalist by the philosophical character which he gives to his work. It is true that history, even thus viewed, may be written by one man more particularly with reference to one kind of actions and events, and by another man more particularly with reference to another kind; but as the subject of history is the progressive development of society, the historian who best seizes on those things which at each stage characterize this progress, will approach nearest to giving his work a real philosophical character. The religion, the positive morality, the legislation, the education, and the domestic habits of a people, are matters which more intimately affect the happiness of a nation, than their skill in the mechanical or other arts. Progress and improvement in the latter, though powerful auxiliaries to human happiness, are by no means either sure indications or the certain concomitants of progress and improvement in the former. While then the philosophic historian, in tracing the progress of any given society from its origin to its present development, omits no event in his series that shall be necessary to link the present with the past, he more particularly directs his attention to the consideration of those civil and religious institutions, and to those popular notions of right and wrong, of virtue and vice, which lie at the bottom of every society that has existed or does exist, however disguised or obscured by the structure which has been reared upon them. To trace to their origin, and to view in their simplest forms, these elements of society, to seize with precision and completeness their characteristics and their differences, to follow them in the progress of their development and modification, both as influencing and being influenced by the new elements which from time to time enter into the composition of society, and so to show at each stage of its progress, not only the condition of society, but the causes which determine such condition—such may be called a philosophic exhibition of history, or, in other words, a determination of the general principles which govern any given society, and the consequences which flow from them.

As this determination of general principles and of their effects forms the scientific part of the subject of history, so tho mode of treating and exhibiting such a subject is the artistic part. No exact rules can be laid down for the treatment of history as a branch of art. It may be simply said that while the main object is to instruct, it is also an object to please, independent of the pleasure given by the mere communication of knowledge; that out of the infinite number of events which mark the progress of society, a few are often sufficient for the purpose of the historian, and that in the selection of the most appropriate he will show his judgment and skill; that while he clearly points out those great principles which have had most influence on the condition of society, he will not overload his work with reflections which the matter will suggest to the reader; and he will often not do more than put him in the way of following out a train of thought. His art will often teach him to conceal his purpose of instruction, when his work will not be prejudiced by his apparent forgetfulness of the dignity of his subject.

To enumerate among the historian's qualifications those of industry, integrity, and sound knowledge, or to detail all the qualifications for executing his task in the best possible manner, would be superfluous, if not impertinent. We will, instead of this, briefly consider the value of his labours when complete, and the advantage which his readers will derive from a careful perusal of his work and an examination of the original sources.

It is a common remark that all history is uncertain, and if the remark were true to the full extent, there would be little use in attempting to show the value of that which cannot be known with certainty. But though many events, or rather the circumstances of such events, are uncertain, the most valuable part of history rests upon monuments which have no uncertainty in their character. The positive institutions of every civilized country, its laws and its literature, are facts recorded, which are rich in instruction, independent of their being evidence of an infinite number of other facts of which they are conclusive proof.

The study of these monuments, whether prosecuted under the guidance of a historian who has used them in the construction of his work, or followed out by individuals according to their own judgment and mainly with reference to some special branch of inquiry, is one of the noblest subjects that can engage our attention. Such a study aims at the philosophical exposition of what now is, by reference to what has led to it: it show what principles lie at the roots of our social system, what they once were, how they have been modified, and what they now are. Knowing what each thing now is, and how it came to be what it is, we are better enabled to form a conjecture of what it will be, and how we may best fashion it to our purposes. Thus, we learn in what circumstances change may be made with advantage; and knowing, from the experience which history teaches, that changes in our social relations become necessary in the course of time, and can neither be resisted with safety nor safely left to be directed by the blind impulses of numbers, we learn how to introduce such changes with the least chance of injury. But such a study, to be prosecuted with success, must be the occupation of a whole life: and if the active man of business into whose hands legislation and administration have been entrusted by choice, or fallen by perverse accident, has neither leisure nor capacity for so extensive a survey, he ought to learn enough to know his incapacity, and to ask counsel of those who are able to give it.

For him who would aspire to the high rank of a reformer of the institutions and the laws of his country, a sound and comprehensive knowledge of the leading notions contained in such institutions and laws, and of their progressive development, is absolutely essential to success in attempting any beneficial change. For in every case of change, the question is not merely, what would be best in the formation of a new society (if such a thing as the formation of a new society could for a moment be supposed), but the question is—what is best in the actual circumstances: and a full or a competent knowledge of actual circumstances must from the very nature of things comprehend a knowledge of previous circumstances.

To those whose business it is to interpret the laws of their country, whether in the way of giving advice or of judicial exposition, a full knowledge of fundamental principles, whether expressed in written laws or resting on recognised customs, is indispensable, in order to enable them to solve the numerous difficulties which attend the complete exposition of rights in a society which has existed for centuries continually progressive in wealth and in numbers. Such an active and living principle can alone maintain the study and the exposition of law in a state of healthy vigour in the midst of the complicated relations of modern society; and such alone can form a sound basis on which to construct a code, if ever the experiment should be found advisable.

The importance of such a sound historical knowledge is forcibly expressed by one of the first writers of any age. 'In every triangle there are certain conditions, from whose combination all others of necessity follow; by these, as for instance, by two sides and the included angle, the triangle is determined. In like manner every part of our law has such elements by which the rest are determined: we may call them leading fundamental principles. To feel these thoroughly, and proceeding from them to recognise the internal connection and the relationship of all juristical notions and principles, is one of the most difficult problems in our science; indeed it is peculiarly that which gives to our labour its scientific character.' And again he observes—'It has been shown above that all results in our science rest on the comprehension of leading fundamental principles, and it is precisely this complete comprehension on which the greatness of the Roman jurists is founded. The notions and the principles of their science appear in their writings not like things arbitrarily assumed; they have a real being, whose existence and genealogy have become known to them by long familiar converse. For this reason their whole mode of proceeding is attended by a certainty which is not found anywhere else except in the mathematics, and we may say without exaggeration that they come to a strict reckoning with their fundamental notions.'

Again—'That which made Rome great was the active, living, political feeling, which kept the people constantly ready so to renovate the forms of their constitution, that the new merely served to develop the old—the true principle of harmony between the power that would maintain things fixed and that which prompts to movement. This feeling operated both in the constitution and in the civil law. Consequently in the civil law also the general character of the Romans exhibited itself in a firm adherence to what was transmitted from their ancestors, without yielding to it as a binding rule when it was no longer in harmony with a new and universally prevailing opinion. Accordingly, the history of the Roman law to the classical period displays a general, gradual, and complete organic development. If a new legal formula arose it was immediately connected with an old and existing one, which thus communicated to the new one its own fixedness and development.' 'From this representation,' adds the same writer (from whom we have made these extracts), 'it is clear that Roman law grew almost entirely out of its internal principles as a law of custom; and the careful study of its history shows how trifling on the whole was the effect of particular enactments so long as the law existed in a living state.' (Savigny, *Vom Beruf unsrer zeit für Gesetzgebung und Rechtswissenschaft*, pp. 22, 28, 31—33.)

What are the advantages of a complete historical study to the philosopher, who would operate upon the popular opinion and impress on his countrymen and the world those principles which he has discovered, or believes, to be the best principles of human action?

While the mass, who are intolerant of the labour of inquiry and reflexion, or are deficient in the power of grasping general principles, cling to every existing thing, and every traditional opinion, with the instinct of self-preservation, those who possess, or think they possess (which is the more common case) enlarged philosophical principles, are apt to overlook the conditions which are necessary for their practical application. Thus each actually existing school of philosophy expects to accomplish everything in its own day· it despises the knowledge of the past, and would anticipate the enlarged experience of the future. But the effort to unsettle what has long existed fails before the 'nert resistance of accumulated ages, embodied in the habits, opinions, and institutions of the actual generation. The anticipation of universal chango 'and complete reformation of social habits and opinions is indulged in for a few short years, sometimes mingled with contempt of those who pertinaciously look behind them, instead of embracing the offered means of perfectibility and throwing away all doubts as to the future. An instructive lesson is all that remains of these brilliant expectations. We learn the folly of wrestling with a power which we have not duly estimated, and of opposing to opinions and habits hardened by the growth of centuries, even the soundest conclusions of our philosophy, when unaided by the experience of history.

HIVE. [BEE.]

HOADLEY, BENJAMIN, born 1676, died 1761; an English clergyman, successively bishop of Bangor, Hereford, Salisbury, and Winchester.

As a general view of Bishop Hoadley's character, and his relation to the times in which he lived, he is to be regarded, 1st, as a principal writer among the divines of the English church who aro called Rational, that is, who have renounced the whole of what constitutes proper Calvinism, and have advanced more or less near to the opinions which are comprehended under the term Unitarianism: not that it would be just to them to rank them among Socinians, or in the more comprehensive class called Unitarians, but only that they had abandoned opinions which are supposed to be the most opposite to those of Unitarians, such as Election and the other distinctive doctrines of Calvinism. His 'Plain Account of the Sacrament,' and, more than this, his 'Discourses on the Terms of Acceptance,' show how rational was the view which he took of Christianity, its requirements, and its ordinances. They are still much read, and greatly valued by Rational divines both in and out of the Establishment. 2. He is to be regarded as the great advocate of what are called Low Church principles, a species of Whiggism in ecclesiastics, in opposition to the high pretensions sometimes advanced by the church or particular churchmen. It was in this character that he wrote his treatise on the 'Measure of Obedience to the Civil Magistrate,' which was animadverted upon by Bishop Atterbury, a great Tory divine, and defended by Hoadley, whose conduct on this occasion so pleased the House of Commons that they represented in an address to Queen Anne what signal service he had done to the cause of civil and religious liberty. But he was engaged moro earnestly in defence of those principles when, being then bishop of Bangor, he printed a sermon from the text, 'My kingdom is not of this world,' concerning the true nature of that kingdom which Christ came to establish on earth, the principles of which were attacked by various persons. It was out of this sermon that the celebrated Bangorian controversy arose, one of the most remarkable in the history of the Protestant church of England.

In the reigns of the first and second Georges, divines of the school to which Hoadley belonged found favour at court. It was otherwise in the reign of George III. The succession of Hoadley's preferments with the dates follows. In early life he was a city clergyman, having the rectory of St. Peter le Poor with the rectorship of St. Mildred in the Poultry. In 1710, when the Tory influence was becoming predominant in the councils of Queen Anne, and he was suffering from that and from the popular High Church delusion of the time, a private patron, Mrs. Howland, of Streatham, who was connected with the noble house of Russell, presented him with the rectory of Streatham. The queen died in 1714, and the accession of king George I. brought with it a great change in the politics of the court; one of the first bishoprics that fell vacant, which was that of Bangor, was presented to him. In 1721 he was translated to Hereford, and from thence in 1723 to Salisbury. In 1734 he was made bishop of Winchester.

A large account of bishop Hoadley, with tho particulars of an extraordinary attempt at imposition upon him in his old age, in an affair of money, by a foreigner to whom he had shown great favour, detected and exposed by him with a vigour which is rarely found in persons at the age of eighty, may be read in the 'Biographia Britannica.' Dr. Benjamin Hoadley, a physician, author of a once popular play, entitled 'The Suspicious Husband,' was his son.

HOANG-HO. [CHINA.]

HOATZIN. [CRACIDÆ, vol. viii., p. 131.]

HOBART TOWN. [TASMANIA.]

HOBBES, THOMAS, was born at Malmesbury, in Wiltshire, on the 5th of April, 1588, and was the son of a Protestant clergyman of that town. At the age of fifteen he was sent to Magdalen Hall, Oxford, and after he had gone through the usual university course, he became in 1608 private tutor in the family of Lord Hardwicke, soon afterwards created earl of Devonshire. In 1610 he went abroad with his pupil Lord Cavendish, and made the tour of France and Italy. After his return he came to mix much, chiefly through the assistance of his patron the earl of Devonshire, with the men most distinguished at that time for learning, as well as with others conspicuous by their high station. He enjoyed the familiar friendship of Bacon, who is said to have been assisted by Hobbes in the translation of some of his works into Latin, and was an intimate associate also of Lord Herbert of Cherbury, and of Ben Jonson. Ben Jonson revised for Hobbes his first work, the translation of Thucydides.

This translation, which had been begun, as Hobbes himself tells us, 'with an honest view of preventing, if possible, those disturbances in which he was apprehensive his country would be involved, by showing, in the history of the Peloponnesian war, the fatal consequences of intestine troubles,' was published in 1628. His patron the earl of Devonshire had died two years before; and the son, Hobbes's pupil, died in the year in which this translation was published. He was so much affected by this loss that he gladly seized an opportunity of going abroad with the son of Sir Gervase Clifton, with whom he remained some time in France. He returned in 1631, at the instance of the dowager countess of Devonshire, to undertake the education of the young earl, who was then only thirteen. In 1634 he went with his new pupil first to Paris, where he enjoyed the friendship and frequent society of father Mersenne, and applied himself much to the study of natural philosophy, and afterwards to Italy, where he became known to Galileo. He returned to England in 1637. Shortly afterwards he applied himself to the composition of his 'Elementa Philosophica de Cive,' a few copies of which were printed in Paris in 1642. A second edition of the work was printed in Holland in 1647, under the superintendence of M. Sorbière, to which were prefixed two laudatory letters addressed to the editor, the one by Gassendi, and the other by Mersenne.

Shortly after the meeting of the Long Parliament, which took place in the end of the year 1640, Hobbes had withdrawn himself to Paris. He became acquainted here with Descartes, with whom he afterwards held a correspondence on mathematical subjects; and he also acquired the friendship of Gassendi.

In 1647 Hobbes was appointed mathematical tutor to the Prince of Wales, afterwards Charles II.; and he so won the esteem and affection of the prince, that though, after the publication of the 'Leviathan,' Charles, yielding to the opinions of divines, forbade him his presence, he yet always spoke of him in terms of the greatest kindness, kept his picture, taken expressly for the purpose, in his study, and when he had been restored to the throne, unasked presented him with a pension.

Hobbes's two small treatises, entitled 'Human Nature' and 'De Corpore Politico,' were published in London in 1650, and in the following year the 'Leviathan.' He caused a copy of this last work to be fairly written out on vellum and presented to Charles II.; but the king, having been informed by some English divines that it contained principles subversive both of religion and civil government, thought it right to withdraw his favour from Hobbes, and, as has been already said, forbade him his presence.

After the publication of the 'Leviathan,' Hobbes returned to England. In 1654 he published his 'Letter upon Liberty and Necessity,' which led to a long controversy with bishop Bramhall [BRAMHALL]; and it was about this time too that he began a controversy with Dr. Wallis, the mathematical professor at Oxford, which lasted until Hobbes's death. By this last controversy he got no honour.

Almost immediately after Charles's restoration in 1660, a pension of 100*l.* a year was settled upon Hobbes out of the privy purse. But this mark of favour from the king had by no means the effect of removing the obloquy under which Hobbes and his opinions laboured; and in 1666 his 'Leviathan' and 'De Cive' were censured by parliament. Shortly after Hobbes was still further alarmed by the introduction of a bill into the House of Commons for the punishing of atheism and profaneness. But this storm blew over; and, as is usually the case, the notoriety attending the obloquy under which Hobbes laboured had its sweets as well as its bitters. In the year 1669 he received a visit from Cosmo de' Medici, then prince and afterwards duke of Tuscany, who honoured him with many presents, and asked in return for his picture and a complete collection of his writings, the former of which he afterwards deposited among his curiosities, and the latter in his library at Florence. He received many similar visits from foreigners of distinction, all of whom were curious to see one whose name and opinions were known throughout Europe.

In 1672 Hobbes wrote his own life in Latin verse, being then in his eighty-fifth year; and in 1675 he published his translation in verse of the Iliad and Odyssey. He had previously, by way of feeler, published four books of the Odyssey; and the reception which they had met with had encouraged him to undertake the whole. But however favourable might have been the reception at the time, the popularity of this translation has certainly long since ceased; and it must be allowed that the fame of the philosopher is anything but heightened by his efforts as a poet. Hobbes had now retired to the earl of Devonshire's seat in Derbyshire; but notwithstanding his advanced age, he still continued to write and publish. His 'Dispute with Laney, bishop of Ely, concerning Liberty and Necessity,' appeared in 1676; and in 1678 his 'Decameron Physiologicum, or Ten Dialogues of Natural Philosophy;' to which was added, a book entitled 'A Dialogue between a Philosopher and a Student of the Common Law of England.' In 1679 he sent his 'Behemoth, or a History of the Civil Wars from 1640 to 1660' to a bookseller, with a letter in which he requested him not to publish it until a fitting occasion offered. It appears from this letter that Hobbes, being anxious to publish the book some time before, had with that view shown it to the king, who refused his permission; and for this reason Hobbes would not now allow the bookseller to publish it. It appeared however almost immediately after Hobbes's death, which took place on the 4th of December, 1679, when he was in his ninety-second year. The immediate cause of his death was a paralytic stroke.

The quality which chiefly strikes us, in contemplating the personal character of Hobbes, is its independence. Placed during the greater part of his life in circumstances which would have made any other man, despite himself, a courtier —the inmate of a noble house and tutor to a king,—amid the temptations of society he steadily pursued philosophy, and at the risk of losing great friends, and indeed with the actual sacrifice of royal favour, constantly put forth and clung to opinions which were then most startling and obnoxious. His independence in smaller things may be gathered from the following account of his daily mode of life in the earl of Devonshire's house, which is given by Dr. Kennet in his 'Memoirs of the Cavendish Family,' and which is interesting if only because it relates to so remarkable a man as Hobbes. 'His professed rule of health was to dedicate the morning to his exercise, and the afternoon to his studies. At his first rising therefore he walked out and climbed any hill within his reach; or, if the weather was not dry, he fatigued himself within doors by some exercise or other, to be in a sweat. After this he took a comfortable breakfast; and then went round the lodgings to wait upon the earl, the countess, and the children, and any considerable strangers, paying some short addresses to all of them. He kept these rounds till about twelve o'clock, when he had a little dinner provided for him, which he ate always by himself without ceremony. Soon after dinner he retired to his study, and had his candle with ten or twelve pipes of tobacco laid by him; then shutting his door, he fell to smoking, thinking, and writing for several hours.' We are told that he was testy and peevish in conversation, more particularly in his latter years, and that he did not easily brook contradiction. And there can be no doubt that his independence was often displayed in that excess in which it takes the name of arrogance. It was one of his boasts, for instance, 'that though physics were a new science, yet civil philosophy was still newer, since it could not be styled older than his book "De Cive."' Such indeed was his usual tone in speaking of his own performances. Another proof of his arrogance is supplied by his mathematical controversies. But after all there is something that we cannot resist admiring in independence of others' opinions, when carried even to the excess in which Hobbes's character displays it. 'There is an air of grandeur,' as Mr. Hazlitt remarks, speaking of Hobbes's style of writing, which has also been often censured as offensively dogmatical, 'in the stern confidence with which he stands alone in the world of his own opinions, regardless of his contemporaries, and conscious that he is the founder of a new race of thinkers.' (*Literary Remains*, vol. i., p. 125.)

If we leave out of account his arrogance, Hobbes seems to have been a man of much amiability, as well as strength of character. When he retired to France, he made a present of his patrimonial property to his brother,—

> 'Of small extent, but a most fertile ground,
> Which did with store of bladed wheat abound—
> Fit for a Prince,'

as he himself tells us with characteristic frankness, and in characteristic verse, in his autobiographical poem.

Turning from the man to the author, we must content ourselves with very few words on a subject worthy of a volume. For Hobbes is indeed, as Mr. Mill remarks, 'a great name in philosophy, on account both of the value of what he taught and the extraordinary impulse which he communicated to the spirit of free inquiry in Europe.' (*Fragment on Mackintosh*, p. 19.) He may be considered the father of English psychology, as well as (what every one must allow him to be) the first great English writer on the science of government. Let it be remarked also (for it is from losing sight of this that some of the most important misconceptions of Hobbes's views have arisen) that though he wrote on psychology, and much of his fame is as a psychologist, his psychology, like that of Bentham, was only auxiliary and in the way of prelude to his writings on government, and he should always emphatically be viewed as a writer on government. And even were his psychology left entirely out of account, his writings on government, of which the 'Leviathan,' the 'De Cive,' and the small treatise 'De Corpore Politico,' are the chief, would be a sufficient passport to immortal fame.

The views of Hobbes on government, as contained in his political treatises, may be thus briefly stated. He views government as a refuge, dictated by reason or the law of nature, from the evils of a state of nature, which he chooses to call (and this one would think was a matter of small import, though, strange to say, it has ever been one of the chief charges brought against Hobbes) a 'state of war.' The government thus recommended is formed (he imagines) by a covenant or contract entered into between those who are to be subjects and those who are to be rulers, and ever after tacitly adopted by all future sets of subjects and future sets of rulers. And the subjects having covenanted complete unconditional obedience to their rulers, and the duty of obedience being directly referred to this covenant, Hobbes views obedience as a religious duty, and the supremacy of the rulers, on the other hand, as a divine right. As regards forms of government, he prefers, on account of its greater vigour and aptitude for business, a monarchy; but he strongly and zealously inculcates at the same time the necessity of a sound education of the people. But whatever be the form of government, he contends that the government must be possessed of supreme powers, else it would not be the government. And being himself in favour of a government of one, or a monarchy, he ever insists on the supremacy of the monarch and on the duty of unconditional obedience to his laws. Thus it is that the decriers of Hobbes, losing sight of his views on the education of the people, and confounding monarchy with tyranny, and supreme with arbitrary power, have nicknamed him him 'the apologist of tyranny.' And because, carrying out his views as to the supremacy of government, he has required submission to the mode of faith which the monarch establishes, and, writing not on moral but on political science, has chosen to define the words 'just' and 'unjust' with a direct reference to the laws which the monarch ordains, and which it is the duty of the subjects to obey, he has been denounced as contemning religion, and as a confounder of moral distinctions. But Hobbes does not take upon himself to say that the monarch's opinion is the test either of true religion or true morals; and indeed, in many parts of his works distinctly asserts the preeminent merits of one form of faith and the independence of morality, which is, as it should be, his criterion of the goodness of law. According to Hobbes, what is established by law must be obeyed; but there is nothing in his views to prevent attempts which are conformable with the laws to alter what in the laws is wrong.

There is no doubt that in Hobbes's views, as we have stated them, there is some error. His hypothesis of a covenant as the origin of government, for instance, is a fiction which has now long been exploded in this country. But this is an error solely speculative, and of little importance; for all the valuable conclusions which Hobbes seeks to derive from his fiction may be got at, without its aid, by means of the principle of utility. As to the grave charges which have been so sedulously brought against Hobbes, from the first appearance of his works to the present time, they have no other foundation than ignorance and prejudice.

The following vigorous remarks on the injustice of the obloquy under which Hobbes has so long laboured, are from a work which, both as regards thought and style, is one of the most masterly that modern times have seen. 'The authors of the antipathy with which he is commonly regarded were the papistical clergy of the Roman Catholic church, the High Church clergy of the Church of England, and the Presbyterian clergy of the true blue complexion. In matters ecclesiastical (a phrase of uncertain meaning, and therefore of measureless compass), independence of secular authority was more or less affected by churchmen of each of those factions. In other words, they held that their own church was co-ordinate with the secular government; or that the secular government was not itself supreme, but rather partook in the supreme powers with one or more of the clerical order. Hobbes's unfailing loyalty to the present temporal sovereign was alarmed and offended by this anarchical pretension; and he repelled it with a weight of reason and an aptness and pungency of expression which the aspiring and vindictive priests did bitterly feel and resent; accordingly they assailed him with the poisoned weapons which are ministered by malignity and cowardice. All of them twitted him (agreeably to their wont) with flat atheism; whilst some of them affected to style him an apologist of tyranny or misrule, and to rank him with the perverse writers (Machiavelli, for example) who really have applauded tyranny maintained by ability and courage. By these calumnies, those conspiring and potent factions blackened the reputation of their common enemy. And so deep and enduring is the impression which they made upon the public mind, that 'Hobbes the atheist' or 'Hobbes the apologist of tyranny' is still regarded with pious or with republican horror by all but the extremely few who have ventured to examine his writings.' (Austin's *Province of Jurisprudence determined*, p. 299, note.)

The number of works to which Hobbes's writings gave rise is very great. 'The Philosopher of Malmesbury,' says Dr. Warburton, 'was the terror of the last age, as Tindall and Collins are of this. The press sweat with controversy, and every young churchman-militant would try his arms in thundering on Hobbes's steel cap.' (*Divine Legation*, vol. ii., p. 9, *preface*.) His principal antagonists were, Clarendon, in a work named 'A Brief View of the Dangerous and Pernicious Errors to Church and State in Mr. Hobbes's book entitled Leviathan;' Cudworth, in his treatise on 'Eternal and Immutable Morality;' and Bishop Cumberland, in his Latin work on the 'Laws of Nature.' Bishop Bramhall published a book called 'The Catching of the Leviathan,' to which Hobbes replied. We may also mention Archbishop Tenison's 'Creed of Mr. Hobbes examined,' and Dr. Eachard's 'Dialogues on Hobbes.' And, in addition to direct and professed attacks on Hobbes, there are numerous references to his views for the purpose of censure in Harrington's 'Oceana,' and in Henry More's writings. But although Hobbes's writings excited so much controversy, and although so much interest even now attaches to his name, it is clear, from the very few editions which have been published of his works, and from the circumstance that those few are old, that they have not for a long time been read. This neglect may account for the continuance of the hostility with which his name is regarded.

HOBBIMA, MINDERHOUT, one of the most eminent of the Flemish landscape painters, was born at Antwerp, as is supposed about the year 1611 It is not known nor, we believe, conjectured by whom he was instructed, but his works evince the most assiduous and successful study of nature. His subjects are in general simple country scenes, the slope of a hill with shrubs and trees, the borders of a forest, a winding path leading to a distant village, or to some ruin, building, or piece of water, often carrying the eye to an almost evanescent distance; such are the materials to which, by accurate perspective, clearness, and fullness of colour, and the most careful execution, with a free and light of pencil, he gives an unrivalled charm. His works are scarce and eagerly sought after. Some of his very finest productions are in England, in Sir R. Peel's collection, and the Grosvenor Gallery. The largest and, in the opinion of Dr. Waagen, the finest of his works is in the possession of Lord Hatherton, who has refused 3000*l.* for it.

HOCHE, LAZARE, born in 1768 near Versailles, of very humble parentage, enlisted in the French Guards at the age of sixteen. When the Revolution broke out he warmly espoused its cause, obtained a lieutenant's commission in a regiment of the line, and served in Flanders under Dumouriez. Having distinguished himself he was rapidly promoted, and at the age of twenty-four was made general in command of the army of the Moselle. He opened the campaign by attacking the duke of Brunswick, in which however he failed. In concert with Pichegru he then attacked the Austrian army under Wurmser, and drove it out of Alsace. Upon incurring the displeasure of St. Just, the terrorist commissioner of the Convention, he was arrested and thrown into prison at Paris, when his life was saved by the timely overthrow of Robespierre in July, 1794. The Convention restored him to his rank, and sent him against the insurgents of La Vendée, where he showed much firmness mixed with considerable address and a disposition to conciliate, instead of driving the royalists to despair. He defeated the emigrants who had landed at Quiberon in July, 1795, and having obliged them to surrender, he wrote to the Convention advising that the leaders only should be punished, and the rest be spared; but the Convention ordered a general massacre. Hoche, upon this, gave up the command of that district to General Lemoine, and withdrawing to the south of the Loire, continued his operations in Vendée Proper, where he succeeded in putting down the insurrection, and seizing Charette and the other leaders, who were put to death. By a decree of the Directory, July, 1796, he was declared to have well deserved of his country.

Hoche now conceived the bold idea of effecting a landing in Ireland, and a fleet having been equipped at Brest with great secrecy, he embarked his troops in December, 1796, but being separated by a storm from the rest of the fleet, he was obliged to return to France without effecting any thing. [BANTRY BAY.]

Upon the Directory giving him the command of the army of Sambre et Meuse, he crossed the Rhine near Neuwied, in presence of an Austrian army, defeated the Austrians in several battles, and advanced as far as Wetzlar, where he heard of the truce of Leoben concluded between Bonaparte and the Archduke Charles, which put a stop to hostilities. In the quarrel which was then beginning to manifest itself between the Directory and the Legislative Councils, Hoche took the part of the Executive, as he had often expressed his opinion that France stood in need of a strong government in order to repress the factions and restore order, and he began to direct some of his forces towards Paris in order to support the Directory in the measures which it contemplated. For this he was denounced by the Councils, and Bonaparte meantime having offered the support of his own army of Italy, the Directory declined Hoche's services, and made use of Augereau to effect the coup d'état of Fructidor. [AUGEREAU.] Hoche seems to have taken to heart this slight of the Directory, and he returned to his head-quarters at Wetzlar, where he was seized by a sudden illness, of which he died on the 15th of September, 1797. The symptoms of the disease give rise to suspicions of poison. His remains were removed to Paris with great pomp. The procession on its way from Wetzlar to Coblenz had to pass through several towns occupied by the Austrians, who vied with the French in doing honour to the deceased. His funeral was celebrated in the Champ de Mars with great magnificence. Hoche was one of the most distinguished generals of the Revolution, not only for his military but for his political abilities, and his aspiring mind; and an impression prevailed long after in France that had he lived he might have exercised great influence on the destinies of that country, and have proved a formidable rival to Bonaparte. His life has been written by Rousselin, in 2 vols. 8vo.

HOCHSTÄDT. [BLENHEIM.]

HOCCO, a name employed by Buffon, Latham, and others, to designate some of the Curassow birds. [CRACIDÆ, vol. viii.]

HODDESDON. [HERTFORDSHIRE.]

HODEIDA. [ARABIA.]

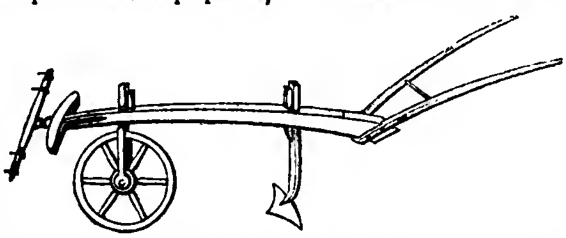
HODY, HUMPHRY, D.D., an eminent divine, was born on the 1st of January, 1659, at Oldcombe, in Somersetshire. He was educated at the University of Oxford, took his degree of M.A. in 1682, and was elected in 1684 a fellow of Wadham College. In the same year he published a 'Dissertatio contra Historiam Aristeæ de LXX. Interpretibus,' which was well received by most of his learned contemporaries. Vossius however published a reply to it in an appendix to his edition of Pomponius Mela. But the works by which Hody was principally known among his contemporaries were those which he published respecting the bishops who had been deprived of their bishoprics during the reign of William and Mary, for refusing to take the oath of allegiance to the new government. The first work which he published on this subject was a translation of a Greek treatise, supposed to have been written by Nicephorus in the latter end of the thirteenth or the beginning of the fourteenth century, in which the writer maintains that 'although a bishop was unjustly deprived, neither he nor the church ever made a separation, if the successor was not a heretic.' The original Greek work, as well as the English translation, were both published in 1691. Amongst the numerous works published in reply to Hody, the most celebrated was written by Dodwell, and was entitled 'A Vindication of the Deprived Bishops' (Lond., 1692). In the following year Hody published another work, entitled 'The Case of Sees Vacant by an Uncanonical Deprivation' (4to., Lond., 1693), in which he supports the opinions of Nicephorus, and replies to the arguments of his opponents. These exertions of Hody in favour of the ruling party in the church did not pass unrewarded. He was appointed domestic chaplain to Tillotson, archbishop of Canterbury, which office he also held under his successor. He was presented with a living in London, and was appointed regius professor of Greek at Oxford in 1698, and archdeacon of Oxford in 1704. He died on the 20th of January, 1706. He founded ten scholarships at Wadham College, in order to promote the study of the Greek and Hebrew languages.

Of the other works of Hody, the most important are:—1. 'De Bibliorum Textibus Originalibus, versionibus Græcis et Latina Vulgata, libri iv.,' Oxford, 1704, fol., which is said by Bishop Marsh to be 'the classical work on the Septuagint.' The first book contains the dissertation against the history of Aristeas, which has been mentioned above. The second gives an account of the real translators of the Septuagint, and of the time when the translation was made. The third book gives a history of the Hebrew text and of the Latin vulgate; and the fourth, of the other antient Greek versions. 2. 'The Resurrection of the (Same) Body Asserted,' 8vo., Lond., 1694. 3. 'Animadversions on two Pamphlets lately published by Mr. Collier,' 8vo., Lond., 1696. Sir W. Perkins and Sir J. Friend had been executed in 1695 for treason against the government; but previous to their execution had been absolved of their crime by some non-juring clergymen. This act was condemned by the ecclesiastical authorities, but was justified by Collier in two pamphlets which he published on the subject. 4. 'De Græcis Illustribus linguæ Græcæ litterarumque humaniorum instauratoribus,' Lond., 1742. This work was published several years after the author's death, by Dr. Jebb, who has prefixed to it an account of Hody's life and writings, to which we are indebted for the greater part of the preceding remarks.

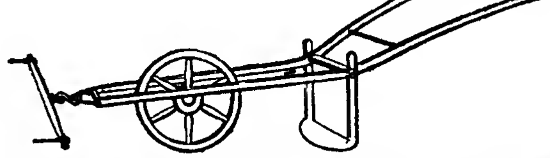
HOE, HORSE-HOEING. The hoe is an instrument used in gardens and in the fields for loosening the earth, and destroying the weeds between plants. It has various forms. The most common hoe consists of a blade or flat piece of iron, with an eye in which a handle is inserted at an acute angle with the plane of the blade. This hoe is used by striking the edge of it down into the ground, and the earth is moved by drawing the handle towards the workman. Another hoe has the handle at a very obtuse angle, and is used by pushing it forward and cutting off the weeds an inch or less under the surface of the ground. Hoes are made of different sizes and shapes according to the work which is to be done. When the earth is to be stirred between plants which are very near each other, the hoe is narrow and pointed, so that the smallest weed may be taken out close to the growing plant. When the distance is considerable, the hoe is wide, and sometimes compounded of several hoes, in order to stir a greater width of earth at once.

One of the greatest improvements in practical agriculture has been the introduction of the hoe into the field for every kind of crop. Peas and beans were probably the first crops which were sown in rows for the purpose of hoeing the intervals; potatoes, turnips, and carrots were probably the next, and the good effects produced on these crops, by stirring and hoeing the intervals between the plants, have led to the drilling of every other kind of produce which is apt to be injured by weeds. Hand-hoeing not having been found sufficiently expeditious on a large scale, a hoe has been invented of a larger form to be drawn by a horse. The rows have in consequence been widened, and this has introduced the horse-hoeing husbandry, which, half a century ago, was thought so important a discovery as to receive the name of the New Husbandry. The great promoter of this system was Jethro Tull, a gentleman from near Hungerford in Berkshire, who having observed the good effects of stirring the soil around plants, imagined that tillage might supersede all manuring, and that by keeping the soil free from weeds and continually stirred and pulverised, an inexhaustible fertility might be produced, and successive crops of the same kind might be raised without limit. The horse-hoe was the chief agent in this system, which imitated that of alternate crops and fallows; for the intervals between the rows in which the seed was sown were kept in a constant state of tillage, and thus fallowed for the reception of the seed for the next crop. Although these high expectations were not fulfilled, the hoeing of the intervals has caused a very great increase in the produce of the land, especially when united with judicious ploughing and manuring, and a proper succession of crops.

The simple horse-hoe is an instrument with a beam like a plough, and two stilts or handles, but much lighter; in this beam is inserted, instead of a coulter, the end of an iron hoe, of the proper breadth to stir the whole surface between the rows. A small wheel is generally added to keep the hoe at a proper depth in the soil.



A horse draws the instrument, which is held and guided like a plough. When the space to be hoed is considerable, the iron of the instrument is shaped differently. The hoe is narrower in the blade, and the instrument resembles a wheel-barrow more nearly than a plough.



From these simple instruments a variety of others have been invented of a more complicated nature, but the object of them all is the same, viz. to stir the ground between the rows, and destroy the weeds as fast as they appear.

The horse-hoe is now chiefly used in the cultivation of peas, beans, potatoes, cabbages, turnips, and carrots. It has been found that the required distance for the horse-hoe to act properly is too wide for rows of corn, and that the narrow hand-hoe is a more effective instrument in keeping these crops clean.

The effect of hoeing is remarkable in very dry weather. Although the stirring of the soil would seem to extract what little moisture there might be in it, and the weeds wither on its surface, it soon appears that, on the contrary, moisture is attracted or produced, and the plants which drooped before appear refreshed and invigorated. This is probably effected by a chemical action of the air on the vegetable portion of the soil and on the roots of the plants, which have the power of combining the gaseous principles in various ways, producing that combination of oxygen and hydrogen which forms water, while the power of vegetation in the plant itself can combine hydrogen and carbon so as to form oil and various other substances. Whatever be the mode in which it acts, experience has proved that the more the earth is stirred around plants the better they thrive.

Where a very great perfection has been attained in drilling the seed, so as to have the rows perfectly equidistant and straight, an instrument may be used which shall hoe ten or a dozen rows at once, without danger of cutting up the growing plants. Such an instrument has been invented, but requires too great perfection in the sowing to be very generally used. It is called the inverted horse-hoe, because the hoes are so placed as to present the back part of the hoes, which are rounded, towards the growing plants, so that even if they went so near as to touch them they would not cut them down. The points of the hoes are all in the middle of the intervals, one pointing to the right and another to the left. When the intervals are very wide, as is the case where potatoes, turnips, or cabbages grow in rows, a light plough, with one horse, going up and down the interval answers the double purpose of a hoe and plough. It stirs the ground to a greater depth, and can be guided nearer to the growing plants than the common horse-hoe. It also turns the soil over into the middle of the interval, from which it may afterwards, when it has been improved by exposure to the air and rains, be thrown back towards the roots and stems of the plants.

The operation of hoeing cannot be performed too soon after the plant has shot out its roots, because the ground may then be stirred very near the young plant without danger, and the roots will spread readily in the newly-stirred soil.

In stiff soils it is often very difficult to use the horse-hoe, owing to the hardness of the surface, which rises in lumps, the very reverse of what is intended; but a little attention to the time of hoeing and to the weather will generally obviate this difficulty. If the soil is bound at the surface, it is a proof that the preceding tillage has not been so perfect as it ought; that the ground has not been stirred to a sufficient depth before winter, nor laid up sufficiently dry, or that it wants underdraining. There are few soils which may not be made mellow and crumbling some time or other in spring; and if the proper time be chosen for the first hoeing, the surface will scarcely ever become so compact as to rise in large clods. In the case of a very tenacious soil the small-spiked roller, described [BEAN] in vol. iv., p. 82, may be had recourse to, and after using it a few times in dry weather, the surface will be left in a fit state for the common horse-hoe. The method usually adopted in the horse-hoeing husbandry has been taken from the common cultivation of the maize or Indian corn in Lombardy. The rows there are about 27 to 30 inches distant: as soon as the plants are out of the ground, the earth is taken from the plants and laid in a ridge in the centre of the interval; here it is exposed to the sun and rains, which, besides killing the weeds, makes it much finer. In this state it is thrown back upon the plants and laid against the stems, which strike fresh roots into this mellow ground. But this will not be equally proper with all plants and in all soils. Both potatoes and cabbages are much improved by heaping up the loose soil over them; but this is not the case with many other plants. The beet, for example, while it is growing and swelling, is not benefited by having earth thrown round it, for this would induce the root to send out fibres sideways, whereas they should strike downwards in search of moisture. Turnips may be partially covered with earth from the intervals, and will be protected from the frost by this covering. By attending to the growth of any plant we may soon discover when it is advantageous to move the earth from the roots and stems, and when it is best to draw it up around them. With respect to the destruction of weeds, there can be no doubt as to its great importance to all crops. It is generally supposed that every time that wheat is hoed judiciously, more than a bushel per acre is added to the crop, besides the benefit which the land receives by eradicating the weeds. Two or three good hand-hoeings will often so completely clear a field of weeds as to render superfluous the fallow which would otherwise have been necessary, and thus save all the expense of fallowing and the loss of one crop in four or five.

A great oversight is often committed when a field is hoed. The parts nearest to the fences and the sides of the banks, where the plough has not been able to go, are seldom hoed; but these parts become by neglect prolific nurseries of all kinds of weeds, which ripen their seeds, and disseminate them all over the field. No part of the surface should be left unhoed; and when the hoers leave a field, they should be able to defy any one to pick up a growing weed in it.

Those who employ labourers to hoe a field, at a certain price per acre, should be careful to see that the whole ground between the rows and the plants has been stirred; for it is a common trick to throw the earth over the growing weeds, and bury them only, without cutting them up, by which, instead of being destroyed, they flourish more vigorously.

The best time for hoeing stiff soils is when they are neither wet nor dry; when the surface is slightly caked, but there is moisture below it, and when the weather is dry after some rain. Light soils can be hoed at any time, and require it oftener than the heavy, especially in showery weather.

HOF, a district in Upper Franconia, in the kingdom of Bavaria, has a population of about 19,000 inhabitants. The chief town, of the same name, called also Stadt-am-Hof, is a place of great antiquity, and was early admitted as a free city of the empire. It has 6800 inhabitants, who carry on extensive manufactures of woollen, cotton, muslin, leather, paper, &c. The breweries are celebrated. There are three churches, a gymnasium, with a large library, a rich hospital, and other public institutions. There are quarries of fine marble and iron-works in the neighbourhood. Of 697 houses, 262, with the fine church of St. Michael and the town-hall, were burnt down in 1823. The town has now recovered from the effects of this disaster, and the regularity of the new buildings has greatly improved its appearance. It is joined to Ratisbon by a bridge over the Saale.

HOFFMANN, FRIEDRICH, was born at Halle in Saxony, in 1660, of a family which had been engaged for two centuries in the practice of medicine. After having graduated and received his diploma at Jena, he established himself as a physician at Minden in 1682. In 1684 he travelled through Holland and England, and on his return was appointed physician to Frederick William, elector of Brandenburg, and to the garrison at Minden. In 1688 he removed to Halberstadt, and having gained considerable celebrity both by his successful practice and his writings, he was invited by Frederick III., elector of Saxony, afterwards king of Prussia, to take the chief professorship of medicine in the University of Halle, which had just been founded. He accepted this appointment in 1693, composed the statutes of the Institution, and retained the professorship with a reputation scarcely inferior to that of his great colleague Stahl, till 1742, the year in which he died. As a practical physician Hoffmann enjoyed a celebrity second only to that of Boerhaave, who was the contemporary professor of medicine at Leyden; his works were well known and esteemed throughout Europe, and he was admitted a member of the scientific societies of London, Berlin, Petersburg, and other cities. He was a most voluminous writer; his collected works form six thick folio volumes, and the titles of his treatises occupy thirty-eight 4to. pages in Haller's *Bibliotheca Medicinæ Practicæ*.

Of the details of all Hoffmann's writings however little is now known. He assisted considerably, by the mass of evidence which he collected in his practice, in establishing the doctrines which had been first advanced by Glisson and Van Helmont, and were more philosophically maintained by Stahl, that the phenomena of living bodies are not explicable by the laws of inanimate matter, but depend on the constant action of a peculiar principle of life. This vital principle, which he believed to emanate from the Deity, was supposed to be accumulated in the brain, whence it was eliminated and conveyed along the nerves to all parts of the body, carrying with it life and energy. He thus ascribed to the nerves a far higher importance than they had been supposed by any (except Glisson) to possess; and in this he certainly made a great advance in medical science, by directing attention more pointedly to the intimate relation in which the nervous system stands to all the others, and by referring to its influence many of the phenomena before regarded as direct results of the agency of the vital principle.

But the principal reputation which Hoffmann now enjoys is the result of the change which he effected in the doctrines supposed to explain the essential nature of disease. The humoral pathology, which ascribed all diseases primarily to a morbid condition of the fluids, which by their action on the solids produced secondary changes in them, had prevailed in all the schools, and had been almost ineffectually opposed by Glisson and Baglivi; and the only subject of dispute had been whether the primary disorder of the fluids consisted in an alteration of their physical or their chemical properties. But Hoffmann showed that the solids were more often the primary seat of disease than the fluids. He believed that all their disorders were attributable to an alteration from the healthy degree of action, or, as he called it, tone, which constitutes the natural state of the moving fibres, a term in which he included nearly all the tissues of the body; if this tone were increased, spasm was said to result; if it were decreased, atony or relaxation was produced; and these opposite conditions occurring in one or other of the chief systems of the body, the nervous or the vascular, produced, he thought, every variety of disease.

Hoffmann's theory has itself long ceased to be studied, but it formed the basis upon which many others, more nearly approaching to accuracy, were founded. Cullen acknowledges that his own doctrines were in a great measure founded upon it; and Brown's hypothesis of exhausted and accumulated excitability, upon which that of Rasori, still received in the Italian schools, was founded, was another modification of the same theory of Hoffmann. In this country some of his terms alone are preserved to express similar and rather indefinite ideas. In the applications of his theory to the details of physiology and pathology, he adopted several explanations from both the mechanical and the chemical doctrines of his predecessors; in his practice he was extremely simple, and, by comparison with modern physicians, temporising and inefficient. In accordance with his theory, most medicines were deemed by him to act either as tonics or as antispasmodics; the former class including all stimulant, and the latter all depressing agents; but he also admitted alteratives and evacuants. His knowledge of chemistry and pharmacy was extensive, and we owe to him the discovery and first introduction of the Seidlitz waters and the purgative salt obtained from them.

The best edition of his complete works is that published at Geneva in 1748, in 6 vols. folio; and his best treatises are the 'Medicina Rationalis Systematica,' which occupies the first 3 volumes, and the 'Consiliarii Medici.' (*Life* prefixed to his works; Broussai's *Examen des Doctrines Médicales*, vol. ii.)

HOFFMANN, CHRISTIAN GOTTFRIED, born in 1692 at Lauben, in Upper Lusatia, studied at Leipzig, where he took his degrees. In 1718 he was made professor of law in that university, and afterwards appointed to the chair of the same faculty at Frankfort-on-the-Oder. He was also appointed counsellor to the king of Prussia, and member of the Academy of Sciences of Berlin. His principal works are: 1. 'Historia Juris Romano-Justinianei.' 2. 'Specimen Conjecturarum de Origine et Natura Legum Germanicarum.' 3. 'Introductio in Jurisprudentiam Canonico-Pontificiam.' 4. 'Nucleus Legum Imperii et Novissimarum Pacificationum.' 5. 'Prænotiones de Origine, Progressu, et Natura Jurisprudentiæ Criminalis Germanicæ.' 6. 'Novum Volumen Scriptorum Rerum Germanicarum, in primis ad Lusatiam et vicinas Regiones spectantium.' 7. 'Nova Scriptorum ac Monumentorum, partim Rarissimorum partim Ineditorum Collectio.' This work is a sequel to the preceding. 8. 'Series Rerum per Germaniam et in Comitiis à Transactione Passaviensi ad annum 1720 gestarum.' He also published in German 'Ausführliche Beschreibung des Russisches Reiches,' and 'Gegenwärtige Zustand der Finanzen von Frankreich.' Hoffmann's eulogium is contained in the 'Nova Acta Eruditorum' for May, 1736. He died in 1735, with the reputation of one of the first jurists of his time.

HOFWYL, the name of the institution of Mons. de Fellenberg. It is situated in a valley about three leagues from the town of Berne, in Switzerland, and consists of a number of distinct buildings surrounded by an estate of about 250 acres. The founder had for his object the improvement of the condition and character of all classes of society by means of an education adapted to their respective wants.

His institution accordingly consists of several distinct schools, with different objects in view.

The class to which his attention was in the first instance turned was that of the peasantry, whose depressed condition was a subject of great concern to him. He found them nearly as ignorant as the oxen that they drove, and able to avail themselves of but few of the advantages which nature offered them for improving their condition. The idea struck him that an estate might be so managed as to constitute not only a source of profit to the proprietor, but a means of rescuing the peasant from a state of brutish ignorance, and making him more comfortable in his circumstances, more happy in himself, and a support to his country instead of an incumbrance. The theory which he devised he also executed; young, full of energy, by birth a patrician, and possessed of a fair proportion of wealth, thirty-six years ago he commenced his operations with advantages that few can command—nor has his zeal flagged. From that time to the present he has been occupied in improving and perfecting his first design, which a long experience has proved to have been justly conceived with reference to the wants, the powers, and character of man.

The chief characteristics of the peasant school are:—

1. The combination of industry with instruction. As in after-life bodily exertion must occupy the largest proportion of a peasant's time, it is made to occupy the larger proportion of the day in the education in this school. Intellectual instruction occupies only a comparatively short period, so as to become rather a relaxation than a task. The industrial employments are varied with the ages and strength of the children, and are superintended in such a manner as to secure the habit of performing each skilfully. Indeed the arrangements of the institution are of a character to permit the children while labouring to receive instruction in various arts which must necessarily be of service to them both in the economy of their own cottages and in making them more valuable as labourers and servants. Thus the use of carpenters' and smiths' tools, the management of a garden, the care of horses and cattle, &c., each in its turn engages the attention of all the children, thus giving them independence by rendering them capable of supplying themselves with many things which they could not purchase, while it enables them to occupy with advantage many a long winter's evening, or day, when employment for wages is not to be had, which would otherwise be spent in listlessness, if not in mischief.

2. The reference of the intellectual instruction to the industrial employment.

Beyond the usual routine of reading, writing, and arithmetic, the children also obtain such an acquaintance with all those properties of bodies by which they are surrounded as can be turned by them practically to account. Mechanics, chemistry, so far as it relates to agriculture, natural history, botany, geology, mensuration, geography, &c., form a part of their instruction; not however in a pedantic manner, under the title of chemistry, natural history, &c., but as facts relating to the bodies by which they are surrounded, which it is necessary for them to know in order that they may avoid pernicious errors. The pedantry of knowledge belongs only to man studying for display, not to man studying because knowledge is a power of which he stands in need.

Drawing and music are also taught. The first, for its great utility in conveying ideas as to which words can give but inadequate information, in correcting the eye, and in assisting in the close observation of external appearances; the second, because it forms a relaxation which, while it is cheerful and soothing, is also innocent, and is of no mean value in aiding the moral training.

3. The profits of the labour of the children being made available for defraying the expenses of the education.

There are about 100 children in the poor school, who are boarded and clothed at the expense of M. de Fellenberg. In order to secure a return from them which will remunerate him for his outlay, he stipulates with the parents that they shall remain with him until twenty-one years of age. Thus their labour in the latter years repays his previous expenditure during their youth.

Besides the school of the sons of peasants there was also, when the writer visited Hofwyl about five years ago, one for girls of the same class, for whom an education similar in character to that of the boys, but adapted to the sex, was given. This school, we have learned, is no longer in existence.

The farmers have also their school, in which the scientific part of education is carried much farther than in the peasant school. Great attention is nere paid to agriculture, both in theory and practice, while the pupils are expected to labour in all the departments of the institution in the same manner, although not for so long a portion of the day, as the peasants. The children in this school pay a small annual sum for their education, as the quantity of labour which they perform is not sufficient to repay the cost of their education.

Besides the schools which we have mentioned there is also another for the higher classes of society. At the time when the writer of this article visited Hofwyl, there were about 100 children in it, thirty of whom were English. The number, it is believed, is at the present time smaller. Here, as in the other schools, bodily labour forms a part of the occupation of the day; but while in the peasant school labour is the chief part, here it is only a relaxation.

For the purpose of attending to the various departments of instruction in all the schools there are no less than thirty professors, who live in a house apart: several of them are individuals of considerable eminence.

In addition to these schools the founder, at his own expense, receives and gives instruction, for a certain period of the year, to all the schoolmasters of the peasant schools of the canton of Berne.

The estate around the institution is so managed as to form a model farm to the country. All the most approved agricultural implements invented in England, Scotland, Belgium, and other countries, are manufactured at the institution for sale to the agriculturists of Switzerland. Considerable attention has been paid to the breeding of horses and cattle.

It is with regret that we have to state that M. de Fellenberg has met with much opposition from his own countrymen in the prosecution of his plans.

HOG. (Zoology.) [SUIDÆ.]

HOG. The hog is one of the domestic animals which is most widely dispersed through the world, and yields to no other in its usefulness. It lives and thrives on every kind of food, vegetable or animal. It grazes like the ox, and will even eat hay; and its stomach can digest what few other animals could swallow with impunity. The sow bears two litters in the year, having from eight to twelve, and even sometimes eighteen or twenty young at a time. No animal converts a given quantity of corn or other nutritive food so soon into fat, or can be made fat on so great a variety of food.

The food of the hog in a wild state is grass, roots, acorns, beech-mast, and wild fruits. He is active and ferocious; and the boar-hunt, from the danger which attends it, is well adapted to excite those who are of a warlike disposition.

There are many varieties of the domestic hog. The brindled hog most nearly resembles the wild species; but although the flesh is savoury, he does not fatten so soon, nor is he so profitable as the more indolent and softer skinned sorts are. The great quality of a hog is his power of digestion; the more rapidly he fattens, and the earlier he can be made to increase in flesh without increasing in bone, the better is the breed. Some of the small hogs which are brought from China are remarkable for this quality, as well as for their prolific nature; and when, by judicious crossing, the size is increased, they are a very profitable breed. The Chinese pig is short in the head, with ears pricked up and pointing backwards, very wide in the cheek, high in the chine, and short in the leg. When a sow of this breed is heavy in pig, her belly generally drags on the ground. The young pigs of the Chinese breed, especially the white variety, are excellent for roasters, at three weeks or a month old. They are small and fat, with little bone, and their skin is very delicate. They also make excellent porkers at about three months old, when kept for some time after weaning on the refuse of the dairy. They may be kept fat from the time they are weaned till they are fit to be killed for bacon; and although they do not come to a great size, they will pay very well for their food if killed at a twelvemonth old.

The breed that is nearest to the Chinese in this country is the Suffolk. They are generally white, with the ears pointed and rather forward. They are broad in the chest and loins, short, and compact: they make fine bacon hogs at twelve or fifteen months old, weighing from twelve to fifteen score when killed. The sucking-pigs and porkers are also very delicate. The Essex breed is mostly black and white. The pure breed however is said to be quite black, and is so nearly allied to the smooth Neapolitan breed, which has scarcely any hair, that we cannot help supposing a consanguinity between them. When crossed with the Neapolitan they produce a breed which fattens at a very early age, and to an astonishing degree. A breed of this cross, carefully selected by Lord Harborough, has gained the first prizes for fat pigs at the Smithfield annual Christmas shows for several years past. They were fed extravagantly, no doubt, but at twenty-two weeks old they were so completely covered with fat, that their feet were scarcely to be seen; and if they could stand, which is doubtful, it is certain that they could not walk.

The Neapolitan hog is black, without any hair, very plump, with pricked ears. No breed can excel it in the aptitude to fatten. The sows often become so fat on very scanty food that they will not breed: they are extremely tender; and if they happen to have litters in winter, it is difficult to save the young pigs from dying in cold nights. A cross of the Neapolitan with some of our hardier breeds greatly improves their usefulness, without injuring their aptitude to fatten: the best cross is with the Berkshire, which is a very well shaped hog, with short legs, small ears, broad chines and loins, and good hams.

From the prolific nature of the hog it is not difficult to select the best individuals to breed from. In every litter there will be pigs better formed than the generality, and by careful selection of these any breed may be soon much improved without crossing; but experience teaches that when the sows and boars are too nearly related the fecundity gradually diminishes; and by continually breeding from the same stock the sows at last produce only two or three diminutive pigs at a litter. Hence the advantage of frequent crossing. To restore fecundity no breed is so effectual as the Chinese. A breed compounded of the Berkshire, Chinese, and Neapolitan, may, by careful selection, produce every quality which can be desired: numerous litters, early fatting, and fine hogs for bacon at twelve or sixteen months old, are the result of care and judicious breeding.

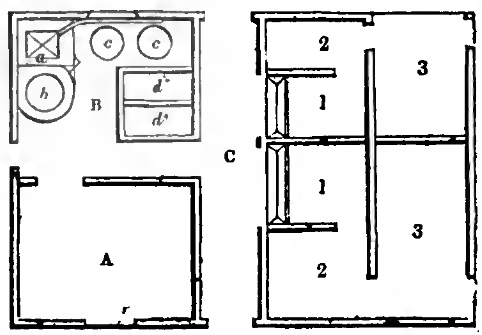
The black hogs are preferred on the whole. They are much less subject to diseases of the skin than the white, and the sun affects them less in summer. For sucking-pigs or porkers many prefer the white, merely for the appearance; for the black skin is in general the finest.

There are some very large breeds, which have been recommended under the idea that in a large hog the bone and offal are less in proportion to the flesh than in a smaller. But these large breeds do not come so soon to maturity. They cannot be profitably put up to fatten till eighteen or twenty months old, or more; and although some of them may make hogs of thirty or forty score when killed, they are so long fatting, and require so much food, that it is very doubtful whether they pay for it as well as the smaller. For delicate bacon the hogs killed at a twelvemonth old, and weighing ten or twelve score, are much preferred; and we are inclined to think that they are most profitable. When hams are the principal object the hogs should be killed before they are so fat as they might be: and the carcase is then cut up and pickled instead of being converted into dry bacon. To keep hogs profitably, a regular system should be pursued both in the breeding and feeding. Proper hogstyes should be constructed, with chambers in which the pigs of different ages and the breeding sows may be kept separate. The food should be prepared for them by boiling or steaming in an apparatus conveniently placed, and the greatest cleanliness and regularity should be maintained. It is a great mistake to suppose that the hog loves dirt. If he can keep himself clean he will do so; and the wallowing in the mud is not from a love of dirt, but from a heat and itching in the skin in warm weather, which is relieved by rolling in the cool mud. If hogs have plenty of clean straw and clean water they never will be dirty, and nothing makes them thrive so quick, or pleases them more, than being washed and curried regularly. If the hogs are not closely confined they will always lay their dung at a distance from the place where they sleep or feed, and in all well constructed styes there should be a small yard to each apartment, in which the hogs can deposit their dung.

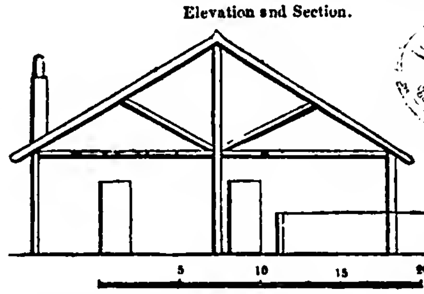
When a sow is near the time of farrowing, which is four months after she has taken the boar, she should be put in a stye by herself, with a moderate quantity of straw, for if there be too great an abundance she is apt to lie down on the young pigs when they bury themselves in the loose straw. Sows, although very careful of their pigs, are very apt to lie on them, especially when any of them are near a wall. To prevent this it is very useful to have a ledge of wood six inches wide and six inches from the ground all round the stye, so that she cannot lie down close to the wall; and if a young pig should be accidentally behind her he can take refuge behind the ledge, and thus escape being lain upon. When no precautions are taken, one-fourth of a litter is often lost in the first day or two after they are born. Some sows have the unnatural propensity of eating their young pigs as soon as they drop; good feeding will prevent this in some measure, but attention at the moment of farrowing is the safest and surest preventive. When once the young pigs have sucked much of the danger is past.

A sow with many pigs should be well fed; bran and barley-meal with milk or whey is the best food; grains, where they are at hand, are excellent; and it is useful to let the sow go out to graze in a meadow or clover-field for an hour or two every day, shutting up the pigs during that time till they are a fortnight or three weeks old, when they may then accompany the sow. A sow will live many years and bring numerous litters, and the older she is the better nurse she is in general. When a sow has ten or twelve pigs at a litter, and two litters in the year, one in spring and another in autumn, she is too valuable to be killed, and ought to be kept as long as she will breed. But otherwise it is very profitable to let a young sow have a litter at ten months old, and spay her immediately; she will then fatten most readily as soon as the pigs are weaned; and the bacon will be as good as that of a maiden pig. Whenever a sow does not bring a sufficient number of pigs, or is not a good nurse, or has ever eaten any of her pigs, she should be spayed and fattened immediately. The young pigs intended to be kept for stores or for porkers, are castrated or spayed at a month or six weeks old. The males are then called *barrow* pigs, and when fatted make the best bacon. They are usually put up at a twelvemonth old and fatted in three or four months. At first they have potatoes raw or boiled, mixed with bran, or bean-meal, or they have dry beans and water. After they are half fat they should only have pease-meal or barley-meal and water, unless in a dairy, where they have the skimmed milk or whey. Hogs fattened on potatoes only do not make so good bacon as those which are fatted on corn. This is the reason why the home-cured bacon sells so much dearer than the Irish. When a piece of raw bacon is put into the pot and swells in the boiling, it is a sure sign that the hog has been well fed; if it shrinks, it may be concluded that he has been fattened chiefly on potatoes. The labourers in the country, who live chiefly on bacon, know this well, and always purchase the best fed bacon, even at a much higher price, finding it most economical. Potatoes are an excellent food for store pigs, and may be given boiled and mixed with meal in the early part of the fatting process; but beans and peas make the firmest flesh, and barley-meal the sweetest. Before a hog is killed he is usually fed for some time on barley-meal and water alone, given as thick as porridge, and very little, if any, water is given to him. This last rule is often carried to too great an extent. Much water will make the food pass through too rapidly, and it will not be digested, but the hog should never suffer from thirst, or he will not thrive. Before a hog is killed he should be kept without food for twelve hours at least. He may however have water. He should be killed without giving him more pain or causing more struggling than is necessary, by a resolute stab with the knife in the lower part of the neck, where the knife may sever the large artery which comes directly from the heart. The blood should be allowed to flow freely till it is all out of the body. The hog, if intended for salt pork, must then be scalded with water not quite boiling, and well scraped to take off the hair with the cuticle; but for bacon it is best to singe the hair by burning straw over the body, and then scraping the skin. Care must be taken not to allow the skin to be burnt so as to crack. The hog is then hung up, and the entrails taken out. The inside of the body is washed clean with a cloth or sponge dipped in water, that no blood may remain, and the next day the hog is cut up. The head and feet are cut off; the chine is taken out, and the upper part of the ribs, with the backbone, are cut out, leaving as much flesh as possible adhering to the fat outside. The small ends of the ribs remain attached to the bacon. The curing of bacon has been described. [HAMPSHIRE—*Agriculture*.]

Hog-stye.—Much of the profit of breeding and fattening hogs depends on the economy of labour in preparing their food. Any place is often thought good enough to lodge a pig in, and a stye is a word synonymous with a filthy place. But in every well arranged farm-yard there should be a convenient place for keeping hogs and feeding them, which may be erected at a small expense, and which will soon repay the outlay. There should be a place to boil and mix the food in, with one or more large coppers and a steaming apparatus. The food should be mixed in square brick tanks sunk in the ground and cemented, that there may be no filtrations. If there is only one tank, there should be a partition in it. From the boiling-house there should be an immediate communication with the feeding-styes, under cover, if possible. Each stye should open into a small yard behind, which should communicate by a door with the principal farm-yard, where the barn is situated in which the corn is thrashed, and be enclosed with a low wall or paling. There should be separate styes for breeding-sows, for porkers, and for fatting hogs. Not more than three or four of the latter should be in one stye. The food should be given in troughs, in a separate compartment from that in which the hogs lie down, and no litter should be allowed there. The floor, which should be of brick or stone, should be frequently washed clean, and the troughs should be cleaned out before every meal; any of the food left from the last meal should be taken out and given to the store-pigs. A very convenient contrivance for keeping the troughs clean is to have a flap or door, made with hinges, to hang horizontally over the trough so that it can swing, and alternately be fastened by a bolt to the inside or outside edge of the trough. When the hogs have fed sufficiently the door is swung back and the trough is easily cleaned out. It remains so till feeding time, when the food is poured in, without any impediment from the greedy hogs, who cannot get at it till the door is swung back. This



Elevation and Section.



SCALE OF FEET.

A, root-house; B, boiling and steaming house; *a*, steamer; *b*, copper; *c*, *c*, steaming-vessels; *d*, *d*, tanks to mix the food; C, passage to the styes, 1, 1, feeding-rooms; 2, 2, sleeping-rooms; 3, 3, yards.

simple contrivance saves a great deal of trouble, and is easily adapted to any common stye. It is a great advantage to be able to inspect the styes without going into them, and this is effected by placing them under a common roof, which may conveniently be a lean-to to the boiling-house or any other building, with a passage between them.

The preceding figure will best explain this, and show its superiority over common styes.

HOG'S LARD. [FAT.]

HOGARTH, WILLIAM, was born in the parish of St. Bartholomew the Great, in London, in 1697, and baptized in the parish church on the 28th November. His father Richard Hogarth (or Hogart, as the name seems originally to have been written and pronounced) died in 1721, leaving two daughters and one son, William. Of William Hogarth's education nothing has been recorded; but we may conclude that it was slight from the frequency of his errors in grammar and orthography. 'My father's pen,' writes Hogarth himself, 'like that of many other authors, did not enable him to do more for me than put me in a way of shifting for myself. As I had naturally a good eye and a fondness for drawing, shows of all sorts gave me uncommon pleasure, and mimiokry, common to all children, was remarkable in me. An early access to a neighbouring painter drew my attention from play, and I was at every possible opportunity employed in making drawings. My exercises when at school were more remarkable for the ornaments which adorned them than for the exercise itself. In the former I soon found that blockheads with hetter memories would soon surpass me, hut for the latter I was particularly distinguished.'

It was at his own wish that he was apprenticed to Ellis Gamble, a silversmith in Cranhourne-street; but he soon found this business too limited, and its scope insufficient for his fancy. 'The painting of St. Paul's Cathedral and Greenwich Hospital,' he writes, 'at this time going on, ran in my head, and I determined that silver-plate engraving should be followed hy me no longer than necessity obliged me to it. Engraving on copper was at twenty years of age my utmost ambition.' In 1718 Hogarth ceased to he an apprentice (Ireland), being twenty-one years old; and, according to Walpole, he attended Sir James Thornhill's academy in St. Martin's-lane, where he 'studied drawing from the life, in which he never attained great excellence.' His livelihood was earned by engraving arms, crests, ciphers, shop-bills, and other similar works, until the year 1724, when he published his first original eugraving, now called the 'Small Masquerade Ticket, or Burlington Gate.' Illustrations to Mortraye's 'Travels,' 'Hudihras,' and other books, were supplied by him in 1725 and the following year, which, with the help of some small etchiugs of scenes of town life and folly, replenished his purse, and gained him a moderate reputation. He now paid his addresses to Jane, daughter of Sir James Thornhill, to whom he was united in 1730, without the consent of her parents. Her father resented the marriage as a degradation to his daughter, and was not reconciled to her until two years after it had taken place. The facility which Hogarth had gained in the use of the brush now indueed him to attempt portrait-painting; hut although he was not unsuccessful in the treatment of many of his subjects, the style did not satisfy his mind: there was too much copying, as it were, and too little room for ingenuity and invention, to compensate for the drudgery. He accordingly abandoned portrait-painting, and entered upon that original style on which his fame rests. 'The reasons,' he says, 'which induced me to adopt this modo of designing were, that I thought hoth writers and painters had, in the historical style, totally overlooked that intermediate species of subjects which may he placed hetween the suhlime and grotesque.'

Before he had done anything of much consequence in this walk he entertained some hopes of succeeding in the higher branch of historical painting. 'He was not,' says Sir Joshua Reynolds (*Discourses*, vol. ii., p. 163), 'blessed with the knowledge of his own deficiency, or of the bounds which were set to the extent of his own powers.' 'After he had invented a new species of dramatio painting, in which probahly he will never he equalled, and had stored his mind with infinite materials to explain and illustrate the domestic and familiar scenes of comic life, which were generally and ought always to have been the subject of his pencil, he very imprudently, or rather presumptuously, attempted the great historical style, for which his previous habits had hy no means prepared him; he was indeed so entirely unacquainted with the principles of this style that he was not even aware that any artificial preparation was at all necessary.'

After this failure as a historical painter, he resumed his former manner, engraving, as had been his oustom, the pictures which he had painted. The eager demand for these engravings induced the printsellers to pirate them; and the piracies so diminished the profits of the author that he applied to parliament for redress: in consequence of his application a bill was passed in 1735, granting a copyright of a print for fourteen years after its publication. The reputation of Hogarth was now established, and he continued to paint with undiminished ability. At the age of forty-eight he was in easy circumstances, and rich enough to keep a carriage. The sale of his prints was his principal source of income: the price of his pictures kept pace neither with his fame nor with his expectations. We find that in 1745 he sold hy auction nineteen pictures, including the Harlot's and Rake's Progresses, for 427*l.* 7*s.*, a sum most unequal to their merits. Some conditions which he had very whimsically annexed to the sale appear to have diminished his profits. In 1753 he published his 'Analysis of Beauty,' in which he attempted to prove that the foundation of beauty and grace consists in a flowing serpentine line: he oites numerous examples; and though his conclusion is unsound, his arguments are both amusing and ingenious. They were attacked and ridiculed by a host of his envious contemporaries.

For an account of Hogarth's contests with Wilkes, the celehrated politician, we must refer to his biographers. After his sixty-sixth year his health began to decline, and he died on the 26th October, 1764. He was buried in the churchyard at Chiswick, where his wife was also interred in 1789, in her 80th year. They had no children.

Hogarth is the first English painter who can be said to have acquired any name among foreigners: he is also one of the few English painters who can be considered an original genius. His style of painting may be characterized as the 'satirical;' the satire being sometimes humorous and comic, sometimes grave, hitter, and tragio. His subjects are chosen from common life, among all classes of society, in his own country and in his own time. His comico-satirical vein may be seen in the Enraged Musician, the March to Finchley, Beer Lane, &c.: his tragico-satirical vein is exemplified in the Harlot's Progress, the Rake's Progress, Gin Lane, &c. The series of Marriage à la Mode contains pictures in both these veins. In the latter style his works are closely analogous to those of Swift; like Swift, he selects and dwells with pleasure upon those parts of human nature from which most men turn with disgust: as for example, in the Four Stages of Cruelty, and Gin Lane. He also resemhles Juvenal, in unmercifully chastising and laying bare the vices and weaknesses of mankind, and displaying them with the most revolting minuteness. The exaggeration of salient peculiarities, and the accumulation of characteristic incidents, which are conspicuous in the works of Hogarth, properly place him in the rank of *caricaturists*. At the same time, he never departs so widely from nature as to mar the effect of his composition. To such an extent is he a caricaturist, that he has heen said *to write* rather than *paint* with the brush. With reference to this quality, it has been remarked of his works, 'that there are such a number of minute circumstances, so many collateral points rather hinted at than expressed, that they can only, even after study of the picture, be taken into the mind in succession; that is to say, in a mode analogous rather to that in which language works, than to the manner in which painting ought to produce its effect.' 'The same tendency is more strongly marked in the means which he frequently had recourse to, to express a witty thought by some allusion written on a scrap of paper, or something of the sort, and which literally make the spectator a *reader*, and the artist something besides a painter.' (Review of Passavant's *Tour*, in Cochrane's *Foreign Quarterly*, vol. i., p. 5.) Although caricature, as its name imports, originated among the Italians, Hogarth must be considered as the great master of this style. As first introduced and perfected by him, this style seems to have suited the genius of the English nation. Gillray, although he never painted, and though he never attempted a line of the art equal to Hogarth, nevertheless produced political caricatures, showing in some cases remarkable genius, and far superior to anything else of the sort with which we are acquainted. The modern caricatures published under the initials of H. B., though less vigorous and in imagination scantier and less varied, are moreover entitled to very high praise in this department of art.

Concerning the merits of Hogarth's technical execution, there has heen some difference of opinion. As to the excellency of his drawing and composition there can, we presume, be no douht in the mind of those who have seen his original piotures. On this subject generally, we quote the opinion of Dr. Waagen respecting the series of Marriage à la Mode, whose high authority we consider altogether decisive. 'What surprises me,' he says, 'is the eminent merit of these works as paintings, since Hogarth's own countryman Horace Walpole says he had but little merit as a painter. All the most delicate shades of his humour are here marked in his heads with consummate skill and freedom, and every other part executed with the same decision, and for the most part with care. Though the colouring on the whole is weak, and the pictures, being painted in dead colours with hardly any glazing, have more the look of water-colour than of oil paintings, yet the colouring of the flesh is often powerful, and the other colours are disposed with so much refined feeling for harmonious effect, that in this respect these pictures stand in a far higher rank than many of the productions of the modern English school, with its glaring inharmonious colours.' (Waagen's *Arts and Artists in England*, German edit., vol. i., p. 230.) Hogarth appears to have avoided high colouring, lest the attention of the spectator should be distracted from the subject of the picture. In the National Gallery there are seven of his pictures, consisting of his own portrait and the series of the Marriage à la Mode.

The first commentator on Hogarth was Dr. Trusler, who was assisted by Mrs. Hogarth: an improved edition of his work, which has been published by Mr. Major, contains a complete list of Hogarth's works. The best criticisms in German are by Lichtenberg. (Walpole's *Anecdotes; Nichols's Anecdotes; Life* by Ireland; *Life* by Allan Cunningham; Hogarth's *Mem. of himself; Essay on Hogarth*, by Chas. Lamb: and the books quoted above.)

HOGG, JAMES, commonly called the Ettrick Shepherd, was born in the forest of Ettrick in Selkirkshire, in 1772, and, as he latterly insisted, on the 25th of January, the birthday of the poet Burns, although that date appears to have been opposed both to his own previous statements and to other evidence. His forefathers had been shepherds for many generations, and although his father, Robert Hogg, at one time took a lease of two farms and began business as a dealer in sheep, the speculation proved unfortunate, and he was compelled to fall back to his original condition, in which also his son James and three brothers were all brought up. Hogg was fond of giving himself out as nearly altogether self-educated; he has stated that all the instruction he ever received was from being two or three winters at school before he had completed his eighth year; but there is reason to believe that in this particular also his account of himself is to be regarded as somewhat poetical. He first began, he tells us, to be known as a maker of songs among the rustic population of his native district in 1796, at which time he was a shepherd in the service of Mr. Laidlaw of Blackhouse. Here we have another coincidence, for that was the very year in which Burns died. The first of his productions that was printed appeared anonymously in 1801, his song of 'Donald MacDonald,' a patriotic effusion on the subject of the threatened French invasion, which immediately became a great popular favourite in Scotland. Soon after, having gone to Edinburgh, to sell his master's sheep, he gratified his vanity by getting 1000 copies thrown off of a small collection of his verses, which however he was afterwards very sorry he had allowed to see the light. It was in the summer of 1801, while he was still with Mr. Laidlaw, that he was discovered by Walter Scott, then engaged in collecting materials for his 'Minstrelsy of the Scottish Border." Hogg, in his own account of their first interview ('Domestic Manners of Sir Walter Scott'), says that he had already seen the first volumes of the 'Minstrelsy;' but this could not have been, for the two first volumes of that work were not published till the following year. He contributed a number of old songs or ballads, which he had collected from the recitation of persons in the forest, to the third and concluding volume of the 'Minstrelsy,' which was published in 1803. That year another collection of his poems, of much superior merit to the former, was published at Edinburgh, under the title of the 'Mountain Bard,' the proceeds of which, with two prizes he got from the Highland Society for essays on the rearing and management of sheep, put him in possession of about 300*l*. With this money he took a farm, which soon turned out a ruinous concern. For some time he attempted without success to get employment again as a shepherd, and at last, in February, 1810, 'in utter desperation,' he says, 'I took my plaid about my shoulders, determined, since no better could be, to push my fortune as a literary man.' This was the commencement of a life of busy authorship, which may be said to have lasted till his death, although in 1814, after having married, he returned to the country, to live on a farm given to him by the duke of Buccleuch, which soon however, under his management, came to yield as little profit to the occupier, as rent to the proprietor. We cannot enter into the long history of his varied but constantly struggling life, marked as it was by much more than the usual share of fluctuation and casualty, and by many curious passages arising out of his transactions with the booksellers and his intercourse with some of his distinguished literary contemporaries. He has prefixed a full memoir of his own life to an edition of his 'Mountain Bard,' published in 1821; and many fragments of autobiography are to be found scattered up and down in his other works. These various sketches however, it is proper to remark, are very far from being perfectly consistent with each other; and some of the statements have been denounced by other parties implicated in them as complete misrepresentations or fictions. Of Hogg's poetical works, by far the most remarkable is his 'Queen's Wake,' first published at Edinburgh in 1813. It is undoubtedly a very extraordinary performance to have proceeded from a person of the author's opportunities, but it has also merits of a kind that do not require the peculiarity of the circumstances in which it was produced to excite admiration. The wild imagination of some parts, the gentle beauty of others, and the spirited flow of the poem throughout, greatly took the public taste, and it went through many editions, both in this country and in America, in a few years. The author never attained the life, or even the polish, of this early work in anything he afterwards wrote; although some of his songs were very happy imitations of the fine old popular poetry of his country, and both in these and in passages of his prose fictions, there is often a humour rich, vigorous, and original, though apt to degenerate into the coarse or extravagant. Of the rest of his works, the chief are (besides contributions to 'Blackwood's Magazine' and other periodical publications), in poetry, 'Madoc of the Moor,' 'The Pilgrims of the Sun,' 'The Poetic Mirror,' (a collection of pieces in imitation of living poets), and 'Queen Hynde,' besides his collections of pieces partly original, partly antient, entitled the 'Jacobite Relics of Scotland,' the 'Border Garland,' a Selection of Songs, and the 'Forest Minstrel:'—in prose, 'The Brownie of Bodsbeck,' 'Winter Evening Tales,' 'The Three Perils of Man,' 'The Three Perils of Woman,' 'The Confessions of a Justified Sinner,' 'The Altrive Tales,' 'The Domestic Manners and Private Life of Sir Walter Scott,' and a volume of 'Lay Sermons.' His death took place at his farm of Altrive, on the 21st of November, 1835. Wordsworth's noble lines suggested by hearing of that event, but in which the mention of the 'Shepherd Poet' merely serves to introduce some greater names, have given to our language one of the finest examples it possesses of the Doric simplicity and grandeur in poetry.

HOGSHEAD, an antient measure of liquids, which, not being mentioned in the act 5 George IV., cannot now be considered as having any legal existence.

The hogshead of wine was 2 wine barrels, or 63 old wine gallons; the London hogshead of ale [BARREL] was 1½ ale barrels, or 48 ale gallons; the London hogshead of beer was 1½ beer barrels, or 54 beer gallons; and the ale and beer hogshead for the rest of England was 1½ barrels, or 51 gallons.

All Excise measurements being now made in gallons, the term hogshead remains in use only as the name of a large cask.

HOGUE, LA, otherwise written **HAGUE**, or **HOUGUE**, a cape forming the north-western extremity of the peninsula of Cotantin, in France, now the department of Manche, in 49° 44′ N. lat. and 1° 58′ W. long. A great battle was fought near the Cape in A.D. 1692, between the French fleet, under Maréchal de Tourville, and the combined English and Dutch fleets, under Admiral Russell. The allies possessed a decided superiority of number, consisting of eighty-eight vessels, while the French had only forty-four. The contest was however maintained throughout the day, but ended in the entire defeat of the French, fifteen of whose ships were destroyed.

HOHENLINDEN. [BONAPARTE.]

HOHENLOHE. [JAXT.]

HOHENSTAUFFEN. [GERMANY-*History, Literature*.]

HOHENZOLLERN, a sovereign principality in Germany, so called from a family of the same name, the original seat of which was the antient castle of Zollern, or Hohenzollern. The oldest known ancestor of the family was Thassilo, count of Zollern, who died in 800. His descendant in the eighth generation was Rudolph II., who lived in 1165, and had two sons, Frederick IV. and Conrad. The latter became in 1200 the first hurggrave of Nürnberg His descendant, Frederick VI., obtained Brandenburg hy purchase in 1415, and received from the Emperor Sigismund the dignity of elector by the title of Frederick I. He was the founder of the present reigning family of Prussia. Conrad's elder hrother, Frederick IV., was the founder of the house of the princes of Hohenzollern, which was divided towards the close of the sixteenth century into the two still existing branches of Hohenzollern-Sigmaringen and Hohenzollern-Hechingen. The two principalities are surrounded by the kingdom of Würtemherg and part of the grand-duchy of Baden. The Danube, with its tributary streams, flows through the southern part of the country, and the Neckar, with its tributaries, through the northern part. The highest mountains are the Kornbühl (2732 feet high), the Zellerhorn, the Heiligenberg, and the Zollerberg.

HOHENZOLLERN-SIGMARINGEN lies in the Suabian Alps, which cover all the north part of the country: the soil is stony, and on the whole unproductive. There are however well-watered valleys, which afford fine pasture, and the land on the right side of the Danube is level and productive. The inhabitants, being very industrious, raise more corn than is necessary for their own consumption. Potatoes abound: hut there are scarcely any fruit-trees. Flax is cultivated for exportation, and the forests produce fine timber, of which large quantities are exported. Horned cattle and sheep are numerous. The only metal is iron. Properly speaking there are no manufactures. The principality is about 44[illegible] square miles in extent. The population in 1834 was 42,4[illegible] who are Roman Catholics. The revenue is ahout 300,000 florins, of which a third is derived from dependencics in Bavaria and estates of the prince in Holland. The hudget for three years, 1837—1840, fixes the expenditure at 204,810 florins. The surplus is allotted to various useful purposes, such as road-making, providing for the widows and orphans of schoolmasters, &c. Sigmaringen, the capital, has 1600 inhabitants, and is the residence of the prince. The government is hereditary, with an assembly of the estates, composed of seventeen members.

HOHENZOLLERN-HECHINGEN is hounded on the north and south hy Würtemberg, and on the east and west by Hohenzollern-Sigmaringen. It is a mountainous country in the Suabian Alps. The highest mountain is the Zollerberg (2620 feet), on which is the castle of Hohenzollern, the original seat of the family, which has lately heen repaired. The area is 140 square miles. The total population is 22,000. The country is on the whole fertile and well cultivated. The lower parts of the mountains and the valleys produce more corn than is required for home consumption, besides potatoes in great abundance, and flax, which, with timber, are the principal productions. The hreeding of cattle, sheep, and swine is carefully attonded to. There is hut little game, there being no preserves and no game-laws. There are quarries of stone for huilding, and lime, hut no metals. There are no manufactures properly so called: some woollens are made at Hechingen, and the villagers used formerly to spin a great quantity of cotton-thread, hut this occupation has greatly declined. The exports consist of timher, corn, gentian, which plant is cultivated very extensively in some tracts, some cotton-thread, and a few other articles. There are no subdivisions of this little principality, which contains one town, Hechingen, 8 market-villages, 20 villages, and several hamlets. Hechingen, the capital, situated on an eminence, has two suburhs, a newly-huilt palace, a synagogue, a very heautiful church, and about 3000 inhabitants, of whom nearly 700 are Jews. The inhabitants of the country are Roman Catholics, with the exception of 700 or 800 Jews. The revenue is 130,000 florins. The government is hereditary: there is a representative assemhly of twelve members.

Neither of the principalities keeps any troops, except the contingent to the army of the Confederation, of which Hohenzollern-Hechingen furnishes 145 men, and Hohenzollern-Sigmaringen 356 men, and which form part of the reserve. In the full council (or plenum) each of the principalities has one vote. In tho close council they are joined with Liechtenstein, Reuss, Schaumburg-Lippe, Lippe-Detmold, and Waldeck, as holding the sixteenth place, with one collective vote. The succession is regulated by family compacts of the years 1575 and 1821, in the latter of which the king of Prussia joined as head of the family. It is hereditary in the male line; so that if the male line in one of the principalities becomes extinct the other succeeds: if the male line in hoth becomes extinct, Prussia succeeds; and it is not till the extinction of the male line in all three houses that the succession can come to the females and their descendants. (Johler, *Geschichte Land- und Ortskunde der Fürstenthümer Hohenzollern.*)

HOLASTER, a genus of fossil Echinidæ, proposed by M. Agassiz to include species once ranked as Spatangi. Spatangus suhglobosus (Leske), Sp. planus (Mantell), and Sp. hemisphericus (Phillips), are examples. The species occur almost exclusively in the chalk formation.

HOLBACH, PAUL THYRY, BARON D', born in 1723 at Heidesheim, in the Palatinate, of a wealthy family, spent the greater part of his life in Paris, where he hecame the friend and patron of many of the men of learning ahout Paris, especially of those who contrihuted to the first Encyclopédie. [DIDEROT.] Holbach was himself a great admirer and disciple of Diderot. The haron was fond of conviviality, and he gave good dinners: for nearly forty years he assembled round his table every Sunday a coterie of literary men, including at one time Diderot, Rousseau, Marmontel, Galiani, Grimm, Damilaville, Morellet, Helvetius, and others. This coterie had at first assembled at Madame Geoffrin's; hut that lady not proving bold enough in her way of thinking, they transferred their meetings to the house of the Baron d'Holbach, who was a free-thinker of the freest kind, and with whom they had no reason for disguising their opinions. Much information concerning these parties is given in the memoirs of the Abbé Morellet, of Madame d'Epinay, in Grimm's 'Correspondence,' and lastly, in a curious though not very impartial work of Madame de Genlis, styled, 'Les Diners du Baron d'Holbach, daus lesquels se trouvent assemblés, sous leurs noms, une partie des Gens de la Cour et des Littérateurs les plus remarquahles du 18 Siècle.' D'Holbach was well acquainted with the physical sciences, especially chemistry and metallurgy, and he translated into French several useful German works on those subjects. He also contributed many articles to the 'Encyclopédie.' He wrote, either wholly or in part, several philosophical works, which were published in Holland under fictitious names, and of which those which made most noise at the time are: 1. 'Le Système de la Nature,' a system of pure materialism, and which Voltaire characterized as absurd as to physics, illogically written, and abominable as to ethics. Frederick II. undertook to refute it; but the best refutation of it is that of Bergier, in the 'Examen du Matérialisme.' 2. 'Morale Universelle, ou Devoirs de l'Homme fondés sur la Nature,' 3 vols. 8vo., Amsterdam, 1776. This work is much better written than the preceding, the precepts are generally good, and the tone is calm, rational, and tolerant; for a proof of which see, among other passages, section iv., chapters 4 and 5, which are entitled 'Devoirs des Grands, des Nobles, et des Guerriers.' 3. 'Le Christianisme devoilé,' attributed hy some to Damilaville; and other works against revealed religion, which are now mostly forgotten.

D'Holbach died at Paris in 1789. He seems to have heen a man of moderate talents, rather credulous, of a generous disposition, and a pleasing host and tahle companion. He was as much praised by his friends as he was ahused by his enemies; among others hy Rousseau, who chose to quarrel with him, as he quarrelled with every body else.

HOLBEACH. [LINCOLNSHIRE.]

HOLBEIN, JOHN, or HANS, is considered by the Germans to he their hest painter next to Albert Dürer, whom he however excelled in portraits. He painted equally well in oil, water-colours, and distemper, on a large scale and in miniature, and was besides well skilled in architecture. It is rather remarkahle that neither the date nor even the place of his birth has been precisely ascertained. Some accounts say that he was horn in 1498, others in 1495; the place of his hirth has usually been supposed to have been either Augsburg or Basel; hut recent researches are said to have proved it to have heen Grünstadt, formerly the residence of the counts of Leiningen-Westerhurg. He was instructed in the art of painting by his father, whom he soon excelled. Accompanying his father to Basel, he hecame acquainted with Erasmus, who was residing thero in order to superintend the printing of his works. Holhein painted several portraits of Erasmus, who gave him a letter of recommendation to Sir Thomas More, and he went to

England in 1526. Sir Thomas took him into his house, and after having employed him for three years, invited King Henry VIII. to see the pictures which Holbein had painted for him. The king was so delighted with them, that he immediately took Holbein into his service, and gave him ample employment, for which he recompensed him with royal munificence. The favour of the king and his own extraordinary merit concurred to bring him into vogue; so that notwithstanding his indefatigable diligence and rapid execution, he was so fully engaged in painting portraits of the nobility and eminent public characters, that he had no leisure in England for historical painting. Of his skill in this department he had given decided proofs before he left Basel, aud many of his pictures are still to be seen in that city. It appears however that he adorned the walls of a saloon in the palace of Whitehall with two great allegorical compositions representing the triumphs of riches and poverty. He likewise executed large pictures of various public transactions, such as Henry VIII. giving a charter to the barber-surgeons, and Edward VI. giving the charter for the foundation of Bridewell Hospital. Holbein was equally remarkable for the freedom and spirit of his pencil, the lightness of his touch, clearness and brilliancy of tone, and exquisite finishing. Though from his long residence in England his original pictures must have been very numerous, yet there can be no douht that, as they represeuted well known characters, many copies, of various degrees of merit, were made even during his life. This fact is too little considered in England, where portraits wholly unworthy of him are ascribed to his pencil hy persons who forget that in refined feeling for nature, accurate delineation of the parts, and vigour of style, his best portraits have an honourable place beside those of the greatest masters. He died at London, of the plague, in 1554.

HOLBERG, BARON LUDVIG, or LEWIS, who may be regarded as the father, or, as he has been styled by some, the Colossus of modern Danish literature, was born at Bergen in Norway, in 1684. So far from being the inheritor of title or patrimony, he was of obscure family, his father having been originally a common soldier, though afterwards promoted to the rank of colonel. His death however, which happened while Ludvig was quite a child, left the family in very straitened circumstances, so that, as soon as the son had completed his studies at Copenhagen, he had no other resource than to become a private tutor. It was not long before a strong inclination for travelling led him, in spite of his exceedingly scanty finances, to set out for Amsterdam, where he had the misfortune to be attacked by a fever. He afterwards made his way back to Christianstad, where he endeavoured to gain a subsistence by teaching French; hut that failing, he came to England, where he stayed about two years at Oxford. On returning to Copenhagen, he obtained the situation of tutor to the son of a wealthy individual, with whom he travelled through Germany. On another occasion he contrived to proceed as far as Rome, journeying for the most part, like Goldsmith, on foot. On his return to Denmark, he made a maintenance hy teaching languages, until he was appointed Professor of Metaphysics, and in 1720 Professor of Eloquence. He was now in tolerably easy and improving circumstances, and had for the first time leisure to apply himself to his pen, and turn to account that multifarious stock of learning which he had picked up in the course of his unsettled life. He had now passed his youth, nor had he given any symptoms of a talent for poetry, when he astonished and delighted his countrymen hy his Satires, and that masterpiece of heroic-comic poetry, his 'Peder Paars.' This production has acquired for its author the title of the Danish Butler; not however on account of any similarity of suhject with 'Hudibras,' but merely as being a national and popular work of the same genus. With less ostentation of wit and learning than its English rival, 'Peder Paars' is far more lively and diverting, and replete with humorous incidents from beginning to end.

The most formidable rival to the author of 'Peder Paars' is Holberg the dramatist; for his comedies have rendered the poem only his secondary title to fame. These productions, amounting to nearly forty, and composed between 1723 and 1746, exhibit very strong graphic and comic power. A modern critic, who has studied the dramatic writers of all nations, assures us there are only three comic poets who really deserve the name—Plautus, Molière, and Holberg. Yet it must be acknowledged that his dramas are not entirely free from defects, although they possess such vigour and spirit that we cheerfully excuse them. His 'Metamorphoses,' in which he has reversed Ovid's system, transforming animals into men, instead of men into animals, is ingenious in idea and happy in execution. But that to which some have assigned the foremost place among his productions is 'Niels Klims' Suhterraneous Journey,' first published in 1741, and written in Latin, hut translated not only into Danish (by Rahbek), but into almost every other European tongue. In this masterly philosophical satire, Holberg has shown himself perhaps the imitator, hut also the rival, of Lucian and Swift.

These works would indicate no little industry, yet they constitute but an inconsiderahle portion of Holberg's writings, whose pen was as prolific as that of Voltaire, there being hardly a department of literature which he left unessayed, if we except tragedy. But if, in regard to this latter, the Frenchman possesses a title to fame not shared by the Dane, Holberg's comedies prove him his superior in dramatic talent. The annals of literature afford no parallel instance of a comic author so admirable, and also so fertile, who was at the same time so universal. History, biography, philosophy, politics, all employed his pen in turn, and to such extent that it would occupy too much space were we to specify severally his writings of this class. Suffice it then to mention merely his 'History of Denmark,' 'Church History,' 'Historia Universalis.' What would be the exact amount of all that he wrote, if printed in a uniform series, we know not, but his select works alone, as edited by Rahbek, 1804—14, extend to twenty-one octavo volumes. Nor is our wonder at their vast number and variety diminished when we consider that he had hardly commenced authorship at a period of life when many have already produced their chief works, and that he did not live to a remarkably advanced age; for he died, Jan. 27, 1754, in his 70th year.

He had raised himself to affluence by his writings, and having no family, for he was never married, he bequeathed the bulk of his property (amounting to 70,000 dollars) to the Academy of Soroe, instituted for the patriotic purpose of preventing the Danish nobility from studying at foreign universities. In conferring on him the rank of nobility (1747), Frederick V. chiefly honoured himself, for he could scarcely hestow additional distinction on the man who was the most illustrious ornament of his reign and the public benefactor of his country. Frederick only created a baron; Holberg had created a national literature.

HOLCROFT, THOMAS, born Decemher 10, 1745 (old style). His father kept a shoemaker's shop in Leicester Fields, and occasionally dealt in horses. The first six years of his life were spent at his birth-place, hut some change in his father's circumstances brought him into Berkshire, and at last to a vagrant life. When very young he became a stable-boy in racing-stables at Newmarket, and continued in the service of training-grooms till his seventeenth year, after which time he lived a desultory life as shoemaker, tramper, or schoolmaster till twenty, when he married. About this time he had proceeded far enough in self-education to dare to commit his performances to the columns of the 'Whitehall Evening Post,' but this whim soon gave way to others, and in a short time he found himself an actor. In 1780, having been some time on the London stage, he turned author, producing first a novel, then a comedy, and afterwards some poems, which were followed in their turn by a series of plays, and by translations of various French works, of which those most remembered at present are—'Tales of the Castle,' and 'The Marriage of Figaro.' In 1789 he lost his son, and in 1790 his third wife. Four years afterwards he was implicated in the political trials relative to the Society for Constitutional Information. From this time his life presents no tangible points: he seems to have spent the greater part of his time in writing and cultivating the fine arts.

He lived much in Germany and occasionally in Paris, and of this residence his 'Travels into France' was the fruit, a book which has probably been depreciated below, as his plays were douhtless raised above, the real merit. He died March 23, 1809.

Holcroft's chief merit lay in translation. As a translator he will prohably be remembered; as an author, probahly he will not. His style bears all the marks of that of a half-educated man. It possesses much occasional vivacity, mingled with mistakes of a character which we should not expect to see if we did not remember how innumerable are the points in which educated men attain an unconscious superiority over the half-educated. The peculiarities of provincial utterance rarely disappear; how much more rarely tha peculiarities, and especially the daficiences, of an uncultivated childhood. The man may struggle against such failings, but ha will nevar entiraly overcome, except by avoiding them.

Holcroft's life has been published, partly from diaries of his own. It is a performance the form of which private friendship has had a large share in determining. Lengthy quotations and needless talk fill three volumes, where one would have amply sufficed.

HOLDERNESS. [YORKSHIRE.]

HOLINSHED, or HOLLYNSHED, RAPHAEL, tha annalist, was born probably during the first half of the 16th century, but when is uncertain. Anthony à Wood says that he 'was educated at one of the universities, and was a minister of God's word,' but it appears most probable that he was steward to Thomas Burdet of Bromcote in Warwickshire. It is possible however that the sentence in which he refers to 'his master' may be interpreted on the supposition of his having been private chaplain, which would reconcile the two statements. He died about 1580, as his will was made fifteen months before, and proved two years after that time.

Holinshed is an important authority in English history, and the list of authors to which he refers shows him to have possessed considerable learning. The first edition of his history is a very scarce black-letter in two folios, adorned by numerous wood-cuts. The second and improved edition omits these adornments, and has suffered also from the censorship of the times, which compelled the cancelling of several sheets. It consists of tha following items:—'Description of England,' by Harrison; of 'Ireland,' by Stanihurst; and of 'Scotland,' from the Latin of Hector Boethius, by W. H(arrison). 'History of England.' by R. H(olinshed); of 'Ireland till the Conquest,' from Giraldus Cambrensis, by J. Hooker (an uncle of the divine); 'till 1509,' by Holinshed; and 'till 1586,' by Hooker and Stanihurst; and of 'Scotland' till 1571, by Holinshed, and continued by others. (Wood's *Ath. Oxon.*; *Biographia Britannica.*)

HOLKAR, MULHAR RAO, the first of the name known in history, was a Mahratta soldier, who having been instrumental in extending the conquests of his nation, under the first Peshwa, towards the north of India, received a grant of land in Malwa about 1736. Ultimately one half of that larga province passed under his rule; and before his death, which took placo in 1766, ha had rendered himself, in all but name, independent of his titular superior the Peshwa. He was succeeded by his grandson, a minor; but this boy soon died, and the inheritance passed to Tuckagee Holkar, a naphew of Mulhar, according to Mr. Mill, but, according to Captain Duff, a stranger in blood. Tuckagee, dying in 1797, left four sons, whose patrimony was usurped for a time by Scindia, the most powerful of the Mahratta chiefs. In 1802 Jaswunt Rao Holkar, the third son, an able, brave, unscrupulous soldier of fortune, dafeated Scindia, and re-established himself in Malwa. The Marquis Wellesley, then Governor-General, refused however to recognise his title, and in 1804 commenced a war against him, which was terminated at the end of 1805 by a peace more favourable than Holkar had reason to expect, which left to him the greater part of his dominions. The violence of his temper ultimately grew into madness; and the last three years of his life were passed in close confinement: he died in 1811. Whan he was placed under restraint his son, a minor four years old, Mulhar Rao Holkar, succeeded to the nominal authority; all real power being of course in the hands of one or two ministers. A wretched anarchy succeeded. Aftar the final overthrow of tha Mahratta power in 1818, Mulhar was suffered to retain a small portion of his dominions under the protection of the British. [MAHRATTAS.] (Mill, *Hist. of British India*; Duff, *Hist. of Mahrattas.*)

HOLLAND. This name properly designates one of the provinces of the antient republic of the Sevan United Provincas, which, baing the largest, richest, and in all respects the most important, has often given name to the whola country; and occasionally, but still more improperly, even to the whole of the original seventeen provinces, when, after a separation of two canturies, they were again united in 1815 by the nama of the kingdom of the Netherlands. Though tha two divisions of the kingdom aro now in fact again separated by the late revolution [BELGIUM], and there is not the slightest probability of their re-union, it is not unlikely that the northern portion will still be called the kingdom of the Netherlands, and we therefore have given the ganeral description of the kingdom under that head.

The province of Holland is situated between 51° 45′ and 53° 30′ N. lat., and 3° 45′ and 5° 20′ E. long., and is bounded on the north and west by the German Ocean, on tha east by the Zuyderzee and the provinces of Utrecht and Guelderland, and on the south by Zealand and Brabant. The whole country is one flat, in many parts below the level of the sea, against which it is protected by stupendous dikes, which are raised along the coast and on the banks of the rivers. To these dikes the country is indebted not merely for safety, but for existence. The two extremities, which are the most exposed (the dikes of the Heldar and of West Cappellen, in Zealand), show what couraga and perseverance can effect. But these dikes are not the only defence against the encroachments of the sea: on the west coast, the Downs, which are a triple row of sand-hills, form a barrier, which the ocean itself has thrown up. The country is traversed by canals in all directions. The soil, like that of Groningen, is marshy, and produces rich pastures, which support a remarkably fine breed of cattle, to the number of nearly a million, and large flocks of sheep; very little corn is grown, except in some parts of South Holland. Flax is cultivated more than hemp, and is of excellent quality. Hemp is produced chiefly in South Holland, but though of a good kind, too little care is bestowed on it. Potatoes are pretty extensively cultivated, and large quantities of seeds of various kinds, rape, mustard, canary, and onion seed, are raised for exportation. The garden produce is abundant and excellent. Flowers are cultivated chiefly in the tract from Alkmaar to the Hague, but more especially at and about Haarlem. But the great source of agricultural wealth is the pastures, which are unrivalled for the abundance and luxuriance of their produce. The quantity of butter and cheese far exceeds what is required for home consumption; and the profit derived from the exportation of these two articles is one of the chief sources of the waalth of the farmers. Wood, both for building and fuel, is very scarce: the greater part of the land gained from the sea never grew any timber; and in the interior, where there may have been forests some thousand years ago, they have been long since extirpated. For fuel the inhabitants use turf, which is dug to the annual value of a million and a half sterling. Of minerals, properly so called, there are none whatever. Large quantities of very fina lime are made from the shalls gathered on the coast about Catwyk, Nordwyk, and Wassenaar. The rivers and seas abound in fish; but the fisheries of Holland, though still productive and profitable, have greatly declined from their former prosperous condition. The manufactures, formerly so flourishing, have been much depressed by heavy taxes, the dearness of provisions, and the rivalry of other nations; but they are still of great importance. The Dutch linen is celebrated for its fineness and durability. Next in importanca and excellence is paper: though Dutch paper is now banished from almost every market, each country manufacturing for itself, there is yet no paper on the Continent equal to the best Dutch kinds. The woollen manufactures are flourishing; and the finest cloths, those of Leyden for instance, fetch very high prices. The distilleries of gin, especially at Schiedam, are very extensive. The solid foundation of the wealth and greatness of Holland has been its commerce. On this subject we might state, as applicable to this province, all that relates to the commerce of the whole country; which, to avoid repetition, is deferred to the article NETHERLANDS. Here it need only be observed that the effects of the French revolution, the annexation of the country to France, and the loss of its colonies brought its commerce to a state of decay, from which it is now beginning to recover. The province of Holland is divided into two governments, North and South Holland.

I. *North Holland* contains 930 square miles, with a population, on the 1st of January 4, 1838, of 22,503 inhabitants. It is divided into the four districts of Amsterdam, Haarlem, Hoorn, and Alkmaar. The Helder is a village at the northern extremity of the province, on the channel called the Mars Diep, which separates it from tha island called tha Texal, calebrated for its larga and secure harbour, and its commodious roadstead on the east coast. Great naval battles between tha English and tha Dutch were fought off the Texel, in 1653, 1673, and 1799. The Helder has about 2500 inhabitants, who are chiefly pilots. The harbour, called the Nieuwe Diep (in which ships of 600 tons burden can lie close to the quays in perfect safety, even in the greatest storm), is defended by two strong forts, which have bomb-proof casemates for 10,000 men. The Nieuwe Diep communicates with Amsterdam by means of the North or Helder Canal, one of the greatest works of our time; it is about 60 miles in length, 24 feet deep, and 120 feet wide, capable therefore of bearing the largest merchantmen. It has sluices through which ships of the line of 74 guns can pass. It cost nearly eight millions sterling. The great dike of the Helder, nearly two leagues in length, is 40 feet broad at the summit, on which there is a very good road, and descends into the sea by a slope of 200 feet, at an angle of 40 degrees. At certain distances enormous buttresses, broad and high in proportion to the rest of the dike, and constructed with still greater solidity, project several hundred yards into the sea. This artificial coast is entirely composed of enormous blocks of granite from Norway. Edam (3500 inh.) is celebrated for its two cheese fairs, at which about seven millions of pounds are annually weighed. In the neighbourhood is the famous Beemster-Polder, about 8000 acres, formerly covered with water, but now gained for cultivation by dikes and canals, and occupied by an industrious and wealthy population of nearly 3000 souls, who have numerous herds of fine cattle. Enkhuyzen, on the Zuyderzee (7500 inh.), though it has declined from its former importance, has still an extensive share in the herring fishery. The other remarkable towns are described at their respective places.

II. *South Holland* contains 1170 square miles, with a population, on the 1st of January, 1838, of 503,354 souls. It is divided into six districts, the Hague, Leyden, Rotterdam, Dortrecht, Gorcum, and Briel, the chief towns of which are of the same names, and, with others belonging to South Holland, are described in their places. Helvoetsluys, on the mouth of the Maas (1500 inh.), has a fine harbour, and likewise a reserve harbour for ships of war and merchantmen, where they are protected against storms.

HOLLAND, NEW. [AUSTRALIA.]

HOLLAND, PHILEMON, was born at Chelmsford in 1551, and educated there and at Trinity College, Cambridge, of which he became a Fellow. Afterwards he was elected master of the Coventry free-school, where he undertook those laborious versions of the classics which have given him a respectable name in literature. He is, to the best of our knowledge, the first English translator of Livy, Suetonius, and Plutarch's 'Morals,' and the only English translator of Pliny's 'Natural History,' and Ammianus Marcellinus. He also translated Xenophon's 'Cyropædia,' and Camden's 'Britannia.' In addition to all this he found time to study and practice physic with considerable reputation, and reached the age of 85, after a most laborious life, with unclouded faculties, having gone on translating till he was 80 years old.

HOLLAR, WENCESLAUS, was born at Prague, in Bohemia, in 1607. He was first intended for the profession of the law; but partly from disinclination to that pursuit, and partly from the ruin of his family after the taking of Prague in 1619, his views in life became changed, and he took to drawing and engraving. He had some instructions from Matthew Marian, an engraver who had worked under Vandyke and Rubens, and who is thought to have taught Hollar that peculiar manner which marks the working on his plates. He was but eighteen when the first specimens of his art appeared. These were a print of the *Ecce Homo*, and another of the Virgin, both small plates, with a Virgin and a Christ after Albert Durer, with Greek verses at the bottom of the plate, executed in 1625. He removed from Prague in 1627. During his stay in different towns of Germany he copied the pictures of several great artists, and took perspective views and draughts of cities, towns, and countries, by land and water, which in delicacy and miniature beauty were exceeded by no artist of his time. His views along the Rhine, the Danube, and the Neckar gained him his greatest reputation. In 1636, Howard earl of Arundel met with Hollar, when proceeding on his embassy to Ferdinand II., and immediately took him into his retinue. Hollar attended him from Cologne to the emperor's court, and in this progress made several draughts and prints of the places through which they travelled. It was then that he took the view of Würzburg, under which is written 'Hollar delineavit in legatione Arundeliana ad Imperatorem.' He afterwards made a drawing of Prague which gave satisfaction to his patron. After finishing his negotiations in Germany, Lord Arundel brought Hollar to England, where he was not confined to his lordship's service, but allowed to take employment from others. His prospect of Greenwich, which he finished in two plates, dated in 1637, was one of his first works in England. In 1639 he etched several portraits of the royal family for the work which was published descriptive of the entry into this kingdom of Mary de' Medicis, the queen mother of France, to visit her daughter Henrietta Maria. About 1640 he seems to have been introduced to the royal family, to give the prince of Wales a taste for the art of design. In this year appeared his beautiful set of figures entitled 'Ornatus Muliebris Anglicanus, or the several habits of English women, from the nobilitie to the countrywoman, as they are in these times.' In 1641 were published his prints of King Charles and his queen. At the breaking out of the civil war Lord Arundel left the kingdom to attend upon the queen, and Hollar was left to shift for himself. From some unknown cause he soon became obnoxious to the ruling powers, probably from his general acquaintance with the friends of his patron, who were mostly royalists, with some of whom he was made prisoner at the surrender of Basing House, in Hampshire, in 1645. Hollar however having some time after obtained his liberty, went over to the Continent to the earl of Arundel, who then resided at Antwerp, where he remained for several years, copying from that portion of his patron's collection which had been carried there, and in working for printsellers and publishers. It was at this time that his portraits from Leonardo da Vinci, Holbein, and other great masters, made their appearance. In 1652 he returned to England, and worked incessantly till the time of his death. The plates by him in the first and second volumes of the old edition of Dugdale's 'Monasticon,' in Dugdale's 'History of St. Paul's,' and in his 'Survey of Warwickshire,' sufficiently prove his industry. It would be endless to enumerate all the subjects he engraved. A map of Donegal, in Ireland, is one of the rarest. In 1669 he was sent to Tangier, in Africa, in quality of his majesty's designer, to take the various prospects there of the garrison, town, fortifications, and surrounding country: these he subsequently engraved. Several of the drawings taken at this time are preserved in the British Museum. They were purchased, together with numerous fine proofs of Hollar's best works, from his widow, by Sir Hans Sloane. Hollar's latest works are probably the plates in Thoroton's 'Antiquities of Nottinghamshire,' some of which remain unfinished. When Hollar was in his seventieth year he had the misfortune to have an execution at his house in Gardiner's Lane, Westminster: he desired only the liberty of dying in his bed, and that he might not be removed to any other prison than his grave Whether this was granted to him or not is uncertain, but he died March 28th, 1677, and, as appears from the parish-register of St. Margaret's, was buried in the New Chapel-yard, near the place of his death. No monument was erected to his memory. Grose, from information he received from Oldys, has recorded that Hollar used to work for the booksellers at fourpence an hour, always having an hour-glass placed before him; and that he was so scrupulously exact, that even whilst talking, though with the persons for whom he was working, and upon their own business, he constantly laid down the glass to prevent the sand from running. His works, according to Vertue's catalogue of them, amount to nearly 2400 prints. In drawing the human figure Hollar was defective; and he failed in a few plates which he attempted to execute with the graver only. (Vertue's *Descr. of the Works of Hollar, with some account of his Life*, 4to., Lond., 1759; Strutt's *Dict. of Engravers*; Chalmers's *Biogr. Dict.*, vol. xviii., pp. 72-78.)

HOLLY. [ILEX.]

HOLOCENTRUM, the name of a genus of fossil Ctenoid fishes. (Agassiz, vol. iii., t. 27; from Monte Bola.)

HOLO'PTYCHUS, the name of a genus of fossil Ganoid fishes. (Agassiz MS.; from the carboniferous limestone of Burdichouse near Edinburgh, and other localities.)

HOLOTHU'RIA. HOLOTHURIA FAMILY. The *Holothuridæ* are a race of marine animals whose particular organization, though not yet entirely and satisfactorily developed, is sufficiently distinct to enable zoologists to collect them into a particular group, though there is still some doubt as to their proper position.

Linnæus, in his last edition of the *Systema Naturæ* (the 12th), gives the following definition of his genus *Holothuria*, which he places under his *Vermes Mollusca*, between *Tethys* and *Terebella*:—'*Body* free, naked, gibbous; vent (anus) terminal. *Tentacles* numerous at the other extremity (tentacula plura in altera extremitate). *Mouth* situated among the tentacles.' He records 9 species. Gmelin, in his edition (13th), increases the species to 23.

The following is Lamarck's definition of *Holothuria*. '*Body* free, cylindrical, thick, soft, very contractile; with a coriaceous skin, which is most frequently papillose. *Mouth* terminal, surrounded with tentacula divided laterally, subramose, or pinnated. 5. Calcareous *teeth* to the *mouth*. *Vent* at the posterior extremity.' He gives 10 species of *Holothuria*; but he separates other *Holothuriæ* of authors into the genera *Fistularia* and *Priapulus*. These three genera are preceded by *Actinia* and followed immediately by *Sipunculus*. The place therefore assigned by Lamarck to *Holothuria* is among the radiated animals, in the third section of which, the *Fistulides*, he has arranged the tribe.

Cuvier gives the *Holuthuriæ* a position among the pedicillated Echinoderms, making them follow the *Echinidæ*. *Priapulus* is placed by him in the next order, the footless Echinoderms. He gives a good outline of the anatomy, referring to the excellent work of Tiedemann.

M. de Blainville's *Echinodermata* form the first class of his *Actinozoa*, and the first order of that class consists of the *Holothuridea*, which are followed ('Actinologie,' 1834) by the *Echinidea*, his second order. M. de Blainville thus defines the *Holothuridea*:—

'*Body* more or less elongated, sometimes subvermiform, soft or flexible on all sides, provided with tentaculiform suckers, often numerous, very extensible, completely retractile, and pierced by a great orifice at each extremity. *Mouth* anterior, at the bottom of a sort of funnel or prebuccal cavity, sustained in its circumference by a circle of fibro-calcareous pieces, and provided with a circle of arbuscular appendages, more or less ramified. *Vent* terminating in a sort of cloaca opening externally by a large terminal orifice. *Generative Organs* terminating externally by a single mesial orifice at a little distance from the anterior extremity, and nearly marginal.'

M. de Blainville observes that Bianchi appears to have been the first who came to the conclusion that this form ought to be approximated to the *Echini*, and in fact names one species *Echinus coriaceus*; an opinion which was adopted by Blumenbach and most of the modern zoologists, when they made the *Holothuriæ* a division of their Echinoderms with the *Echini* and *Asteriæ*; some however, following the idea of Pallas, consider that they should be placed near the *Actiniæ*.

Organization.

The author last quoted remarks that the organization of these animals is not yet completely known, notwithstanding the labours of Bohatsch, Müller, Vahl, Forskahl, Monro, Tiedemann, and Delle Chiaje. In addition to these names we would call the attention of the reader to the drawing and description of *Holothuria tremula*, Linn., left by John Hunter. The drawing is beautifully engraved, and, with the description, will be found in the 1st vol. of the Descriptive and Illustrated Catalogue of the 'Physiological Series of Comparative Anatomy, contained in the Museum of the Royal College of Surgeons in London,' pl. iii. The following parts are distinctly made out, viz.: 1. The mouth, in which a bristle is introduced. 2. *Appendicula cæca*, which surround the mouth, or fauces, into which they enter, and which Mr. Hunter supposes to be salivary glands and ducts. 3. A large one, lower down, just at the beginning of the intestinal canal. 4. The whole tract of the intestinal canal, which is of considerable length. 5. The dilated part of the intestine, or rectum, or what seems to answer the same purpose as the dilated part of the gut at the anus in a bird. 6. The anus. The use of the parts to which we next have to advert, though the parts themselves are most clearly demonstrated, seems to have been more the subject of conjecture with Mr. Hunter. 7. Two branching bodies almost like a tree, which consist of a duct with its branches, and which open into the dilated part of the rectum. These Mr. Hunter suspects to be the kidneys, from their opening similar to the kidneys in birds, turtles, &c. There are small oblong bodies near the opening of the principal trunk into the rectum. 8. A vast number of hollow round tubes, all entering into one duct, which opens at the head. These will be best seen in another plate which will be published in the fasciculus of the catalogue relating to generation. 9. Vessels which seem to have neither beginning nor end, somewhat like the *vena portarum*: 'they appear,' adds Mr. Hunter, 'to be collecting at one end while they are ramifying at the other; but which is the collecting end, and which the ramifying, I do not know; however it is possible one end is the absorbing system, the other the arterial. Whenever there is a heart one commonly can make out the motion of the blood from and to that viscus; but where we are deprived of that guide it becomes difficult to determine.' 10. A distinct vessel from the former. These parts are indicated in the plate and description by the letters *a* to *k* inclusive. Upon this Mr. Owen remarks, that as the object of this figure is to show the general form of all the organs, rather than the particular disposition of any single system, the vessels are not delineated in the position which is requisite to convey an idea of the whole course of the circulation; and he further observes, that according to Tiedemann's description, *i i* are the intestinal veins, which receive the blood from *k k* the intestinal artery, and carry it by the trunks *l l*, to the respiratory organ (regarded by Mr. Hunter as analogous to the kidney), whence it is returned by the branchial vein, part of which is seen at *m*, to the intestine, where it again passes into the intestinal artery: *k*, Mr. Owen adds, is a large anastomosis joining two portions of the intestinal artery, and from which Tiedemann recommends the vessel to be injected. To the description of the plate succeeds a general account of the animal by Mr. Hunter, to which we must refer the reader, our limits not permitting us to enter into it at large, interesting though it be.

The preparation No. 984 ('Physiological Series,' Gallery) in the Museum of the Royal College of Surgeons, is the specimen of *Holothuria tremula* laid open, and the alimentary canal and generative tubes turned aside to show the respiratory organs, which have been injected. These organs consist of two elongated, hollow, ramified processes, commencing by a common orifice from the closed cavity, and extending towards the opposite end of the body. One of them is in more immediate connexion with the alimentary canal, and is abundantly supplied by ramifications of the intestinal vessel, the contents of which are thus brought into necessary communication with the sea-water introduced into the tubular branchia from the cloaca. The other gill is more closely attached to the parietes of the body, and probably serves to aërate the vessel of that part. (*Cat.*, vol. ii.) To this Professor Owen adds, that in the description of the Holothuria above quoted, Mr. Hunter attributes to these organs a more limited share in the great excretory functions than they undoubtedly perform, regarding them, from their connexion with the cloaca, as analogous to the kidneys of the higher animals. Distinct urinary organs are not however, observes the Professor, developed until we arrive at a much higher point in the scale of organization than the Holothuria and its congeners attain to; the preparation is therefore placed in the respiratory series. (*Ibid.*)

Geographical Distribution of the Holothuridæ.—M. de Blainville states that it would seem that these animals exist in all seas; but that perhaps they occur more plentifully in comparatively cold climates than in those that are very warm. This may be doubted (see post, p. 270 et seq.). Many species are found in the European seas, and they are especially abundant in the Mediterranean.

Habits, &c.—These animals live in the salt waters, and often at considerable depths, but sometimes near the shore in the midst of fucus, and among the rocks at no great distance from it. M. de Blainville says that in storms they anchor themselves by their tentacular suckers, which are capable of great extension. Their habits, food, and mode of reproduction are very little known. Lamarck states that they are internally gemmiparous, and that they cast forth gemmules already in part developed, which, being observed, has caused some to say that they are viviparous. Their growth and the duration of their life are known as little; and M. de Blainville ('Actinologie,' 1834) observes, how desirable it is that naturalists who inhabit the shore of the Mediterranean, where many species are so common, should turn their attention to this subject.

Genera.

M. de Blainville acknowledges the difficulty which attends the distinction of the species, from the following, among other causes:—

1. The general form is extremely variable. When the animal is in a state of tranquillity in the enjoyment of all its faculties at the bottom of the water, it is, in the greatest number of cases at least, very much elongated, often cylindrical, and almost vermiform: on the contrary, when in a state of repose, it becomes much shorter and ordinarily more convex in the middle than at the extremities. When it is irritated, whether in or out of the water, the contractile action becomes stronger, and the animal can no longer be recognised. But it is especially when it has been plunged in spirit that the form differs totally from that which the living animal exhibits.

2. The size, the form, and distribution of the more or less mammillated tubercles which are numerously spread over the skin appear, to M. de Blainville, to offer too great a number of variations to permit of their being employed in distinguishing specific character.

3. The tentaculiform suckers, which have their exit through the pores or holes in the skin, and by means of which these animals attach themselves to submarine bodies, are, in a certain number of species, spread nearly equally over the whole superficies of the body; but in others they are accumulated on the lower surface, without order, in a determinate order, or are disposed in double series upon five longitudinal lines, as in *Holothuria pentacta*.

4. The more or less terminal position of the two orifices may, M. de Blainville thinks, be taken into consideration advantageously.

5. Some zoologists, and among others M. Lesueur, says M. de Blainville, attach a great importance to the number of the tentacular appendages of the mouth, and to their form and mode of division; but, M. de Blainville fears, erroneously, for he has been positively assured that the most common species of the Mediterranean, *H. tubulosa*, which is found in hundreds at Toulon, varies much, both as to the number and terminal divisions of these organs.

6. It seems to M. de Blainville that a better character may be drawn from the form of the circle of the solid pieces of the mouth, which is constant, as he believes, in each species; it is however difficult to employ this test.

7. To judge from a considerable number of *Holothuriæ tubulosæ* seen by M. de Blainville, colour in these animals is very variable, in intensity at least, passing from a nearly deep black to a reddish bordering upon whitish.

8. With regard to dimensions, besides the difficulty of measuring the animals when captured, it appears that they vary considerably in size, doubtless from age.

M. de Blainville finally, after a careful analysis of the different species described by authors, joined to his own observations upon seven or eight species in a living state, distributes these animals into the following five sections, which he considers to be sufficiently natural, and some of which may be established as genera:—

Body	Flattened, with suckers below	*Cuvieria.*
	Subprismatic, with inferior suckers	*Holothuria.*
	Fusiform, with scattered suckers	*Thyone.*
	Vermiform, with pinnated tentacles	*Fistularia.*
	Subpentagonal, with ambulacriform suckers	*Cucumaria.*

A. Species whose rather short body, more convex and harder above than below, is provided with tentaculiform suckers, only on that side, and with fairly developed buccal appendages; the two apertures more or less superior. (*Cuvieria*, Péron; *Psolus*, Oken)

Example, *Holothuria Phantapus*. Scarborough Ascidia of Pennant (' Brit. Zool.').

B. Species whose coriaceous and rather elongated body is subprismatic; the belly sufficiently distinct from the back, and alone provided with tentaculiform suckers, scattered throughout its whole extent; the buccal appendages in general but little ramified; the mouth subinferior. (*Holothuria*, Lam.)

Example, *Holothuria tubulosa*.

C. Species whose body, in general elongated, but little coriaceous, cylindrical, or fusiform, is entirely covered with retractile papillæ, and whose buccal appendages are very large. (*Thyone*, Oken; *Mulleria*, Fleming.)

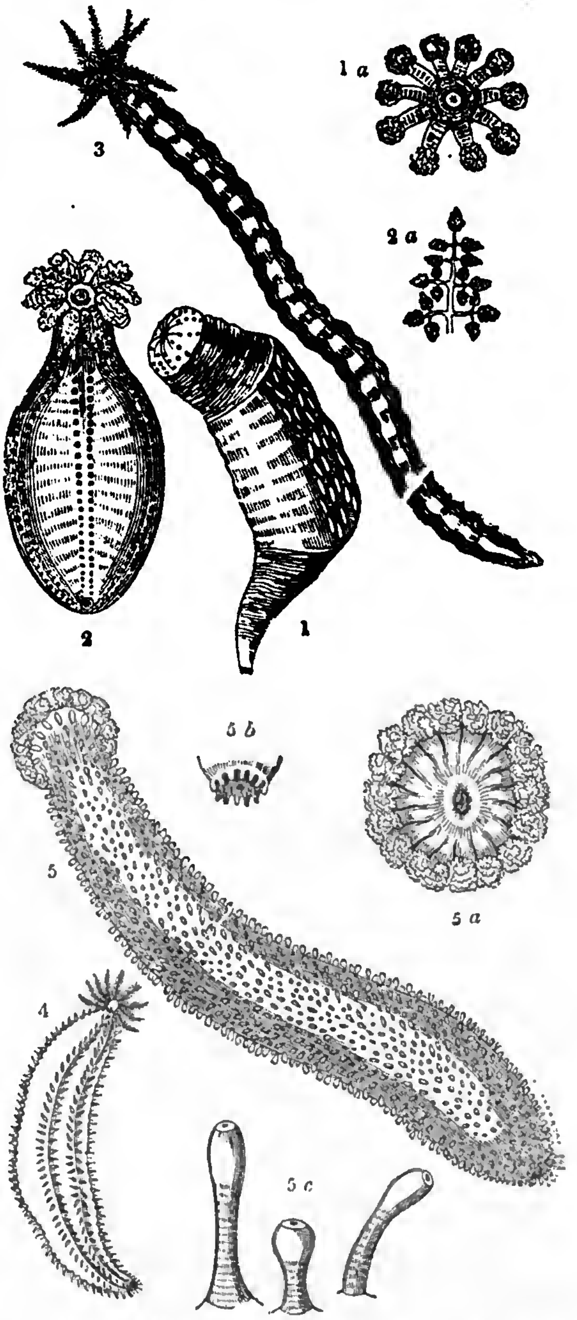
Example, *Holothuria papillosa*.

D. Very soft species, but little or not at all coriaceous, very long and vermiform, cylindrical or subpentagonal, provided with cirrhiform papillæ, which are very small, scattered, and with the buccal appendages usually regularly pinnated.

Example, *Holothuria vittata*.

E. Species sufficiently coriaceous, smooth, in general short or moderately elongated, regularly pentagonal, with tentaculiform suckers in ten rows, two at each ambulacral angle. (*Cucumaria*; Sea-Cucumbers.)

Example, *Holothuria Cucumis*.



1. Holothuria Phantapus; 1 *a*, its buccal appendages. 2, Holothuria papillosa; 2 *a*, a branch of its buccal appendages isolated. 3, Holothuria vittata. 4, Holothuria Cucumis. 5, Holothuria tubulosa; 5 *a*, its oral extremity; 5 *b*, its anal extremity; 5 *c*, some of the cirrhi, of the natural size.

Such was M. de Blainville's arrangement in 1834, and from the figures a general idea of some of the forms of this large family may be collected; but the number of new and fine species discovered by Lesueur, Quoy and Gaimard, Lesson and Garnot, De Chamisso and Eisenhardt, Rüppell, Escholtz, and Mertens, could not fail of throwing new lights upon these curious animated forms; and the systems of M. Jæger and M. Brandt made their appearance. Upon these M. de Blainville remarks (1836), that M. Brandt having had the great advantage of possessing both the beautiful zoological and anatomical drawings made by M. Mertens or his draughtsman, taken from the living and well-developed animals, as well as the descriptions left in manuscript by the former, it may be conceived that the system of M. Brandt, strengthened by that of M. Jæger, rests upon differences of great value, but is in M. de Blainville's opinion sometimes a little too anatomical, which may be injurious to its adoption. The characters upon which the system of MM. Jæger and Brandt rests are the following:—

1. The absence or the presence of tentaculiform suckers, which M. Brandt, as well as M. Jæger, calls feet, in common with many zoologists.

2. The resemblance or dissemblance of those organs.

3. The existence or absence of the posterior and internal aquiferous, branchial apparatus, which they name lungs, with good reason, because the ambient fluid penetrates therein.

4. The disposition of the tentaculiform suckers at the surface of the body, all round it or on certain parts only, in regular series, of variable number, or irregularly scattered.

5. The freedom or the adhesion of the respiratory aquiferous tree, divided by M. Jæger into the intestinal lung and the locomotive lung.

6. The last and least important character is drawn from the form of the tentacles which surround the buccal aperture, which leads M. Jæger to his subgenera and tribes, and M. Brandt to his genera and subgenera. M. Jæger forms, says M. de Blainville, in fact three groups only, which he considers as subgenera, *Cucumaria*, *Tiedmannia* (Fistularia), and *Holothuria*, which he separates into six tribes, *Mulleria*, *Bohatschia*, *Cuvieria*, *Psolus*, *Holothuria*, and *Trepang*, this last being in truth held doubtful in the system of M. Brandt, as M. Jæger himself considered it.

M. Brandt's divisions resolve themselves into seven groups:—

1. *Pentastichoæ*, answering to M. de Blainville's division E (*Cucumaria*), and subdivided according to the free or fixed state of the aquiferous tree.

2. *Sporadipodæ*, confounded by M. de Blainville with the *Holothuriæ* properly so called, from which he says they do not differ really, excepting that the tentaculiform suckers with which the body is covered are similar both above and below. This division contains only two genera, established upon the distinction of having the tentacula sheathed or not.

3. *Hippopodæ*, comprising M. de Blainville's division A, separated into two genera, *Cuvieria* and *Psolus*, containing each two species.

4. The *Apneumones*, which were regarded by M. de Blainville as belonging to the genus *Fistularia* of Lamarck, to the number of four or more, the half of which are doubtful, and containing only, for M. Brandt, the genus *Oncinolabes*.

5. *Schizopodæ*, which are diversiform species more or less elongated, in which the tentaculiform suckers are disposed in three or five longitudinal rows: these form but two genera, each containing one species only

6. *Heteropodæ*, corresponding to M. de Blainville's divisions B and C, that is to say, to his *Holothuriæ* properly so called, and to his *Mulleriæ*, of which M. Brandt forms seven genera.

All these are *Holothuriæ pedatæ*, but the

7. consists of the *Non pedatæ*, forming a great part of M. de Blainville's division D, that is to say, the genus *Fistularia* of Lamarck, separated into three principal genera, two of which, provided with aquiferous trees, are distinguished by the form of their body, and the third has been named *Synapta* by Escholtz.

Though M. de Blainville does not think that this disposition of the *Holothuridæ* is very natural, nor in a serial order, he takes advantage of it to complete his method according to his principles of zootaxy, and in his 'Nouvelles Additions et Corrections' (1836) to his *Actinologie* published in 1834, carries his method out with some interesting observations relating to the affinities and analogies of the various groups. We must refer the reader for details to the work itself, and must limit ourselves to the mere notice of his amended divisions, which he subdivides, retaining many of the generic names of Jæger and Brandt.

A. The *Vermiform Holothuriæ* (Fistularia), which have the body elongated, soft, vermiform, and the tentacular suckers very small or even null. Three divisions.

1. Without suckers, tentacula pinnated. (*Synapta*, Escholtz.)
2. Without suckers, tentacula pinnatifid. (*Chirodota*, Esch.)
3. Very small suckers disposed in five bands. (*Onciolabes*, Brandt.)

B. *The Ascidiform Holothuriæ* (Psolus), whose body is on the contrary short, coriaceous, convex above, flattened below, with superior rather than terminal orifices.

1. Skin as it were squamous. (*Cuvieria*, Péron.)
2. Skin rugose, but soft. (*Psolus*, Oken.)

C. The ordinary or *Veretilliform Holothuriæ*, whose body is sufficiently elongated, sufficiently soft, subcylindrical, and covered throughout with tentaculiform suckers, the lowest of which are longest.

1. Vent (anus) largely open. (*Holothuria*.)
2. Vent plaited. (*Bohadschia*, Jæger.)
3. Vent closed with five teeth. (*Mulleria*, Jæger.)

D. *Holothuriæ*, whose body is more or less elongated; the lower tentacular suckers longer than the upper ones, and disposed in longitudinal series in a determined number.

1. Suckers in three rows. (*Stichopus*, Brandt.)
2. Suckers in five rows. (*Diploperideris*, Brandt.)

E. The *Cucumiform Holothuriæ*, whose body is but little elongated, more or less fusiform, pentagonal, with tentaculiform suckers forming five ambulacra, one on each angle. (Brandt.)

1. Tentacular suckers very small or null. (*Liosoma*, Brandt.)
2. Suckers very visible.
   - *a.* Tentacles pinnated, ramose. (*Cladodactylus*, Brandt.)
   - *b.* Tentacles pinnatifid. (*Dactylota*, Brandt.)

F. The *Sipunculiform Holothuriæ*. Body more or less suddenly attenuated backwards, of an ill-defined pentagonal form, without either ambulacra or suckers? Tentacles simple, short, and cylindrical, as in the Actiniæ. (*Molpadia*, Cuvier.)

1. M. Holothuroides. (Cuv.)
2. M. Musculus. (Risso.)

Utility to Man.—When M. de Blainville says that he has never heard that any of these animals were of much utility to mankind, but that M. Delle Chiaje does indeed inform us that the poor inhabitants of the Neapolitan coasts eat them. He appears to have forgotten the great Oriental traffic carried on with some of the species as an article of food under the name of *Trepang* or *Tripang*, *Biche-de-mer* or *Beche-de-mer*. Captain Flinders fell in with a fleet of Malay proas at the English Company's Islands, north coast of New Holland, near the Gulf of Carpentaria (1803), and was informed that sixty proas belonging to the raja of Boni, and carrying one thousand men, had left Macassar with the north-west monsoon, two months before, on an expedition to that coast. 'The object of their expedition,' writes Captain Flinders (*Voyage to Terra Australis*), 'was a certain marine animal called *trepang*. Of this they gave me two dried specimens; and it proved to be the *beche-de-mer*, or sea-cucumber, which we had first seen on the reefs of the east coast, and had afterwards hauled on shore so plentifully with the seine, especially in Caledon Bay. They got the *trepang* by diving, in from 3 to 8 fathoms water; and where it is abundant, a man will bring up eight or ten at a time. The mode of preserving it is this:—the animal is split down one side, boiled, and pressed with a weight of stones; then stretched open with slips of bamboo, dried in the sun, and afterwards in smoke, when it is fit to be put away in bags, but requires frequent exposure to the sun. A thousand trepangs make a *picol*, of about 125 Dutch pounds; and one hundred picols are a cargo for a prow. It is carried to Timor, and sold to the Chinese, who meet them there; and when all the prows are assembled, the fleet returns to Macassar. By Timor seemed to be meant Timor-laoet; for when I inquired concerning the English, Dutch, and Portuguese there, Pobassoo (Captain Flinders's informant) knew nothing of them: he had heard of Coepang, a Dutch settlement, but said it was on another island. There are two kinds of trepang: the black, called *baatoo*, is sold to the Chinese for forty dollars the picol; the white or grey, called *koro*, is worth no more than twenty. The *baatoo* seems to be what we found upon the coral reefs near the Northumberland Islands, and, were a colony established in Broad Sound or Shoal-water Bay, it might perhaps derive considerable advantage from the trepang. In the Gulf of Carpentaria we did not observe any other than the *koro* or grey slug.'

Captain Phillip Parker King, who quotes a part of the above passage (' Survey of the Intertropical Coasts of Australia'), found a fleet of Malay proas in the bay at Coepang (1818): it had just returned from an unsuccessful voyage on the south coast of Timor in search of trepang. Dramah, the principal raja of the fleet, gave Captian King the following information respecting the coast of New Holland, which the raja had frequently visited in the command of a fleet that annually frequents its shores. The coast is called by them 'Marega,' and has been known to them for many years. A fleet to the number of 200 proas (but Captain King thinks that this number is perhaps very much exaggerated) annually leaves Macassar for this fishery; it sails in January, during the western monsoon, and coasts from island to island, until it reaches the north-east end of Timor, when it steers south-east and south-south-east, which courses carry them to the coast of New Holland; the body of the fleet then steers eastward, leaving here and there a division of fifteen or sixteen proas, under the command of an inferior rajà, who leads the fleet and is always implicitly obeyed. His proa is the only vessel which is provided with a compass; it also has one or two swivels, or small guns, and is, perhaps, armed with muskets. Their provisions chiefly consist of rice and cocoa-nuts; and their water, which during the westerly monsoon is easily replenished on all parts of the coast, is carried in joints of bamboo. 'After having fished along the coast to the eastward until the westerly monsoon breaks up, they return, and by the last day of May each detached fleet leaves the coast, without waiting to collect in one body. On their return they steer north-west, which brings them to some part of Timor, from whence they easily retrace their steps to Macassar, where the Chinese traders meet them and purchase their cargoes. At this time (1818) the value of the trepang was from forty to fifty dollars a *picol;* so that if each vessel returns with 100 *picols* of trepang, her cargo will be worth 5000 dollars. Besides trepang, they trade in sharks' fins and birds' nests [SWALLOWS], the latter being worth about 3000 dollars the *picol.*' To this Captain King appends a note stating that in 1822 the value of the trepang was much less, the price having fallen to twenty-five dollars the *picol.*

In Crawfurd's 'Indian Archipelago' it is stated that the slug, or tripang, is sometimes as much as two feet in length and from seven to eight inches in circumference; a span in length and two or three inches in girth is however the ordinary size. But the quality and value do not depend upon its size, but upon properties not discernible by those who have not had much experience in the trade. In shallow water the animal is taken out by the hand, but in deeper water it is sometimes speared. When taken it is gutted, dried in the sun, and smoked over a wood-fire. The fishery is carried on from the western shores of New Guinea, and the southern shores of Australia, to Ceylon inclusive. Indeed within the last few years it has been successfully presecuted on the shores of the Mauritius. The whole produce goes to China. In the market of Macassar, the great staple of this fishery, not less than thirty varieties are distinguished, varying in price from five Spanish dollars a *picul* (133⅓ lbs.) to fourteen times that price, each variety being distinguished by well known names. The quantity of trepang sent annually to China from Macassar is about 7000 piculs, or 8333 cwt.; the price usually varying from eight dollars a picul to 110 and 115, according to quality. There is also a considerable export of trepang from Manilla to Canton. (See M'Culloch's *Dictionary of Commerce*, article 'Tripang.')

HOLROYD, LORD SHEFFIELD. [GIBBON.]

HOLSTEIN, a duchy belonging to Denmark, in the north of Germany, comprised between 53° 30′ and 54° 24′ N. lat., and 8° 41′ 22″ and 11° 2′ E. long. It is bounded on the north by Schleswig, on the east by the Baltic, on the west by the German Ocean, on the south-east by Lübeck and Lauenburg, on the south by the Elbe (which separates it from Hanover) and the territory of Hamburg. Its form is pretty compact, and its superficial extent about 3250 square miles; the number of inhabitants was, in 1803, 325,743; in 1826, 401,528, and in 1835, 435,596; nearly all of the Lutheran religion. The eastern part of the province is an elevated hilly country, with many beautiful little lakes, numerous woods, pleasant villages, and pretty towns; and it abounds in picturesque scenery. The central part is a sandy barren tract, full of heaths and moors: the western part is low and level, and protected by dikes against the encroachments of the sea. The rivers are the Elbe, the Stör, the Eider, the Alster, the Bille, the Schwentine, and the Trave, &c. The largest of the lakes is that of Ploen. The country is on the whole fertile, especially in the marshlands on the German Ocean and the Elbe; and the eastern parts have of late years been rendered almost equal to the marshlands, chiefly by the use of marl. The mineral products are, in the vicinity of Oldeslohe, salt, lime and plaster of Paris, and near the Baltic, amber; but there are no metals. The large quantities of boulders from the Scandinavian Peninsula, which lie in parts of Holstein (Brongniart, *Tableau des Terrains*, &c.), constitute the most curious problem in the geological character of Holstein. The agricultural products are corn, more than sufficient for the home consumption, pulse, potatoes, some hops, flax, and hemp. The breed of horses and of horned cattle is excellent. There are likewise sheep, swine, and abundance of poultry and game. There are no manufactures that need any particular notice. The situation of Holstein between two seas is highly favourable to commerce; the exports consist of corn, timber, horses, cattle, butter, and turf; the imports, of colonial produce, wines, and manufactures. The herring fishery, and the Greenland whale and sea fishery, are a source of considerable profit. Trade is greatly facilitated by the Holstein or Kiel canal, made in the years 1777—1784, at the expense of above two millions and a half of dollars, to form a communication between the German Ocean and the Baltic. It is 23 miles in length, 100 feet broad at the surface, 54 feet broad at the bottom, and 10 feet deep. It has 6 sluices through which ships 100 feet long, 26 feet wide, and drawing not more than 9 feet water, can pass. The principal towns in Holstein are, Kiel on the Baltic, near the termination of the canal [KIEL]; and Altona, the largest town in the Danish dominions, next to Copenhagen. [ALTONA.] Glückstadt on the Elbe, half way between Hamburg and the mouth of the river, with 5200 inhabitants, the capital of the duchy, is a pretty regularly built trading town, formerly surrounded by ramparts, which are now demolished. It has a Lutheran, a Calvinist, a Roman Catholic church, a gymnasium, and other public institutions. It was declared a free port in 1830, and has much trade, and several ships engaged in the whale-fishery. Blankenese is a large and remarkable village, most beautifully situated on the Elbe, between 6 and 7 miles from Hamburg; the inhabitants, about 2000 in number, are all fishermen, and highly serviceable as skilful and intrepid pilots on the Elbe and neighbouring coasts of the ocean. The king of Denmark, as duke of Holstein and Lauenburg, is a member of the German Confederation; his place is the tenth in rank, and he has three votes in the full council. The contingent for both Holstein and Lauenburg is 3000 men, who form part of the 10th corps of the army of the Confederation, and the pecuniary contribution is 2000 florins per annum. After the peace in 1815, the king at different times signified his intention of introducing a representative constitution, and on the 28th of May, 1831, there appeared a general law for the establishment of provincial assemblies in the duchies of Schleswig and Holstein. It was not till May 15, 1833, that the laws were published, by which four provincial assemblies are established in the kingdom. The estates are to meet every two years. Those of Holstein and Lauenburg consist of 48 members; and their place of meeting is Itzehoe, an open town on the river Stör, with about 5000 inhabitants.

The early history of Holstein is obscure. Charlemagne subdued the Saxons, who then inhabited it; removed 10,000 families of them to Flanders, Brabant, and Holland, and declared the Eider, on its northern frontier, to be the boundary between Germany and Denmark. The Emperor Lotharius made Holstein and Stormarn a county, which he granted as a fief in 1106 to Adolphus, count of Schauenburg, whose son, Adolphus II., conquered Wagria. The family became extinct on the death of Adolphus VIII., and the estates chose, in 1460, Christian I., king of Denmark, for their count, securing to themselves the right of choosing their princes among his descendants, which they actually exercised to the time of Christian IV. and Duke Philip, in 1597. Various changes took place in the sequel, in consequence of the division of the families into different branches, and the subsequent extinction of collateral lines; and it was not till 1733 that the whole came permanently under Danish government. The king of Denmark had a seat in the diet as duke of Holstein; but on the dissolution of the empire and the formation of the Rhenish Confederation in 1806, he declared all his German possessions to be parts of the kingdom of Denmark: however, on the formation of the German Confederation in 1815 he became a member of it, and Holstein was re-annexed to Germany. (E. Kuss, *Herzogth. Schleswig und Holstein;* J. F. A. Dörfer, *Topographie der Herzogth. Holstein und Lauenburg.*)

HOLSTE'NIUS, the Latinized name of L. HOLSTE, born at Hamburg in 1595, became one of the first scholars of his time. After travelling through Italy, England, and other countries, he settled at Paris, where he became acquainted with the brothers Dupuy, Peiresc, and other learned men. At Paris he embraced the Roman Catholic religion, in consequence, he said, of his deeply studying the works of the Fathers, and of his seeking for the principle of unity in the Church. Peiresc introduced Holstenius to the pope's nuncio, Cardinal Barberini, the nephew of Urban VIII., whom he accompanied to Rome in 1527. From that time he lived in the cardinal's house, became his librarian, and was made canon of St. Peter's, and lastly librarian of the Vatican. He was sent on several missions to Germany, among others, to Innspruck, to receive the abjuration of Queen Christina of Sweden. He was also instrumental in effecting other conversions to Catholicism. Holstenius died at Rome in February, 1661, leaving his patron, Cardinal Barberini, his universal legatee. He had collected a vast quantity of scarce books and MSS., and he left many works of his own in an unfinished state. With much application and a great desire of knowledge, he wanted perseverance, and was apt to suddenly desert one branch of study for another. Among his published works are the following:—1. 'Porphyrii liber de Vita Pythagoræ,' Rome, 1630, with a Latin version and notes, and a dissertation on the life and writings of Porphyrius, which has been considered as a model of learned biography. 2. 'Demophili, Democratis, et Secundi Veterum Philosophorum Sententiæ Morales,' Leyden, 1638. 3. 'Notæ in Sallustium Philosophum de Diis et Mundo.' 4. 'Observationes ad Apollonii Rhodii Argonautica.' 5. 'Arrianus de Venatione,' with a Latin version. 6. 'Adnotationes in Geographiam Sacram Caroli à S. Paulo, Italiam Antiquam Cluverii, et Thesaurum Geographicum Ortelii.' 7. 'Notæ et Castigationes Posthumæ in Stephani Byzantini de Urbibus,' edited by Ryckius. 8. 'Liber Diurnus Pontificum Romanorum,' a collection of papal acts and decrees. He also wrote a collection of the rules of the earlier monastic orders, which was published after his death; and he edited in his lifetime the 'Antiquities of Præneste,' by Suares. Many of his Latin letters have been also published. His life was written by N. Wilkins, Hamburg, 1723.

HOLT, SIR JOHN, lord-chief-justice of the King's Bench, was the eldest son of Sir Thomas Holt, Knt., a bencher of Gray's Inn, and a gentleman of property in Oxfordshire. Sir John Holt was born at Thamo in Oxfordshire, on the 30th of December, 1642, and after spending some years at the free-school of Abingdon was in his sixteenth year entered as a gentleman commoner at Oriel College. Oxford. His college life appears to have been unusually wild and licentious; but like his predecessor in the King's Bench (Sir Mathew Hale), he discarded his irregular habits, and became remarkable for diligence and application. In 1652, before he was ten years old, he had been entered upon the books of the Society of Gray's Inn, and on the 27th February, 1663, he was called to the bar, and rose rapidly into notice as a first-rate lawyer and successful advocate. He was employed in most of the state trials which the troubled times in which he lived produced, and was generally counsel on behalf of the accused. His opposition to the measures of the court brought upon him the vengeance of James II., who procured his removal from the recordership of London. Shortly after the accession of William III. (April, 1689) Sir John Holt was made lord-chief-justice of the King's Bench, in which situation he continued during the remainder of his life, although the chancellorship was offered to him on the removal of Lord Somers in 1700. Sir John Holt in the discharge of the duties of his office evinced great resolution in opposing the encroachments as well of the crown as of the houses of parliament. His demeanour towards prisoners presented a noble contrast to the intemperance, brutality, and vulgar ribaldry which had disgraced the criminal proceedings of former reigns, and he set an example of spirit and temper which has continued to distinguish and adorn the judicial bench of England.

It was the fortune of Sir John Holt to be placed more than once in a position to bring into a striking point of view the personal intrepidity of his character, one instance of which, from the interest attached to it from the recent claims of privilege by the House of Commons, may be here mentioned. It arose in the famous case of the Aylesbury burgesses, several of whom claimed damages against the returning officer who had refused to record their votes. The House of Commons resolved that the plaintiffs were guilty of a breach of privilege, and committed them to Newgate; but they sued out writs of Habeas Corpus, and the chief-justice was of opinion they were entitled to their discharge. Upon this the House of Commons issued warrants for the apprehension of the counsel who had argued for the burgesses, and sent the serjeant-at-arms to Sir John Holt to summon him to appear at the bar of the house. The chief justice bade him begone, upon which the house sent a second message by their speaker, attended by as many members as supported the measure. After the speaker had delivered his message, Sir John Holt is reported to have said, 'Go back to your chair, Mr. Speaker, within this five minutes, or you may depend upon it I will send you to Newgate. You speak of your authority; but I will tell you I sit here as the interpreter of the laws, and a distributor of justice, and were the whole House of Commons in your belly, I would not stir one foot.' The accuracy of this reply has been questioned, but it has been extensively stated, and from the spirited observations made by Sir John Holt whenever the due course of law or justice was attempted to be impeded, it is probable that his anger at the interference of the House of Commons would be shown by pretty strong language.

Sir John Holt died in March, 1709-10, leaving behind him a reputation for learning, honour, and integrity, which has never been surpassed even among the many eminent individuals who have succeeded him in his dignified office.

There is no complete biographical account of Sir John Holt. The volume which bears the title 'The Life of the Right Hon. Sir John Holt, Knt.' (London, 1764), is merely a collection of arguments, and contains only a few meagre notices of his life. The above account has been taken chiefly from a memoir published in the 'Law Magazine.' 'The Tatler' (No. 14) contains an outline of his character.

HOLYHEAD, or CAER GYBI, a seaport and market-town situated upon a small island of the same name at the western extremity of the island of Anglesey, 267 miles north-west by west from London. The Romans are supposed to have had a station here, as numerous Roman coins have been found in the vicinity at different times; there are also distinct traces of Druidical remains. The two principal streets are broad and well built, and several of the residences are erected in a very superior style. The harbour is formed by a pier 900 feet in length, constructed chiefly of hewn limestone, and at the pier-head there is, during ordinary tides, a depth of 14 feet at low-water. The other extremity of the pier is connected with the land by means of a suspension bridge of cast-iron, and the mail-road is thence continued across the island of Anglesey to the Menai Bridge. The church is a very antient structure, embattled, with the inside of the porch and part of the transept rudely carved. (Pennant's *Tour.*) The living is a paid curacy in the diocese of Bangor, with an average net income of 167*l.*, in the gift of Jesus College, Oxford. Holyhead is the station of the post-office packets, which sail daily between this port and Dublin. The inhabitants are principally employed in the coasting trade, ship building, &c.: the population in 1831 was 4282. (*Parliamentary Papers*, &c.)

HOLY ISLAND. [DURHAM.]

HOLYROOD HOUSE. [EDINBURGH.]

HOLYWELL, a manufacturing town in the hundred of Rhuddlan and county of Flint, situated upon an eminence near the southern shore of the æstuary of the Dee, 203 miles north-west from London, and 11 miles east from St. Asaph. It was formerly an inconsiderable village, but is now become, from its mineral riches and the manufactures carried on in the neighbourhood, a rapidly improving and flourishing town. Besides corn-mills, smelting-houses, copper-works, brass-works, wire-mills, &c., there is a cotton-twist manufactory, which is carried on upon a large scale, and in the vicinity are the coal-pits and great lead mines of Flintshire, which afford constant employment to about 600 of the inhabitants of Holywell. The machinery belonging to the establishments above mentioned is occasionally worked by steam power, but it is more frequently driven by the force of a stream which issues from the remarkable Holy-Well of St. Wenefrede, and which is justly considered by the inhabitants as the origin of their present prosperity. According to Pennant this spring throws up twenty-one tons of water in a minute, and has never been known to freeze, but it is a vulgar error to suppose that it is subject to no fluctuations during drought. The spring issues from the rock into a beautiful polygonal well, over which a chapel was erected by the Stanley family about the time of Henry VII. The waters were formerly in high repute for the cure of diseases, and were moreover resorted to by large numbers of pilgrims. Even as late as the time of Pennant the Lancashire pilgrims were to be seen in deep devotion up to their chins for hours, sending up prayers, and making a prescribed number of evolutions, and this excess of piety was carried so far as in several instances to cost the devotees their life. Near this town are the remains of the abbey of Basingwerk; and near the spring are the remains of the old British fortification of Dinas Basing, 'the fort in the bottom.'

The manufactured copper and brass is all shipped on the Dee, just below the factory, to the warehouses of the company at Liverpool, whence large quantities are reshipped to London, America, and India. Holywell is a contributory parliamentary borough to Flint. The living is a vicarage in the diocese of St. Asaph, with an average net income of 250*l.* The resident population in 1831 was 8969. (*History of the Parishes of Whiteford and Holywell*, 4to. 1796, &c.)

HOLZMINDEN. [Brunswick.]

HOMAGE, an incident of tenure which is now abolished by 12 Car. II., c. 24. [Feudal System.] The word, according to Sir Edward Coke, is derived from homo, because when the tenant did his service to the Lord, he said 'I become your man,' &c.

Homage, according to the old English law writers, was of three kinds: by ligeance, by reason of tenure, and ancestrel; the distinction between which is not necessary to state here: the whole subject, which is now merely matter of curiosity, is explained in 'Coke upon Litt.,' p. 64, and following pages.

The copyholders, or tenants who attend to do their duty in a court baron, are called *the homage*.

HOMALIA'CEÆ, a small natural order of shrubby exogenous plants with polypetalous flowers, a row of glands in front of the segments of the calyx, many perigynous stamens, and a 2-5-styled ovary, with as many parietal placentæ as styles. The species chiefly inhabit tropical countries; they have small starry flowers, and are of no known utility. Brown considers them nearly related to Passifloraceæ.

Homalium racemosum.
(1. An expanded flower; 2, an ovary with its two styles.

HO'MARUS, the name employed by M. Milne Edwards to distinguish the true Lobsters generically. That acute zoologist has lately noticed (*Histoire Naturelle des Crustacés*, 1837) certain differences which induce him to separate the true lobsters, *Homarus*, from the Crawfishes, *Astacus*, and to combine the genera *Astacus, Homarus*, and *Nephrops* in one small group, which he designates as the family of the *Astacians*. These he considers as forming the passage between the *Cuirassed Macrurous Crustaceans* and the *Salicoques*, or *Shrimps*, but as differing sufficiently to require separation. In the general form of the body the *Astacians* approximate very nearly to the *Salicoques*, but they have not, he remarks, like them, branchiæ composed of laminæ piled one on another; these organs being formed by an assemblage of small cylinders more or less long, and brush-like, as in the greater part of the *Cuirassed Macrura*, which the *Astacians* also resemble in the hardness of their tegumentary skeleton; but their *sternum* is not enlarged into a plastron, and the nervous ganglions corresponding with the two thoracic rings are distant, and united by rather long double cords.

The *body* of the *Astacians* is elongated and a little compressed; the *abdomen* is very large, but at the same time less developed in proportion to the thorax than it is in the Shrimps. The *carapace* terminates anteriorly by a moderate rostrum, which overhangs the base of the ocular peduncles. The *antennæ* are inserted nearly on the same transversal line; those of the first pair are of moderate length, their peduncle is straight, and their terminal filaments two in number. The external or second pair are much longer, and their peduncle is furnished above with a moveable plate, which is analogous to the spiniform appendage in the *Paguri*; as well as to a similar but much larger plate which is found in the *Salicoques*. In the *Astacians* this appendage is hastiform, and never entirely covers the last peduncular joint situated below, and it is even rudimentary. The *buccal apparatus* presents nothing remarkable; the *external jaw-feet* are elongated, but bent back upon the mouth; their second joint is much larger than those which succeed, and they do not assist in locomotion. The first pair of *feet* are very large, and terminated by a large didactylous claw; the four last pairs are of moderate length, and nearly of the same general form, excepting that the second and third pairs are provided with a small didactylous claw, and that the four last are monodactylous. The abdomen is nearly of the same size throughout, and presents on each side a lamellar prolongation, which descends so as to incase more or less completely the base of the false feet. The last segment is very wide, and forms, with the two plates of each of the appendages of the sixth ring, a great caudal fin, all the pieces of which are nearly of the same length. The external plate of this fin has a transverse joint towards its posterior third part. The false natatory feet are elongated; in the male the first pair are styliform, nearly as in the *Brachyura*, while the others are terminated by two large foliaceous plates with ciliated borders, a condition which belongs to the whole of these feet in the female. The branchiæ amount to twenty on each side. They are disposed in three rows, so as to form vertical bundles separated by flabelliform appendages, fixed to the base of the feet. These last-mentioned appendages are very large, and are only wanting in the posterior feet.

This family corresponds to the genus *Astacus* of Fabricius; and M. Milne Edwards, adopting the division established by Dr. Leach in founding his genus *Nephrops*, further separates the Crawfishes properly so called from the true Lobsters thus:—

Astacians.	Rostrum depressed, and armed with one tooth at most on each side. Last thoracic ring moveable.		Crawfishes; *Astacus*.
	Rostrum straight, and armed with many teeth on each side.	Eyes spherical. Last ring of the thorax soldered to the preceding.	Lobsters; *Homarus*.
		Eyes reniform. Last ring of the thorax preserving a little mobility.	*Nephrops*.

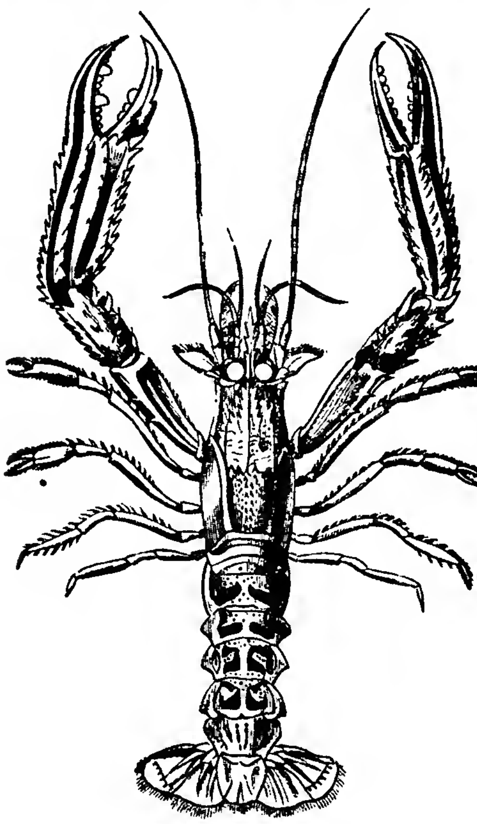
But the separation thus further carried out by M. Milne Edwards does not depend on external distinctions only; for there are great differences in the conformation of the internal organs of generation and digestion, as compared with that of those essential parts of the animal oconomy in the other *Astacians*. Thus M. Milne Edwards remarks, that in the Crawfishes the duodenal portion of the intestine presents on its internal surface a great number of small villosities, and is not clearly separated from the rectum, which is smooth internally; while in *Homarus* the duodenum is smooth within, the rectum is plaited internally, and there exists between these two parts of the digestive tube a kind of circular valvule; the posterior cœcal appendage of the 'ntestine, which is seen at the extremity of the duodenum of the true Lobsters, is wanting in the Crawfishes. The liver is composed in the Crawfishes of small cœcal tubes, which are comparatively much more elongated, and its anterior lobes aro less developed; the testicle is very small, and is composed of three lobes, whence spring the very long and tortuous deferent vessels, whilst in the true Lobsters these secreting organs are very much elongated, extending from the head into the abdomen, presenting no mesial lobe, but a simple commissure, and only giving rise to very short deferent canals.

The *Astaci*, which are all fluviatile, consist of the species *A. fluviatilis* (the natural history of which will be found in the article ASTACUS, vol. ii.), *Bartonii*, *affinis*, *Australasiensis*, *Chilensis*, and *Blandingii*?

The *Homari*, which are all marine, consist of the species *H. vulgaris*, the Common Lobster (the natural history of which will also be found under ASTACUS), *Americanus*, with its immense claws, and *Capensis*, according to M. Edwards, who considers the *Astacus scaber* of Fabricius as identical with *Capensis*. The species *A. cærulescens*, *A. fulgens*, *A. fulvus*, are unknown to M. Edwards, and considered doubtful by Latreille.

Nephrops. (Leach.)

Body more elongated than that of the Crawfishes; *rostrum* slender and rather long, armed with lateral teeth like that of *Homarus*. *Eyes* large and reniform. Lamellar appendage of the external antennæ wido, and long enough to extend beyond the peduncle situated below. *Feet*, first pair long and prismatic; succeeding pairs with a compressed



Nephrops Norvegicus.

manus. Nothing remarkahle oither in the abdomen or in tho buccal appendages. *Branchiæ* disposed as in *Homarus*

Example, *Nephrops Norvegicus*, *Norway Lobster* of authors. Length six or seven inches.

FOSSIL ASTACIANS.

M. Milne Edwards refers the impression of the small Macrurous crustacean from the beds in the neighbourhood of Pappenheim to the genus *Astacus* provisionally. He quotes the figures of Knorr (pl. v., fig. 8-5), and Desmarest (*Crustacés Fossiles*, pl. ii., fig. 5), and dedicates the species to the first of these naturalists, under the name of *Astacus Knorrii*. He considers that the fossil figured by M. Desmarest (pl. ii., fig. 3), under the name of *Palinurus Regleyanus*, has more relation to *Nephrops* than any other genus of Macrurous crustaceans, but that it probably ought to constitute a particular genus. *Astacus Leachii* of Mantell (*Geology of Sussex*) helongs, in the opinion of M. Milne Edwards, to tho family of Astacians; but he remarks that it differs considerably from the species which compose the three genera constituting that family. Of the genus *Coleia*, established by Mr. Broderip, and described and figured by him from the lias in 'Geol. Trans.,' 2nd series, vol. v., p. 171, pl. 12, M. Milne Edwards says that he considers it to be intermediate between the *Astacians* and *Salicoques*.

HOMBURG, HESSE. [HESSE-HOMBURG.]

HOME, HENRY (Lord Kames), was born at Kames, in the county of Borwick, 1696. Ho was originally bound to a writer of the signet, but by diligent study he qualified himself for the higher practice of an advocate. His first work, entitled 'Remarkable Decisions in the Court of Sessions,' which appeared in 1728, excited considerable attention. The reputation of Mr. Home was still further established by the publication of his 'Essays on several Subjects in Law.' In 1741 he published, in 2 vols. fol., 'Decisions of the Court of Sessions,' which were arranged under heads in tho form of a dictionary; and in 1747 appeared his 'Essays on several Subjects concerning British Antiquities.' In his 'Essays on the Principles of Morality and Natural Religion,' while he worked out extensively the principle of a moral sense as taught by Lord Shaftesbury, he opposed all exclusive theories of human nature which dorive all the actions of men from some single principle, and endeavoured to establish several general principles. Some of the propositions advanced by him concerning natural religion gave offence to a few, who thought that they could advance the interests of Christiauity by depreciating the reason, on which however all revealed religion ultimately rests. In 1752 Mr. Home was appointed a judge of the court of session, and took his seat on the bench by the title of Lord Kames. At the same time he was nominated a trustee for the encouragemeut of manufactures, fisheries, and arts, and also commissioner for the management of forfeited estates. But the activity of his mind was far from being exhausted by his numerous official duties, and he found leisure to compose two important works, in which he attempted to apply to the science of jurisprudence the principlos of philosophy. The titles of these works are, 'Historical Law Tracts' and 'The Principles of Equity.' In 1761 he published an 'Introduction to the Art of Thinking,' for the use of youth, which, as an elementary work, is still highly esteemed. The year following there appeared 'Elements of Criticism,' 3 vols. 8vo., which exhibit a rare union of philosophical acuteness with a fino tasto and warm feeling for the beautiful. In 1763 he was appointed one of the lords commissioners of justiciary; but his literary labours were still uninterrupted by the growing weight of duty and of years, and in 1774 he published 'Sketches of the History of Man,' 2 vols. 4to., an ingenious and amusing work; but the fanciful ideas and the doubtful authority of the facts upon which it rests materially detract from the value of the many important views of society which it lays open. In 1776 appeared 'The Gentleman Farmer, or an Attempt to improve Agriculturo by subjecting it to the test of Rational Principles.' This treatise is even now referred to by writers on agriculture, and was not without its influence in effecting the present improved state of Scotch farming. His last work was devoted to the benefit of the young. His 'Loose Hints on Education' were published in the 85th year of his age, and in the following year he died, on the 27th December, 1782.

Lord Kames's reputation as an author rests at present principally upon his 'Elements of Criticism.' This work consists partly of a mass of psychological observations upon the sublime and the beautiful, considered relatively to those mental faculties by which they are apprehended and exhibited; and partly of an inquiry into those attributes, relations, and circumstances of things whereby they are calculated to awaken correspondent emotions. The fine arts, he observes, are a subject as well of reasoning as of taste. In his use of the term 'taste' however he is inconsistent with himself: occasionally he understands by it the simple feeling of gratification which accompanies every perception of a congruity in objects to man's triple nature, whether they present themselves under the form of the good, of the beautiful, or of the true. It is in this sense of the term that he makes taste to be similar, and indeed nearly allied, to the moral sense. But he more frequently uses it in the larger and more general sense, in which it comprises not merely this simple feeling, but the cultivation also of an intellectual perception of the causes and ground of this congruity itself in the objects of taste. This is particularly noticeable in his remarks upon beauty. This term he confines originally to objects of sight; it is only figuratively that it can be applied to the objects of other senses. Visible beauty is of two kinds: *intrinsic*, which is perceived immediately; and *relative*, which is only mediately perceived by an act of reflexion and the discovery of some useful end. The latter however is so strong, that oftentimes the judgment may overbear the taste, and an object totally devoid of intrinsic beauty may appear beautiful upon a perception of its utility; for instance, a want of form and symmetry in a tree will not prevent its appearing beautiful, if known to produce good fruit.

His theory of the sublime is more correct. The strong emotion produced by the impression of a great or grand object which we cannot apprehend without an effort is the source of the satisfaction which is felt upon the perception of its sublimity. However he considers it difficult to reconcile the sense of the beautiful with the sense of the sublime, since many sublime objects are not merely deficient in but even directly opposite to the beautiful; and yet he rightly observes that psychologically they agree in exciting an agreeable emotion diversely modified by its respective objects or causes.

The chapters on Wit, Language of the Passions, Language, &c., contain many excellent remarks and happy illustrations. In those on Epic and Dramatic Poetry, Lord Kames insists that the unities of time and place do not rest upon any general principle, although absolutely necessary to the Greek Drama, in consequence of the presence of the chorus. (*Life of Lord Kames*, by Lord Woodhouselee.)

HOME, or HUME, JOHN, was born in Scotland about the year 1722, and is supposed to have been a relation of David Hume. He was bred to the ministry of the kirk, and subsequently nominated to the parish of Athelstaneford, where he produced his tragedy of 'Douglas,' which was acted at Edinburgh with the most unbounded applause. Perhaps there never was a composition more perfectly harmless and free from offence; but the circumstance of its being a drama was enough to draw down the anger of the rigid elders of the kirk, who were shocked to find such a work proceed from the pen of a minister. Not only did they expel* him from the ministry, but even denounced those of his friends who might visit him, or go to see the performance of his piece. Home retired to England, where he received the protection of the earl of Bute, and obtained a pension. Four other tragedies, 'Agis,' 'Aquileia,' 'The Fatal Discovery,' and 'Alonso,' followed 'Douglas,' but they did not equal it, and have been long since forgotten. Home died in 1808.

The play of 'Douglas' has always kept its place on the stage, and from its pure style, elegant language, and interesting plot, will ever continue a favourite. Never was fanaticism more unlucky than in having such an inoffensive work as the object of its fury. An unprejudiced person on reading the drama would never dream of the possibility of its exciting anything like persecution, and while Home's work goes down to posterity as a classical and moral production, the virulence of the elders must be regarded by every rational person with indignation and contempt, unless indeed a liberal allowance be made for the bigotry of the age.

HOMER (in Greek, Homéros), the supposed author of the earliest Greek heroic poems extant, and of some hymns in praise of different gods. Opinions the most various have been held regarding his birthplace, his age, his station, and the circumstances of his life; so that it seems almost hopeless to come to any satisfactory conclusion on subjects which history has given us such scanty materials to determine. The author or authors of the Iliad must have been accurately acquainted with the geography of Greece and the northern part of the Archipelago. Leake notices several instances where epithets are applied with an exactness which seems to indicate personal knowledge of the places; and as these places are in different parts of Greece, we may infer that Homer was a wandering minstrel. The existence of such wandering minstrels seems to be shown by the Hymn to Apollo, quoted by Thucydides; as the notices of Phemius and Demodocus, in the Homeric poems, prove the existence of bards attached to particular courts. And indeed, without this information, the analogy of our own heroic age would render it highly probable that there should have been an order of wandering minstrels; while in a country like Greece, inhabited by kindred though often hostile tribes, it would be impossible for a wandering musician to recite the same tales at every court and before every audience. Either he must have had contradictory accounts to retail according to the tribe among which he exercised his powers, if he exercised them on international feuds at all, or, which is much more probable considering the reverence in which national legends were held, he must have confined himself to subjects where the whole race could be contemplated as uniting against a common foe, or have resigned all claim to be considered an heroic bard.

Of these two plans, the author of the Iliad adopted the former. The story of Helen was probably an Athenian legend, as we find that the Attic hero Theseus is reported to have stolen her when young. What then could be more natural than for a minstrel, particularly an Attic minstrel, to take this legend, and combining it with others which gave some account of an expedition undertaken by the Greeks against Asia, produce the narrative which we find in the Iliad. We do not insist on this method of accounting for the origin of the Homeric poems; all we wish to do is to illustrate the way in which they *might* have arisen, and to give what we think a rational exhibition of the causes, or some few of the more important of the causes, which led to the establishment of a national heroic epos in opposition to a cycle of poems referring to the exploits of particular tribes. Whatever be the origin of the Iliad, it is peculiarly remarkable in standing as it does a witness of the unity of the Hellenic races. We find these races, historically speaking, opposed in every possible way, as rivals, as strangers, as enemies; if we turn to their poetry, we find them united. The common Christianity of Europe is not a more strongly marked bond of union than the common poetry of the Greeks, and this community must, in the Epic period particularly (wherein it is most strongly marked), be referred to that genius—whether in the author, or in the race for whom he composed, matters not,—which has given birth to the Iliad.

We have before endeavoured [EPIC] to point out the manner in which epic poetry arises, and in which it naturally divides into two parts, the one bearing reference to the internal or religious, the other to the external or political element of man's constitution. The religious element is most perfectly developed in Hesiod, the poet of that contemplative life which was overborne and thrown into shade by the brilliant extravagances of the Heroic age. (*Ulrici* vol. i.) The poems attributed to Homer are the Iliad and the Odyssey, to which some have added the Homeric Hymns. Of these poems, the Iliad stands first, as the oldest and at the same time the completest specimen of a national heroic poem.

Its subject, as is known to all, is the revenge which Achilles took on Agamemnon for depriving him of his mistress Briseis, during the siege of Troy; and the consequent evils which befel the Greeks. It is divided into twenty-four rhapsodies or books, which detail the history of the besieging force during the period of Achilles' anger, and end with the death of Hector (who is slain by Achilles in retaliation for Hector's having killed Patroclus), and the solemn burial of the Trojan warrior. If any one reflects on the form which the first imaginative compositions of any people in an early stage of progress must take, and when he has ascertained, what he probably will ascertain, that those compositions, if not of a sacred nature, will bear reference to external and active

* Some accounts say that he foresaw his expulsion, and avoided it by retiring.

life, goes on to apply his conclusions to the Greek nation in particular, and furthermore to the heroic age of the Greeks, he will doubtless find little difficulty in agreeing with a remark which has already been made regarding heroic poetry, namely, that as a simple form of art it does not imply the development of a plot, but rather the extraction of a certain portion from the poetical annals of a nation, beginning and ending just where the subject may seem to suggest, but not necessarily ending with a regular disengagement of a plot regularly worked up and studiously combined from the beginning of the poem. To apply this to the Iliad: we shall see that it would be vain, not to say out of place, to aim at proving, as some have done, that the Iliad is a poem constructed on regular principles of art. It is a poem of natural growth; the earliest and yet the noblest attempt made by the epic spirit in the most imaginative nation of which we have any record, and, as Thirlwall has remarked, perhaps the first work to which was applied the newly invented art of writing. This last supposition, if adopted, would lead us to infer that the reason why the Iliad has attained to a size much greater, as far as we can tell, than any earlier poems, is because Homer, seeing the art of writing in its rudest state already practised, was the first to apply it, as well as the first to supply extensive material for its application. Whether what we now possess be the exact poem which thus forms the beginning of all literature properly so called, or not, is scarcely doubtful. The lapse of so many ages can hardly have failed to have introduced some passages, altered and removed others; but whether to any great extent seems almost impossible to decide. Particular scholars may impugn particular passages, and themselves entertain no doubt of their own infallibility; but it behoves every one to remember that the same practice in style which would be necessary to enable a scholar to decide correctly on a passage of doubtful authenticity would, unless that scholar's ingenuity were under perfect control, be very likely to suggest difficulties and questions too tempting for his judgment to resist. But the same spirit of criticism which suggested these doubts has also suggested others, as it would seem, on better foundation. We mean those relating to the authorship of the Odyssey. Before entering on this question it will be as well to observe that the Odyssey can hardly be called a national epic. It is much nearer the romance of chivalry than any other antient work. It contains the account of those adventures which Ulysses encountered on his way home from Troy, and in its present state consists of twenty-four books, which division is said to be owing to the grammarians in the time of the Ptolemies. Nitzsch (*Anmerkungen*, vol. ii., p. xxxiv.) divides the Odyssey into four parts, ending with the 4th, the 92nd line of the 13th, the 19th, and the 24th books respectively, and containing the story of the absent, the returning, the vengeance-planning, and the vengeance-accomplishing Ulysses; and he professes, as many others have done, to point out all the interpolations. Our limits do not permit us to say more on this subject than to notice that there is little doubt that much has been interpolated in the account of Ulysses's visit to the shades, and that Aristophanes and Aristarchus the grammarians considered the latter part of the 23rd and all the 24th book spurious. It will be more to our purpose to consider the question whether the Iliad and Odyssey are or are not to be referred to the same author, and this we shall do rather more with the view of pointing out some important features in the discussion, than as hoping to arrive at any very definite result. A sect arose very early among the grammarians called 'The Dividers' (οἱ χωρίζοντες), who denied to Homer the authorship of the Odyssey. The grounds of this opinion were mostly critical, such as the different use of different words in the two poems; or historical, such as contradictions, real or apparent, in points relating to Helen, Neleus' sons, Aphrodite's husband, &c.; but we possess but little of the fruits of their researches, although enough, according to Grauert (*Rheinisches Museum*, i.), to show that they could not have belonged to the early childhood of criticism. In our day, or at least in that of our fathers, the question has been revived, with a power of suggesting doubts, as much greater as that of satisfying them is less. With regard to the argument from the use of different words in the two poems, both in antient and in modern times, it must be observed that in the Iliad itself, compared with itself, there is, if any thing, a more remarkable variety in the use of words than in the two poems. We do not remember to have seen the observation, but we think that any one who reads the Iliad, noting down any words which strike him, will find that no sooner has he got acquainted with a set of words than they disappear, and that this rising and setting of words continues all through the poem. If then the use of different words argue different authors, there will be some difficulty in escaping the conclusion that different books of the Iliad, as well as the two Homeric poems, were the production of separate authors. The different use of words however is a strong argument, but a stronger than all is to be found in the different state of civilization which the two poems exhibit, and in the tendency which the Odyssey displays to exalt the individual above the class, a tendency which proves that an advance had been made to that kind of poetry which treats of individual feeling, namely lyrical poetry. But there is one other characteristic of the Odyssey to which we have before slightly alluded, we mean its romantic look, using romantic as opposed to classical. There is something quite northern in the adventures of Ulysses; they might have happened to a knight of Arthur's court, or perhaps still better to Beowulf. The Sirens would be singing maidens, who decoy travellers by their strains; the nymph Calypso would find an antitype in some enchantress. Ulysses slays the suitors, much in the way of William of Cloudesley, in the old ballad; and the horror of great darkness which the prophet sees surrounding the suitors is so like Sir W Scott's description of the banquet at the end of the 'Lay of the Last Minstrel,' where the goblin-page is recalled, that we might suppose it had suggested the scene, were we not almost certain that he had borrowed, consciously or unconsciously, from some northern story, if at all. To this we might add the charm in shape of a fillet, which Leucothee gives Ulysses (*Od.*, v. 346), the story of the Lotos-eaters, the tying up the winds in a bag (*Od.*, x. 19), a practice still in use among the Laplanders, and the ship of the Phæacians,

> 'That asked no aid of sail or oar,
> That feared no spite of wind or tide.'

These grounds and others have impressed many modern scholars with the opinion that the Odyssey and Iliad are not the produce of the same mind. How far either poem can claim a single author is another question, and one which it is far less easy to solve. We have mentioned some of the arguments that have been urged, and to these we might add an historical analogy from the same kind of poetry in our own country. The great romances, some of them at least, were more than a century in their production, and one, the 'Romance of Alexander,' had, if we mistake not, at least a dozen contributors. Whether there be the same traces of unity of design in the two poems, we must leave to others; if not, the instance proves no more than it would to refer to the 'Mirror for Magistrates,' which contains more separate accounts than it had authors. Again, Henry the Minstrel, although blind, was the author of a poem which rivals the Iliad in length; so that it is not impossible that Homer, whether blind or not, should have composed and recited the whole Iliad, even without the aid of letters. Examples then lead in this case to no definite result, and if we attempt to base our conclusions upon them, we may be led with nearly equal probabilities to opposite results. But there is an historical fact which has been adduced in support of one side of this question, namely, the existence of a race of men called Rhapsodists,* or Homeridæ, who imitated Homer, enlarged upon him, and interpolated his poems with verses of their own (Hermann, *Preface to Homer's Hymns*, p. 7); treating him very much as the Bible was treated by one school of the early Mystery-mongers.

Now those who deny the unity of the Iliad assert that these Rhapsodists manufactured it among themselves, until it gradually assumed that form in which Pisistratus finally established it, and in which we now have it. The question then comes again to be one of taste. Those who think they see in the Iliad proofs of such unity of design as outweigh all the arguments brought from history and criticism, will have reason for considering the Iliad to be the work of one author far stronger than any which their opponents can possibly possess on the other side, inasmuch as the conviction of taste is always much more binding than

* Rhapsodists (ῥαψῳδοί), men who recite ῥαπτὰ ἔπη or poetry, not, as has been said, men who patch or string together other people's verses, or who recite with a wand (ῥάβδος) in their hands. (See Heyne's 'Excursus,' ii., § 3, on the last book of the Iliad, page 263, Engl. edition.)

a logical proof, especially one which only goes on probabilities. Each man who engages in the controversy will have it decided for him as much by his own natural character and bent as by argument; and here we may leave it, with this one remark, that the most which can be proved, even by the rules of taste, is that the great design and chief filling-up is by one author: individual lines or even whole passages may in any case be interpolations. On this part of the question the reader will find some very valuable remarks in Hermann's preface already quoted, which relate also to the opening lines of the Theogony, and more especially to those other poems which we come now to notice, the Homeric Hymns.

The Hymn to Apollo, as Hermann thinks, owes its present form to the fact of the last transcriber having had before him at least four hymns, each with a similar introduction, all which introductions, in transcribing, he mixed up together; and furthermore to his having mixed up two separate hymns, one to the Delian and one to the Pythian Apollo, of which the latter was itself composed of two, one to the Pythian and one to the Tilphussian Apollo. The Hymn to Hermes is very corrupt, consisting of a larger and a smaller hymn, and interpolations. The Hymn to Aphrodite and that to Demeter are also much altered; the latter, according to Hermann, bears marks of at least two editions. These are the principal of the Homeric hymns: the fragmentary one to Dionysus seems also to have been one of the larger and more important ones. There are twenty-eight shorter hymns given in Hermann's edition, as well as seventeen epigrams, or rather epigraphs. These, with the 'Battle of the Frogs and Mice,' make up the sum of the Homeric poems, genuine and spurious.

The earliest mention made of Homer is by Pindar. Herodotus and Thucydides quote and refer to him; and when we get to Plato he is constantly either hinted at or transcribed. There is a good deal of information on this topic and others in Heyne's work already quoted; but we may quote Thirlwall's authority for the remark that 'an argument which confines itself to the writings of Wolf and Heyne can now add but little to our means of forming a judgment on the question, and must keep some of its most important elements out of sight.' A great deal more information is to be found, by those who will take the trouble to look for it, scattered up and down in the pages of German periodicals. Buttmann's Lexilogus and Thiersch's Grammar supply critical matter in abundance. Creuzer's 'Symbolik und Mythologie,' Hermann and Creuzer's 'Letters on Homer and Hesiod,' Voss, Nitzsch, and K. O. Mueller, may be also studied with advantage, as well as Mr. Thirlwall's 'History of Greece.' See also the 'History of the Literature of Greece,' in the 'Library of Useful Knowledge.'

The principal modern editions of Homer are, those by Clarke and Payne Knight, in this country (the latter having the digammas inserted in what the editor supposes to be their proper places), and abroad, Hayne, Hermann, and Nitzsch (which is as yet incomplete), for the Iliad, Hymns, and Odyssey respectively. Of translations we have Hobbes, Chapman, Pope, and Cowper; but of these Pope's, the best known, is rather an imitation, not at all in the style of the original, than a translation. Perhaps, on the whole, Chapman's is the best. The German translation by Voss is perfectly wonderful as regards accuracy. It is in hexameters, and preserves every sentence and nearly every word.

HOMICIDE, in the English law, signifies the killing of one man by another. Homicide is of three kinds: justifiable, excusable, and felonious. Justifiable homicide is when the death is caused by the performance of an act of unavoidable necessity, where no shadow of blame can be attached to the party killing, as soldiers in action, persons defending their own lives, &c. Excusable homicide is of two kinds, by misadventure, and in self-defence; the first is where a man doing a lawful act, and using proper precautions, unfortunately kills another; the second, where a person in defending himself from an assault of a less serious nature than the second instance of justifiable homicide before mentioned, kills the offender; and this it is often difficult to distinguish from manslaughter, in the legal sense of the word.

Felonious homicide is the offence of murder; for the legal definition of which crime see MURDER.

HOMILY (ὁμιλία), in ecclesiastical writers, is a familiar discourse on a religious subject. In the earliest ages of the church the words *sermon* (λόγος) and *homily* appear to have been used indifferently; but Photius distinguishes the homily from the sermon, as being a familiar conversation, in which the preacher and people interrogated each other.

All the homilies of the Greek and Latin fathers were composed by bishops, for before the fifth century none but bishops were allowed to preach. We have good specimens of this sort of composition extant among the works of Chrysostom, Gregory, and other fathers. The 'Clementine Homilies' are supposed by Le Clerc to have been forged by an Ebionite in the second century. (Lardner's *Credibility*, pt. ii., c. 29.)

In modern use the term 'homily' is applied to a discourse read out of a book, and not composed by the preacher.

In the eighth century a collection of homilies was compiled from the writings of the fathers by Paul the Deacon and Alcuin, at the command of Charlemagne. This collection is called the 'Homiliarium of Charlemagne.'

At the period of the Reformation in England two books of homilies were published by authority, in order to ensure uniformity of doctrine and to supply the defects of some of the clergy. The first book was published in 1547, and consists of twelve discourses, most of which are ascribed to Cranmer; the second, containing twenty-one discourses, supposed to be written by Bishop Jewell, was published in 1562. They were appointed to be read in churches every Sunday unless there were a sermon. These homilies are recommended by the 35th Article of the Church of England as 'containing a godly and wholesome doctrine.' A handsome edition of the homilies has lately been published by the Prayer-Book and Homily Society (London, 1833).

HOMOCERCAL. Fishes with symmetrical forms of tail are thus named by M. Agassiz, in contradistinction to HETEROCERCAL.

HOMŒO'PATHY (a Greek word, ὁμοιοπάθεια, literally 'similar or like state of feeling'), a mode of treating diseases, founded on peculiar doctrines, which were first proposed in 1796 by a German physician named Hahnemann. The homœopathic method consists in the administration of a medicine which is capable of exciting in healthy persons symptoms closely similar to those of the disease which it is desired to cure.

Samuel Hahnemann, born at Meissen in Upper Saxony, in the year 1755, was educated for the medical profession at Leipzig, and soon obtained considerable reputation in his own country for his knowledge of chemistry and of the properties of medicines. He was however no physiologist; he knew nothing of the laws of action of the animal system. While experimenting, in 1790, on the mode of action of Cinchona bark in his own person, he observed that it produced symptoms like those of intermittent fever, the disease for which this medicine is known to be an almost specific remedy. It was this circumstance which led him to adopt the opinions afterwards so zealously promulgated by him in his writings and in his public lectures at Leipzig.

It has been a principle much insisted on by physicians, to endeavour to remove the diseased state of one part of the body by inducing a new action in another, in this endeavour imitating nature herself. This is styled by Hahnemann the 'allopathic method.' He professes however to neglect the efforts of nature, characterizing them as generally inefficacious, and frequently destructive. Again, physicians have been accustomed under some circumstances to palliate symptoms by means known to produce opposite states; thus, to relieve weakness, they would give strengthening and exciting medicines; to remove fullness of blood, they would bleed; acting thus on the principle of 'contraria contrariis curantur.' But Hahnemann denies the utility of this 'antipathic method' also, and maintains that it is never successful against diseases of long standing, except when in the prescriptions employed some homœopathic medicine has been unwittingly included. All remedies which are known to have the power of removing certain diseases act, according to Hahnemann and his followers, on the homœopathic principle: thus quinine, which is used so successfully in the cure of ague, will, they say, produce in a healthy person all the symptoms of that disease; sulphur, which is a specific against scabies, gives rise, when taken internally, to an eruption of pustules on the skin; and vaccine, they suppose, prevents the occurrence of small pox only because it excites a similar disease. Their principle then is 'similia similibus curantur;' and in estimating the resemblance between a disease and the state produced by the medicine, they regard only the external symptoms, and do not consider on what essential internal condition of the body these depend. But even the resemblance between the *apparent* symptoms of the disease and those produced by the substance said to be its homœopathic remedy is, in most cases, very slight. This ground-work of the doctrine is extremely weak.

Hahnemann's explanation of the efficacy of the homœopathic method is ingenious. Two different diseases, he says, cannot destroy each other, for they affect different parts of the system; they will either continue their progress simultaneously, or the weaker will merely be arrested during the continuance of the stronger; while, on the contrary, if the morbid state secondarily excited resemble in its symptoms the original disease, it will affect the same parts of the body, 'and the two, meeting there, will destroy each other.'

A great peculiarity of the homœopathic treatment is the minuteness of the doses in which the medicines are administered. A substance of which other physicians prescribe several grains is given by the homœopathist in the quantity of a decillionth of a grain, or even less. An ordinary form in which the dose is administered is that of a comfit of sugar of the size of a poppy seed impregnated with a very weak solution of the medicine; 'but if the patient is very sensitive, it will be sufficient to let him smell once to a phial containing a comfit of sugar, thus impregnated, of the size of a mustard-seed.' Such doses appear at first sight ridiculously small, but Hahnemann reminds us that since homœopathic medicines produce the same symptoms as the original disease, they must act on the same parts, and hence have far greater power than substances acting on other parts of the body. Moreover he has discovered that his medicines acquire at each division or dilution a new degree of power by the rubbing or shaking which they undergo, 'so that latterly,' he says, 'I have been forced by experience to reduce the number of shakes to two, while I formerly prescribed ten to each dilution.' It is worthy of remark that Hahnemann was a disciple of Mesmer, a believer in animal magnetism, and speaks of the wonderful effects which he has seen produced by a homœopathic dose of Mesmerism, that is to say, by one movement of the hands of the magnetizer along the surface of the body of the patient, from the crown of the head to the soles of the feet.

There can be no doubt that cures have been performed by the Hahnemannic method, but it appears most reasonable to regard these merely as new proofs of how much may be done by the strict regulation of diet, by the powers of nature, and by the wonderful influence of the imagination upon the body. When patients are firmly convinced that they shall be cured, the cessation of nervous pains, particularly those of a hysterical nature, may with more justice be ascribed to the influence of the mind than to the power of infinitesimal doses of medicine.

HOMOGE'NEOUS and **HETEROGE'NEOUS**, terms applied in mathematical language to expressions which have or have not the same number of factors of a given sort. Thus, with respect to x and y, $ax^2+bxy+cx^2$ is homogeneous, but ax^2+by is heterogeneous.

HO'MOLA, HOMOLA TRIBE. The *Homolians*, according to the system of M. Milne Edwards, are the second tribe of the *Apterurous* family of the *Anomurous* crustaceans, and their place is between the *Dromians* and the *Raninians*.

Character of the Tribe.—*Carapace* spiny, and armed with a rostrum. Internal pair of *antennæ* without a pit, and incapable of being bent back upon the front. *Jaw-feet* pediform. *Feet* of the second, third, and fourth pairs, very long; fifth pair very short, and of no service in progression. *Sternal plastron* enlarged. *Claw* terminating the anterior feet composed of two fingers in the ordinary form. *Tarsi* of the three following feet styliform. Posterior feet more or less completely prehensile.

M. Milne Edwards thus divides the tribe into three genera:—

HOMOLIANS having the posterior feet	Subcheliform and exposed; carapace quadrilateral.		Homola.
	Cheliform, and hidden under the lateral parts of the carapace.	Carapace triangular; rostrum very much elongated.	Lithodes.
		Carapace circular; rostrum rudimentary.	Lomis.

Homola. (Leach.)

Carapace longer than wide, nearly quadrilateral; the stomachal region occupying the whole breadth of it anteriorly; and the branchial regions, though not prolonged above the base of the feet, very large; lateral portions of carapace vertical. *Front* narrow, and advancing so as to form a small rostrum; on each side of its base a large conic tooth directed forwards. *Orbits* extremely incomplete, even within, where the articulation of the ocular peduncles is naked; they are scarcely limited without, and are continued with a large oblique and very superficial pit, against which the eyes are applied. *Ocular peduncles* cylindrical and divided into two portions, one internal, slender, and elongated; the other stout, short, and terminated by the eye. *Internal antennæ* not lodged in pits; their basilary joint nearly globular and advancing below the insertion of the ocular peduncles, the two succeeding joints very long, the third, as in the *Brachyura*, supporting two very small multiarticulate filaments. *External antennæ* inserted nearly on the same line as the internal; at their base a large auditory tubercle, which is sometimes extremely projecting; their first joint cylindrical, rather stout, and moderately long; the second slender and very long; the third very short; the terminal filament very long. *Buccal frame* quadrilateral. *External jaw-feet* nearly pediform, their three last joints being large and nearly as long as the two preceding, which are hardly flattened. *Sternal plastron* much resembling that of the *Dromians*, and not containing the genital parts. *Feet* very long; 1st pair terminated by a nearly cylindrical hand, 5th pair raised upon the back and subcheliform. *Abdomen* very wide in the male as well as the female, and composed of 7 distinct joints; in the female the first ring carries a pair of very short appendages; those of the four succeeding segments are of the same form as in the *Brachyura*; the penultimate ring has no vestige of any appendage. The *vulvæ*, instead of occupying a place in the sternal plastron, as in the *Brachyura*, are hollowed in the basilary joint of the third pair of feet. The disposition of the *branchiæ* is equally remarkable; there are fourteen on each side; the first is laid across (en travers) under the base of the succeeding ones, and fixed to the base of the second jaw-foot. But the others are all directed obliquely up, and are fixed to the circumference of the vault of the sides. One is inserted at the ring which carries the jaw-feet of the second pair, two above the base of the external jaw-foot, three on each of the two succeeding rings, and two to the penultimate ring.

Locality, Seas of Europe.

Example, *Homola spinifrons.*—Body covered with yellow hairs; length about 18 lines.

Locality, the Mediterranean Sea.

Homola spinifrons. *a*, left external jaw-foot.'

Homola Cuvierii is the *Hippocarcinus hispidus* of Aldrovandus, also an inhabitant of the Mediterranean Sea.

Lithodes. (Latreille.)

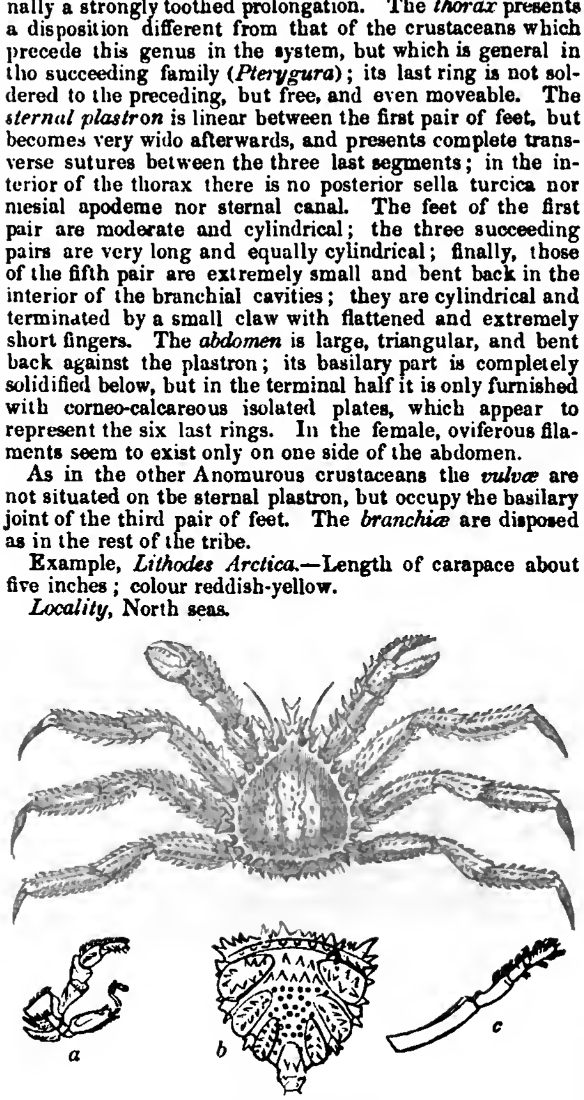
M. Milne Edwards remarks that up to the present time the *Lithodes* have been arranged among the Oxyrhynchi, on account of the form of the rostrum, but he asserts that it is not their place, and that they evidently belong to the *Anomura*. They bear, he says, the greatest analogy to the *Apterura*, and especially to *Homola;* but they establish the passage between those crustaceans and *Birgus*.

Carapace triangular or rather heart-shaped, its upper surface distinctly limited by a thick and spiny border. *Rostrum* horizontal and very long; its base covers the insertion of the eyes and the anterior border of the carapace is very short. No *orbits;* but a stout conic tooth is seen at the place ordinarily occupied by the external angle of those cavities. *Ocular peduncles* very short. *Internal antennæ* inserted far from the mesial line, below and within the eyes; their first joint nearly cylindrical; the two succeeding, of moderate length, and the terminal filaments of the same conformation as in the *Brachyura*. *External antennæ* inserted more backwards and outwards than the preceding; their basilary joint entirely mortised between a prolongation of the lateral border of the buccal frame and the anterior border of the carapace; the second carries a conic tooth externally, the last joint of the peduncle is long and slender, and finally the multiarticulate stem is rather long. The *buccal frame* is not distinct, except laterally, where its bordors are straight. The *external jaw-feet* are pediform, and their second joint, which is stout and short, carries internally a strongly toothed prolongation. The *thorax* presents a disposition different from that of the crustaceans which precede this genus in the system, but which is general in the succeeding family (*Pterygura*); its last ring is not soldered to the preceding, but free, and even moveable. The *sternal plastron* is linear between the first pair of feet, but becomes very wido afterwards, and presents complete transverse sutures between the three last segments; in the interior of the thorax there is no posterior sella turcica nor mesial apodeme nor sternal canal. The feet of the first pair are moderate and cylindrical; the three succeeding pairs are very long and equally cylindrical; finally, those of the fifth pair are extremely small and bent back in the interior of the branchial cavities; they are cylindrical and terminated by a small claw with flattened and extremely short fingers. The *abdomen* is large, triangular, and bent back against the plastron; its basilary part is completely solidified below, but in the terminal half it is only furnished with corneo-calcareous isolated plates, which appear to represent the six last rings. In the female, oviferous filaments seem to exist only on one side of the abdomen.

As in the other Anomurous crustaceans the *vulvæ* are not situated on the sternal plastron, but occupy the basilary joint of the third pair of feet. The *branchiæ* are disposed as in the rest of the tribe.

Example, *Lithodes Arctica*.—Length of carapace about five inches; colour reddish-yellow.

Locality, North seas.



Lithodes Arctica (female).
a, Left external jaw-foot; *b*, abdomen; *c*, foot of the fifth pair.

Lomis. (Milne Edwards.)

M. Milne Edwards remarks that the small crustacean on which he has founded this new genus has been confounded up to the present time with the *Porcellanæ*, to which it, in fact, bears a resemblance in its general form, but from which it differs in many important particulars, such as the conformation of the tail, the antennæ, &c. He gives the following generic character:—

Carapace depressed, narrowed anteriorly and truncated posteriorly, it does not reach beyond the middle of the base of the third pair of feet, and the rest of the dorsal surface of the body is occupied by the base of the abdomen. The *front* is truncated and armed with a small mesial tooth; there are no orbital pits, and the *ocular peduncles* have the form of two great triangular joints which touch each other on their internal edge and carry the eyes at their external angle. The *internal antennæ* aro moderate; their three first joints are cylindrical, and terminate by two small filaments. The *external antennæ* are inserted on the outside of the eyes and nearly on the same line; they are large and terminated by a stout multiarticulate stem furnished with long hairs at its lower border. The *external jaw-feet* are pediform; their third joint has no noticeable dilatation, and the three succeeding joints are very stout. The *sternum* is large, and the last thoracic ring is not soldered to the preceding. The first pair of *feet* are very large, very wide, and extremely depressed; the carpus is as large as the arm and nearly quadrilateral; the claw is stout, short, and nearly horizontal. The three succeeding pair are short, stout, and terminated by a nearly conical joint; the fifth pair are very slender and bent back abovo the others in the branchial cavity. The *abdomen* is very wide but lamellar, bent back below the sternum, as in the *Porcellanæ*, and presents no vestiges of appendages belonging to the penultimate ring.

M. Milne Edwards says that he knows nothing of the manners of these small crustaceans, of which only one species is known, viz. *Lomis hirta* (*Porcellana hirta* of Lamarck). The body above is covered by very short and close-set hairs, and the hands are nearly as large as the carapace.

Locality, supposed to be the seas of Australasia.

HOMO'LOGOUS, a term applied in Euclid to those magnitudes which, being of the same kind, occupy different places in a proportion, one being an extreme, and the other a mean. Thus, if

$$A : B :: C : D;$$

then A and B being of the same kind, and also C and D, but the first pair of a different kind from the second, A and B are homologous, and so are C and D. But if all four be of the same kind, A and B are homologous terms, and also A and C; B and C are homologous, and also B and D.

HOMOLONO'TUS, the name of a group of trilobites, as they are generally called (Palæaderna Dalman); in which the tripartite character of the dorsal crust is almost lost; for which reason Mr. Miller called it Monolobite. Homolonotus Knightii occurs in the Upper Silurian rocks of England, and a similar species at the Cape of Good Hope. (König, *Icones Sectiles;* Mr. Murchison.)

HOMO'PTERA, one of the sections into which the class Insecta is divided. According to Leach, Stephens, and some other authors, the section Homoptera is regarded as an order; but in Latreille's arrangement it forms the second of the two great sections into which the order Hemiptera is divided. The insects of this group are thus characterized by Latreille:—rostrum arising from the lowest part of the head near tho chest; the elytra, almost always tectiform, are of the same consistence throughout, semi-membranous, and sometimes resembling the wings; the three segments of the thorax are blended, and the first is often shorter than the following.

In the typical Homoptera the head is large, broader than long; the eyes are large, and there are ocelli, or simple eyes, between them; the antennæ are minute, composed of but few joints, and terminated by a seta; the rostrum is a slender, jointed process, which, like that of the Hemiptera, lies close to the chest; the legs are of moderate size; the hinder tibiæ are usually spined; the body is convex above and flattish beneath; the wings are semi-membranous; the anterior pair often opaque, sometimes transparent, and always of a uniform texture throughout. The larvæ are active, and resemble the perfect insect, excepting that they possess no wings; the pupæ are also active, but possess rudimentary wings.

These insects feed upon vegetable juices. The females are furnished with an ovipositor, composed of three denticulated blade-like processes, which are lodged in a groove in the abdomen. By means of this ovipositor they pierce holes in vegetables, in which they deposit their eggs. Many Homopterous insects possess the power of leaping by means of their posterior pair of legs.

The section or order Homoptera may be divided into the following families, most of which aro analogous to Linnæan genera, or nearly so.

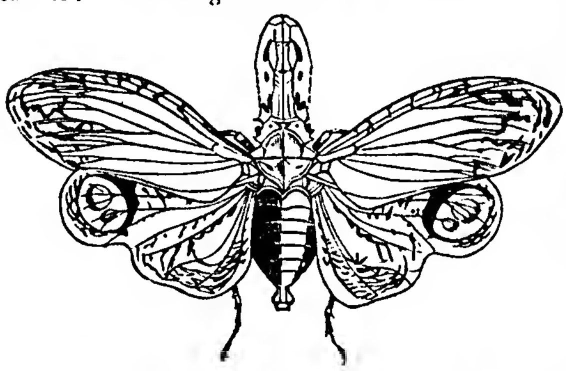
Family 1. *Cicadiidæ* (Leach) comprises those species in which the antennæ are six-jointed, where there are three ocelli on the upper surface of the head, and where the tarsi are three-jointed.

In these insects the wings are usually transparent, and have dark nervures; the males are furnished with an apparatus, situated at the base of the abdomen on each side, by means of which they create a monotonous musical sound. They are usually of large size (some measuring as much as seven inches in width when the wings are expanded), and for the most part inhabit hot countries. But one species is found in England, the *Cicada hæmatodes* of authors, an insect about two inches in width, with transparent wings having black nervures, and their basal portion red; the anterior margin of the fore wing is also red; the body is black, but with the margin of each segment red; the legs are red, varied with black. This, which is the largest Homopterous insect found in England, is not uncommonly met with in the New Forest, in Hampshire.

Family 2. *Fulgoridæ* (Stephens). Antennæ three-jointed, inserted beneath the eyes; ocelli two in number; tarsi three-jointed.

The insects of this family have most generally the fore part of the head produced, and varying in form according to the species. They do not possess the power of creating a sound, nor do those of the following families.

The above two families constitute the section *Cicadariæ* of the 'Règne Animal.' The *Fulgoria laternaria* (Linn.) will serve as an illustration of the second. This curious insect is an inhabitant of Brazil. It is about five inches wide, and two and a half inches long, of a yellowish colour mottled with black, and having a large ocellated spot on each of the under wings.



Fulgoria laternaria, half the natural size.

Family 3. *Cercopidæ* (Leach). The antennæ three-jointed; tarsus three-jointed; ocelli two in number; antennæ situated between the eyes. [CICADELLA.]*

Family 4. *Psyllidæ* (Stephens). Antennæ with ten or eleven joints, of which the last is terminated by two setæ; legs formed for leaping; tarsi two-jointed; both sexes winged.

Family 5. *Thripidæ* (Stephens). Antennæ eight-jointed; rostrum minute; tarsi terminated by a vesicular joint, and without claws.

Family 6. *Aphidæ* (Leach). Tarsi two-jointed; antennæ with seven joints; rostrum, in both sexes, with three distinct joints; females generally apterous. [APHIS.]

Family 7. *Coccidæ* (Leach), *Gallinsecta* (Latreille). Tarsus with but one joint and one claw; the male sex destitute of rostrum, and possessing but two wings; the female apterous, and furnished with a rostrum; antennæ generally eleven-jointed. [GALLINSECTA.]

HONDEKOETER, the namo of a celebrated family of Dutch painters, of whom the founder, Egidius or Gilles Hondekoeter, born at Utrecht in 1583, was the son of a marquis of Westerloo, a wealthy landowner in Brazil, who was obliged by the persecutions of the Inquisition to withdraw from his own country. He painted landscapes in the manner of Savery and Vinckenboems, in which he introduced fowls of different kinds, highly finished. His son Gysbrecht, born 1613 at Utrecht, was a skilful painter of domestic poultry, but was far surpassed by his son Michael, born at Utrecht in 1636. Till the age of seventeen Michael was carefully instructed by his father, on whose death in 1653 he studied for a time under John Baptist Weenix, his uncle. His representations of cocks, hens, ducks, peacocks, &c., excel in truth, life, elegance of design, and delicacy of execution, the works of all other painters of such subjects. His genuine pictures are held in high estimation, and fetch great prices. He died in 1695, aged 59.

HONDURAS. [CENTRAL AMERICA.]

HONEY is a fluid or semi-fluid substance, the materials of which are collected by different kinds of bees, in Europe chiefly by the *apis mellifica*, or hive-bee, and solely by the neuter or working bees, from the nectariferous glands in the cup or chalice of flowers. It cannot be said to be a purely vegetable production, for after being collected by the proboscis of the insect it is transmitted to that distension of the œsophagus termed the crop, sucking-stomach, or honey-bag, where it is elaborated, and again disgorged, to be deposited in the cell of the honey-comb. It undergoes less change when the bees are very young, remaining nearly white, and is then denominated *virgin* honey. At all times it retains qualities derived from the kind of plant whence it has been procured, as is manifest not only by the peculiar odour of the honey, but by the effects which follow the use of honey obtained from certain plants, chiefly of the subtribe *Rhodoraceæ*, such as the Azalea, rhododendron, kalmia, &c., which yield a honey frequently poisonous, while that from the genus *Erica* (termed heather-honey), and most *labiate* plants, is wholesome. (For an account of the plants of Hymettus, see Chandler's 'Travels,' chap. xxvii., and Hobhouse's 'Letters from Albania,' letter xxiv.)

The honey of the common bee is at first generally white, inclining to yellow, but by age it becomes of a deeper colour and greater consistence, and of a more acrid taste. The honey of Surinam and Cayenne, collected by the apis amalthea, is red. The apis unicolor of Madagascar produces a greenish honey collected from the Mimosa heterophylla and Weinmannia glabra, of the most exquisite flavour. Honey is of different degrees of consistence: that of Mahon, of Hymettus, and of the Bermudas is liquid; that of England is more or less disposed to become nearly solid.

Honey is sweet, faintly aromatic, granular, soluble in water, and capable of undergoing the vinous fermentation, and so yielding an intoxicating drink called hydromel, metheglin, or mead. Honey consists of an uncrystallizable portion, and a portion which crystallizes in very white grains. The former is soluble in alcohol, the latter not, and is regarded as a sort of *Mannite*, or manna sugar, which, by the action of nitric acid, can be converted into oxalic acid, like the sugar of the sugar-cane. When old it probably contains some free acid. Honey is sometimes adulterated with flour, from which and other impurities it may be freed by diffusing it through cold water. Honey is certainly nutritive, but it cannot be employed to any great extent, since, if taken in considerable quantity it excites the action of the bowels, and is gently laxative. Its effects in this way will be greater in proportion to its age and acridity, and less or scarcely appreciable if largely diluted with water. In this last state it is rather demulcent, emollient, and refrigerant, and hence forms a good drink in fever and other inflammatory complaints, but it should not be taken if there be much gastric or intestinal irritation. It is used likewise in catarrhs, and when drank warm is considered to be expectorant. Along with vinegar it forms a good gargle in slight cases of sore throat, and combined with borax a most efficacious application in aphthæ of the mouth and throat. Owing to idiosyncracy in some individuals honey causes great uneasiness, or even severe suffering, but it is most likely that such cases originate in the kind of plant from which the honey is collected, or in the measures used to destroy the bees. Smoking them with sulphur must be hurtful, from forming sulphurous acid gas, which may be absorbed by the honey. Humanity as well as economy demands that other means should be employed to procure the honey without sacrificing the life of the industrious insects which collect it. (See the plans of Nutt and Taylor in Taylor's *Bee-keeper's Manual.*)

HONEYSUCKLE. [CAPRIFOLIUM.]

HONFLEUR, a town in France, in the department of Calvados, in 49° 25′ N. lat. and 0° 13′ E. long., 99 miles in a

* For the word *Hymenoptera*, in the second line of the article CICADELLA, that of *Hemiptera* should be substituted

straight line north-west or west-north-west of Paris, or 117 miles by the road through Pontoise and Rouen. It is on the left bank of the Seine, very near the mouth of that river. This town is built on the slope of a hill, the crest of which is covered with wood, and crowned with a chapel which the sailors hold in great veneration. The streets are irregularly laid out and dirty, and the port will not contain more than thirty vessels. There are two lighthouses. There are two churches: the principal one is built of wood. The population in 1831 was 8409 for the town, or 8888 for the whole commune. The inhabitants are engaged in the cod, whiting, herring, and mackerel fisheries. Constant communication is kept up with Le Hâvre by steam-boats. Hosiery, copperas, oil of vitriol, and iron wares are manufactured, and ships are built. Considerable trade is carried on with Europe and America.

HONG MERCHANTS. [CANTON.]

HONITON, a parliamentary borough, market-town, and parish in the hundred of Axminster and county of Devon, 148 miles west-south-west from London. The town lies on the great western road from London to Exeter, and is pleasantly situated on a rising ground to tho south of the river Otter, which commands a fine view of the surrounding country. It consists principally of one broad handsome street, running from east to west, and another of less length, at right angles to it. Through the former flows a small transparent stream, from which the inhabitants are supplied by means of a dipping-place opposite almost every door. (Polwhele's *Devonshire*, vol. ii., p. 278.) The buildings are mostly modern, and covered with slate, and the streets are well paved and lighted. The church, distant about half a mile from the town, was originally a small chapel for mendicant friars. The screen which separates the chancel from the nave is of curious workmanship, and was erected about the year 1482 by Courtenay, bishop of Exeter. The living is a rectory in tho diocese of Exeter, and in the patronage of the earl of Devon, with an average net income of 886*l*. Honiton, though an antient borough by prescription, was only twice represented in parliament prior to the reign of Charles I. Since that time it has roturned two members.

The government of the town is vested in a portreeve and bailiff, who are chosen annually at the court of the lord of the manor. The principal manufacture is lace, of which considerable quantities are annually sent to the metropolis. The population of the borough and parish in 1831 was 3509. The education of the poorer classes is partly provided for by a free-school for boys and a school of industry for girls, the latter of which is supported by the subscriptions of females.

(*Parliamentary Papers*, &c.)

HONO'RIUS, son of Theodosius the Great, and younger brother of Arcadius, was born at Constantinople, A.D. 384. After the death of his father in 395 Honorius had for his share the Empiro of the West, under the guardianship of Stilichon, a distinguisbed general of tho Imperial armies. Honorius fixed his residence at Milan. For several years after Stilichon was the real sovereign of the West; and he also endeavoured to extend his sway over the territories of Arcadius in the East, under pretence of defending them against the Goths. He gave his daughter Maria in marriage to Honorius, and recovered the province of Africa, which had revolted. About the year 400 the Goths and the Huns, under Alaric and Radagaisus, invaded Italy, but were repelled by Stilichon. In the year 402 Alaric came again into Italy, and spread alarm as far as Rome, when Stilichon hastily collected an army, with which he met Alaric at Pollentia, on the banks of the Tanaro, completely defeated him, and obliged him to recross the Noric Alps. After this victory Honorius repaired to Rome with Stilichon, where they were both received with great applause. On that occasion Honorius abolished by a decree the fights of gladiators, and he also forbade, under penalty of death, all sacrifices and offerings to the Pagan gods, and ordered their statues to be destroyed. In the year 404 Honorius left Rome for Ravenna, where he established his court, making it the seat of the empire, like another Rome, in consequence of which the province in which Ravenna is situated assumed the name of Romania, Romaniola, and afterwards Romagna, which it retains to this day. In the following year Radagaisus again invaded Italy with a large force of barbarians, but ho was completely defeated and put to death by Stilichon, in the mountains near Fesulæ, in Etruria. In the next year the Vandals, the Alani, the Alemanni, and other barbarians, crossed the Rhine, and invaded Gaul. A soldier named Constantine revolted in Britain, usurped the Imperial power, and, having passed over into Gaul, established his dominion over part of that country, and was acknowledged by Honorius as his colleague, with the title of Augustus. Stilichon now began to be suspected of having an understanding with the barbarians, and especially with Alaric, to whom he advised the emperor to pay a tribute of 4000 pounds weight of gold. Honorius gave an order for his death, which was executed at Ravenna in August of the year 408. Historians are divided concerning the fact of Stilichon's treason: Zosimus and the poet Claudianus consider it as a calumny. His death however was fatal to tho empire, of which he was the only remaining support. Alaric again invaded Italy, besieged Rome, and at last took it, and proclaimed the prefect Attalus emperor. Honorius meantime remained inactive and shut up within Ravenna. [ALARIC.] The continual indecision and bad faith of Honorius, or rather of his favourites, brought Alaric again before Rome, which was this time plundered, A.D. 410. After Alaric's death his son Ataulphus married Placidia, sister of Honorius, and took possession of Spain. The rest of the reign of Honorius was a succession of calamities. The Empire of the West was now falling to pieces on every side; and in the midst of the universal ruin Honorius died of the dropsy at Ravenna, in August, 423, leaving no issue.

Coin of Honorius.

British Museum. Actual Size. Gold. Weight, 65¼ grains.

HONO'RIUS I., a native of Campania, succeeded Boniface V. as bishop of Rome, A.D. 626, with the sanction of the Imperial Exarch of Ravenna. In 627 he sent the pallium to the archbishops of York and Canterbury, but he found great opposition among the Welsh clergy, who resisted the metropolitan authority assumed by these newly-appointed prelates, and the supremacy claimed by the bishops of Rome. Those members of the more antient British church differed also from Rome in their manner of computing Easter. (Pinkerton's *Enquiry into the Early History of Scotland*, edition of 1814, vol. ii., p. 265; Usher; Geoffrey of Monmouth.) Honorius held a correspondence with Sergius, patriarch of Constantinople, who favoured the doctrine of the Monothelites concerning the singleness of the will in Jesus Christ. [EUTYCHIANS.] Two letters of Honorius to Sergius, which are preserved, contain passages apparently in favour of Monothelism, at the same time recommending not to dwell too much upon those subtle distinctions, for fear of creating scandal and schism. In the sixth council of Constantinople the doctrine of Honorius on this subject was condemned as heretical. Bartoli, in his 'Apologia pro Honorio,' Baronius and others, have undertaken to refute the charge of Monothelism brought against Honorius. Fabricius, in his 'Bibliotheca Græca,' gives an accurate account of those writers who have treated of the history of Monothelism. Honorius died A.D. 638, and was succeeded by Severinus.

HONORIUS II., Cardinal Lamberto, bishop of Ostia, was elected by the cardinals, A.D. 1124, after the death of Calixtus II., while most of the bishops assembled at Romo elected Tebaldus, cardinal of Santa Anastasia. Honorius was supported by the powerful family of the Frangipani; and the people being divided in opinion, Tebaldus, to avoid further strife, waived his claim, and Honorius himself is said to have expressed doubts concerning the validity of his own election until it was confirmed by the clergy and the people of Rome, which was consequently done. He refused the investiture of the duchies of Apulia and Calabria to Roger, count of Sicily; and Roger having besieged the pope within Benevento, Honorius excommunicated him; but afterwards peace was concluded between them, and Honorius granted the investiture. He also confirmed the election of Lotharius as king of Italy, and excommunicated his rival Conrad. Honorius died at Ostia in 1130. His death was followed by a schism between two rival candidates, Anacletus and Innocent II.

HONORIUS III., Cardinal Cencio Savelli, succeeded Innocent III. in 1216. He employed himself zealously, but with no great success, in restoring peace among the Italian cities, which, having become independent of the German empire since the peace of Constance, seemed to have no other notion of enjoying their independence hut by waging war against one another. Another object of the pope's efforts was that of persuading the Christian princes, and especially Frederick II., to undertake a great crusade against the Mussulmans in the East. Frederick promised everything, in order to be crowned, which ceremony was performed by the pope at Rome on the 22nd of November, 1220; but afterwards Frederick, instead of proceeding to Palestine, tarried in Apulia and Sicily, in order to reduce those countries to complete submission. Honorius was meantime frequently at variance with the nobles and people of Rome, who drove him repeatedly from that city. After ten years of a very troubled pontificate Honorius died in March, 1227, and was succeeded by Gregory IX.

HONORIUS IV., Cardinal Giacomo Savelli, succeeded Martin IV. in 1285. He showed great zeal for the cause of Charles of Anjou against the Aragonese, who had occupied Sicily; and he even preached a crusade against the latter, qualifying it as a 'holy war.' The Aragonese however stood firm, and defeated the French on several occasions. Honorius died in April, 1287, and is said to have contrived, during his short pontificate, to enrich his family considerably. He was succeeded by Nicholas IV.

HOOD, ROBIN, a personage very famous in our popular poetry, is supposed to have lived in the reign of Richard I. His epitaph, said to have been inscribed on his tombstone near the nunnery of Kirklees in Yorkshire, and first printed in Thoresby's 'Ducatus Leodensis' (1714), the genuineness of which however has been doubted, makes him to have died '24 Kal. Dekembris' (perhaps meaning the 24th of December), 1247. Other copies have '14 Kal. Dekembris,' which would be properly the 18th of November. He was the most distinguished in his time of those numerous outlaws who under the tyrannical government of the early Norman kings lived in bands in all the great forests, and combined a sort of championship of the cause of the old national independence with the practice of deer-shooting and robbery. The chief residence of Robin Hood and his followers, as is well known, was the forest of Shirewood, or Sherwood, in Nottinghamshire; but he is said to have also frequented Barnsdale in Yorkshire, and, according to some accounts, Plumpton Park in Cumberland. 'The said Robert,' says Stow, 'entertained an hundred tall men and good archers with such spoils and thefts as he got, upon whom four hundred (were they never so strong) durst not give the onset. He suffered no woman to be oppressed, violated, or otherwise molested: poor men's goods he spared, abundantly relieving them with that which by theft he got from abbeys and the houses of rich carles: whom Major (the Scottish historian) blameth for his rapine and theft, but of all thieves he affirmeth him to be the prince, and the most gentle thief.' He seems to have been as famous in Scotland as in England, as is evinced by the honourable mention made of him both by Major and hy his predecessor Fordun. 'The personal courage of this celebrated outlaw,' Bishop Percy observes, 'his skill in archery, his humanity, and especially his levelling principle of taking from the rich and giving to the poor, have in all ages rendered him the favourite of the common people.' His exploits appear to have been a common subject of popular song, at least from the time of Edward III., though most of the numerous ballads still extant in which he is celebrated are probably of more recent origin, and, at least in the shape in which we now possess them, are certainly comparatively modern. Of these pieces the most complete collection is that published by Ritson under the title of 'Robin Hood; a collection of all the antient poems, songs, and hallads now extant, relating to that celebrated English outlaw,' 8vo., Lon., 1795. Prefixed to this collection are 'historical anecdotes' of the life of Robin Hood, which consist of an accumulation of all the notices respecting the outlaw that the compiler's reading had discovered in manuscripts or printed books. It cannot he said however that much, or indeed any thing, has been added to the real facts of his history by this investigation, if it deserve that name. Nothing can be more uncritical than the manner in which the writer jumbles together all sorts of relations about his hero, and builds his chief conclusions on the most unauthoritative testimonies. A source of information upon which he greatly relies is a MS. in the Sloane Collection in the British Museum, which as evidence really cannot be considered to be entitled to more regard than any other of the various traditionary histories of Rohin Hood, all of which, as well as it, have indisputably been put together some centuries after the date of the events which they profess to detail. But even this manuscript does not contain what Ritson solemnly sets down as an established fact in his opening paragraph, that Robin Hood's true name was Robert Fitz-ooth, and that he had some claim by descent to the earldom of Huntingdon. It is true he is styled Earl of Huntingdon on the epitaph already mentioned, and some of the old Latin chroniclers speak of him as of noble lineage; but the account here gravely given of his name and genealogy is founded upon nothing better than a pedigree drawn out hy Stukely and published in the 'Palæographia Britannica,' No. 2 (1746), which appears to be a mere joke of that antiquary. It is as wholly unsupported hy any sort of evidence as any pedigree in the Greek or Roman mythology. The ballads about Robin Hood usually describe him as a yeoman. One of these hallads tells us that he was born in the town of Locksley, or Laxley, in Nottinghamshire, and such is also the account of the Sloane MS., which moreover assigns his birth to about the year 1160. Ritson therefore sets down this as an ascertained fact; but he at the same time admits that no place so named is now known either in Nottinghamshire or Yorkshire. Of Robin Hood's followers the most celebrated were, Little John (whose surname is traditionally said to have heen Nailor)); his chaplain, called Friar Tuck, whom some will have to have heen a real monk; and his paramour named Marian. This famous outlaw and archer appears to have been subsequent in date to his countrymen Adam Bell, Clym of the Clough, and William of Cloudesly, who haunted Eaglewood Forest, near Carlisle, and whose exploits, of the same description with his, have been also a favourite theme of our ballad minstrelsy. (See, besides Ritson, Percy's *Reliques of Antient English Poetry*, 4th edit., vol. i., pp. 81 and 154; and Hawkins's *History of Music*, vol. iii., p. 410.)

HOOD, SAMUEL, VISCOUNT, was born Dec. 12, 1724, at Butley in Somersetshire, of which parish his father was the incumbent. He was hrought up to the navy and after passing with credit through the inferior ranks of the service, was appointed in 1757 to command the Antelope, 50 guns, in which he took a French 50-gun ship. In 1759, in the Vestal, 32 guns, he was again successful in capturing the Bellona, a French frigate of equal force. He served in the Mediterranean, under Sir Charles Saunders, till the end of the war in 1763, and was appointed to command on the Boston station in 1768. In 1778 his services were rewarded with a baronetcy. In 1780 he was promoted to the rank of rear-admiral, and sailed with a squadron to the West Indies to join Sir George Rodney. Though only second in command, Hood found several opportunities to display his talents. On the 28th of April, 1781, he encountered a superior French fleet under the Comte de Grasse, who, having the advantage of the wind, baffled the English admiral's attempts to bring him to a close and decisive engagement. By Rodney's departure to England at the end of July, Hood succeeded to the command of the fleet. The events of the war called him almost immediately to America. He fought another indecisive action with De Grasse off the mouth of the Chesapeak, but was unable to prevent the blockade of that bay, and the consequent surrender of the British army. [CORNWALLIS.] In January, 1782, the French invaded the island of St. Christopher. Hood hastened to relieve it; and having induced De Grasse, who lay in the road of Basse-terre with a considerably superior fleet, to sail out and offer battle, January 25, he quietly slipped into the vacant anchorage, and maintained his position against repeated efforts to dislodge him. But ho was unahle to prevent the surrender of the island, which took place on the 13th of February; and on the same night he stood out to sea. It was his desire to preserve his fleet uninjured until Rodney, who was daily expected, should arrive with reinforcements, rather than encounter a premature action with a superior enemy; and so well was the manœuvre executed, that he passed undiscovered within five miles of the enemy. His conduct in the whole of this affair has been warmly applauded hy naval critics. For the following transactions see RODNEY. The brunt of the action of the 9th of April fell on the van division, which Hood commanded: his own ship, the Barfleur, had at one time seven, and generally three, antagonists. On the great day of the 12th his conduct was equally distinguished. For these services he was created an Irish peer by the title of Baron Hood of Catherington. After this battle Rodney returned finally to England, leaving Lord Hood again in the chief command, which he retained till the peace of 1783. In the memorable Westminster election of 1784 Lord Hood opposed Fox, and was returned at the head of the poll. He lost his seat on being made a lord of the admiralty, in 1788, but was re-elected in 1790. In 1793 he was appointed to command the Mediterranean fleet. An arduous responsibility, both civil and military, devolved on him, in consequence of the surrender of Toulon to the British fleet by the French Royalists. After a long siege the town was pronounced untenable [BONAPARTE], and evacuated December 18. On this occasion a severe injury was done to the French navy by burning the arsenal, dock-yard, and fifteen ships of war; in addition to which eight were carried away. Early in 1794 Lord Hood applied himself to the expulsion of the French from Corsica, which was accomplished chiefly by the astonishing exertions of the British sailors on shore. These were most signally displayed in the capture of Bastia [NELSON], for which Lord Hood received the thanks of both houses of parliament. His health being much impaired, he returned to England at the close of the year, and was not again employed in active service. In 1796 he was appointed governor of Greenwich Hospital, and raised to the English peerage by the title of Viscount Hood of Whitley. He afterwards received the Grand Cross of the Bath. He died at Bath, in his ninety-second year, June 27, 1816. His professional character has been thus given:—'To great bravery he united great seamanship: he possessed at the same time a certain promptitude of decision, coupled with extraordinary coolness, skill, and judgment. These qualities justly entitled him to the confidence of the public, which he uniformly possessed; while all under his authority yielded a ready obedience to a commander, who, when necessary, always appeared foremost in danger, but never risked either ships or men except for the attainment of some great object. (*Obituary, Naval Chronicle.*)

HOOD, ALEXANDER, VISCOUNT BRIDPORT, younger brother of the above, was also brought up to the navy, and also found many opportunities of signalising his skill, activity, and bravery, in the lower ranks of his profession. He was made rear-admiral in 1780, and in 1782 sailed as second in command of the fleet sent under Lord Howe to relieve Gibraltar. [HOWE.] He held the same rank in the Channel fleet, under the same commander, in 1794; and bore a distinguished part in the great victory of the 1st of June. In 1795 he engaged a French fleet off L'Orient, and took three ships of the line; and in the following year, on Lord Howe's resignation, he was appointed to the command of the Channel fleet, which he held till April, 1800. He was successively raised to the Irish and English peerage by the titles of Baron and Viscount Bridport, the last creation June 10, 1801. Lord Bridport died at Bath, May 3, 1814. The title is now extinct.

HOOD, SIR SAMUEL, VICE-ADMIRAL, who also was elected M.P. for Westminster in 1806, is not to be confounded with Lord Hood, his namesake and cousin. He was in Rodney's battle of the 12th of April, served in the Mediterranean under Lord Hood in the Juno frigate, and distinguished himself at Toulon and in the reduction of Corsica. Being promoted to the Zealous, 74, he was engaged in the battle of the Nile, and otherwise was honourably employed till the peace of 1802. In 1803, being sent to command on the Leeward Island station, he captured Tobago and the Dutch settlements in Guiana. For these services he received the order of the Bath. He lost his arm off Rochefort, in 1806, in an action in which he captured three French frigates; but was again engaged in the expedition against Copenhagen in 1807. He was afterwards appointed to the chief command in India, where he died in 1814, much honoured, regretted, and beloved. He was an admirable officer, cool and prudent, as well as fearless, possessed of great professional skill, ready resources, and a more than common share of scientific knowledge.

HOOD, CAPT. ALEXANDER, brother of the above, another brave and meritorious officer, was killed in command of the Mars, in action with the French 74 L'Hercule, which was captured April 21, 1798.

HOOFT, PETER CORNELIUS, one of the most eminent poets and prose writers of Holland, was born on the 16th of March, 1581, at Amsterdam, where his father was an eminent burghermaster. After studying at the high-school at Leyden he travelled to Italy, the study of whose literature and poetry chiefly occupied him during his stay there. On his return, in 1602, after an absence of three years, he published his tragedy of 'Granida,' which, for elegance and harmony of diction, is still considered one of the choicest specimens of the Dutch language. Thus he may be said to have polished his native idiom all at once, and to have refined it, from the harshness and stiffness in which he found it, into such melodiousness and flexibility, that he left others more to imitate than to improve upon. He composed several other tragedies, and may be considered in some degree as the founder of the Dutch stage. These pieces, like those of his great contemporary Vondel, are all on the Greek model, and interspersed with choruses. But it is in his lesser productions, his Minnedigte, or amatory compositions, that Hooft displays most originality. Many of these are replete with Anacreontic playfulness, naïveté, and elegance. Few who have been eminent as poets have obtained anything like equal celebrity as prose writers: but this distinction belongs to Hooft, for he succeeded in the still more difficult task of establishing a correct and harmonious style of prose, of which his 'History of the Netherlands' is justly esteemed a model, remarkable both for its purity and its vigour. Hooft was twice married; his first wife died in 1624, his second survived him. In her society and that of his numerous friends the last twenty years of his life were passed in lettered ease and enjoyment. His château at Muiden was the rendezvous of all who were distinguished for talents. He died May 21st, 1647.

HOOGE, PETER DE, was born about 1643, but the place of his birth is uncertain, as well as the master under whom he studied, though some say it was Berghem. At all events it is evident from his works that he had studied in some good school. 'His pictures,' says a profound judge (Dr. Waagen), 'are a striking proof that an artist has but to produce something excellent, even in a lower department of the art, in order to make his works highly attractive. For the actions in which his persons are engaged are in general very indifferent, the faces monotonous and vacant, and the execution often careless; but then he understands how to represent the effects of the light of the sun in the most marvellous force and clearness, and to avail himself, with the finest tact, of all the advantages of his art by soft gradations and striking contrasts.' His pictures, of which there are some capital specimens in England, sell at high prices.

HOOGEVEEN, HENRY, was born at Leyden in January, A.D. 1712. His parents, who were in humble circumstances, sent him to the gymnasium in his native town, where, like many other persons who have distinguished themselves in after-life, he did not at first make much progress in his studies. But as he advanced to maturity, his merit became apparent, and he was appointed at the age of twenty co-director of the school of Gorinchem, and in the following year (1733) was placed at the head of the gymnasium at Woerden. He filled successively the office of rector at the gymnasiums of Kuilenburg, Breda, Dort, and Delft, at the last of which places he died in 1791.

The principal work of Hoogeveen is a treatise on the Greek Particles (2 vols. 4to., Leyd., 1769), of which an abridgment was made by Schütz (Leip., 1806). He also published an edition of Viger on the Greek Particles, with numerous Notes; but neither this work nor his treatise on the Greek Particles gives us a high opinion of his scholarship. A useful work of Hoogeveen, entitled 'Dictionarium Analogicum Linguæ Græcæ,' was published after his death at Cambridge, in 1800. This dictionary is merely a list of the words in the Greek language, arranged in alphabetical order, according to their final letters. All words with the same termination of course come together, and thus a comparison can be instituted between them, which often leads to valuable etymological results.

HOOGLY. [CALCUTTA; HINDUSTAN.]

HOOKE, NATHANIEL, died in 1764. We are ignorant of the place and time of his birth. He was a Roman Catholic, enjoyed the friendship of Pope, and was intimate with most of his eminent literary contemporaries.

He is said to have lost his fortune in the South Sea scheme.

The work by which Hooke is principally known is entitled 'The Roman History, from the Building of Romo to the Ruin of the Commonwealth,' which was originally published in 4 vols. 4to., 1733—1771, and has since been frequently reprinted. This work is little else than a translation of the classical writers on Roman history; and in those parts which relate to the contests between the Patricians and Plebeians the author defends the cause of the latter with as much partiality as Middleton, in his 'Life of Cicero,' had supported the side of the former. Hooke also published a work on the Roman senate in answer to Dr. Middleton's and Dr. Chapman's treatises on the same subject, 1758; and translated from the French the 'Life of Fenelon,' 1723, and Ramsay's 'Travels of Cyrus,' 1739.

HOOKE, ROBERT, was born July 18, 1635, at Freshwater, in the Isle of Wight, of which parish his father was then minister. After leaving Westminster School, where he had been placed under the care of Dr. Busby, he entered Christ Church, Oxford, in the year 1653; and shortly afterwards, having been introduced to the Philosophical Society of Oxford, we learn that he was engaged to assist Dr. Wallis in his chemical experiments, and that he subsequently served Mr. Robert Boyle in a similar capacity. In 1662 he was appointed curator of experiments to the Royal Society; and when that body was incorporated by charter the following year, Mr. Hooke was one of those Fellows who were first nominated by the council. (Thomson's *Hist. of the Royal Society*, appendix iv.) In 1664 he succeeded Dr. Dacres as professor of geometry in Gresham College; and two years after, having produced a plan for rebuilding the city of London, which had been recently destroyed by fire, he received the appointment of city surveyor, and from the emoluments of that office he subsequently acquired considerable wealth. (Ward's *Lives of the Gresham Professors*, London, 1740, fol.) In 1668, Hevelius having sent a copy of his 'Cometographia' to Mr. Hooke, the latter, in return, sent Hevelius a description of his new dioptric telescope, which led to a dispute wherein several of the members of the Royal Society afterwards became involved. [HEVELIUS.] In 1677 he succeeded Oldenburg as secretary to the Society. In 1691 he was created Doctor of Physic, by a warrant from Archbishop Tillotson. He died at Gresham College in 1702, in his sixty-eighth year, exhausted by long continued and meritorious exertions in the cause of science. His funeral was attended by all the members of the Royal Society, and his remains were interred in the church of St. Helen, Bishopgate Street. In his person Hooke was short of stature, thin, and crooked. He seldom retired to bed till two or three o'clock in the morning, and frequently pursued his studies during the whole night. His inventive faculty was surprisingly great, but he was chiefly characterized by his mechanical turn and his great sagacity in discovering the general laws of phenomena, in proof of which it will be sufficient to give the following extract from a paper communicated by Dr. Hooke in 1674 (*Phil. Trans.*, No. 101, p. 12), entitled 'An Attempt to prove the Motion of the Earth from Observation,' wherein he says 'he will explain a system of the world differing from any yet known, but answering in all things to the common rules of mechanical motions, which system depends upon three suppositions. 1. That all celestial bodies whatsoever have an attraction or gravitating power towards their own centres, whereby they attract not only their own parts and keep them from flying from them (as we may observe the earth to do), but also all other celestial bodies that are within the sphere of their activity. 2. That all bodies whatsoever that are put into a direct and simple motion will so continue to move forward in a straight line till they are by some more effectual power deflected and bent into a motion that describes some curved line. 3. That these attractive powers are so much the more powerful in operating, by how much nearer the body wrought upon is to their own centres.' 'This,' observes Mr. Barlow (*Ency. Metro.*, art. 'Astronomy'), 'was a very precise enunciation of a proper philosophical theory.' The works left by Dr. Hooke are too numerous to mention here; but the reader will find a complete list of those published during his lifetime, and also of his posthumous works, in Ward's 'Lives of the Gresham Professors.'

HOOKER, otherwise VOWELL, JOHN, an English historian, born at Exeter about 1524. His father, Robert Hooker, was mayor of that city in 1529. John Hooker was bred at Oxford, but whether in Exeter or Corpus Christi College, Wood was uncertain. He afterwards travelled in Germany, and studied law at Cologne. Soon after his return to England in 1554, he was made chamberlain of his native city, being the first person who held that office. He was subsequently sent into Ireland upon the affairs of Sir Peter Carew, and was elected burgess for Athenry in the parliament of 1568. In 1571 he represented Exeter in the parliament of England. His printed works were: 1. 'The Order and Usage of keeping of the Parliaments in England,' 4to., London, 1572; written for the purpose of regulating and conducting the proceedings of the parliament of Ireland. 2. 'The Events of Comets or Blazing Stars made upon the Sight of the Comet Pagania, which appeared in November and December, 1577,' 4to., Lond., 1577. 3. 'The Description of the Cittie of Excester,' 4to. 4. 'A Pamphlet of the Offices and Duties of everie particular sworne Officer of the Cittie of Excester,' 4to., London, 1584. 5. 'A Catalogue of the Bishops of Excester,' 4to., London, 1584. The three last articles were reprinted together at Exeter, 4to., 1765. Hooker was also the principal editor of Holinshed's 'Chronicles,' in 1586, which he greatly augmented and continued; more particularly in what related to Ireland. He also added to Holinshed a translation of Giraldus Cambrensis. He died in 1601, and was buried in the cathedral of Exeter.

(Wood, *Ath. Ox.*, last edition, vol. i., p. 713; Herbert's *Typogr. Antiq.*; Prince's *Worthies of Devon;* Tanner, *Bibl. Brit. Hib.*)

HOOKER, RICHARD, was born at Heavytree, near Exeter, about A.D. 1553, according to Walton, or about Easter, 1554, according to Wood. By the kindness of his uncle, John Hooker, chamberlain of Exeter, he obtained a better education at school than his parents could have afforded; and he was afterwards introduced by the same relative to the notice of Bishop Jewel, who procured him, in 1567, a clerkship in Corpus Christi College, Oxford. In December, 1573, he became a scholar of that college, and a fellow and master of arts in 1577. In 1579 he was appointed lecturer on Hebrew in the university, and in October of the same year he was expelled his college, with Dr. John Reynolds, and three other Fellows, but restored the same month. In about two years he took orders, and was appointed to preach at Paul's Cross. On this occasion he lodged with Mr. John Churchman, whose daughter Joan he married in the following year. 'This lady,' Izaak Walton says, 'brought him neither beauty nor portion.' His fellowship being vacated by his marriage, he was presented to the living of Drayton-Beauchamp in Bucks, by John Cherry, Esq., in 1584. Here he received a visit from an old pupil, Edward Sandys, who took pity on his poverty, and obtained from his father, the archbishop of York, a promise of preferment for him. Through the archbishop's influence he was appointed Master of the Temple in 1585. Here he became engaged in a controversy on church discipline and some points of doctrine with Walter Travers, afternoon lecturer at the Temple, who had been ordained by the Presbytery at Antwerp, and held most of the opinions of the divines of Geneva. Travers being silenced by archbishop Whitgift, appealed to the privy-council, but without success. His petition to the council was published, and answered by Hooker. Travers had many adherents in the Temple, and it was their opposition, according to Izaak Walton, which induced Hooker to commence his work on the 'Laws of Ecclesiastical Polity.' Finding that he had not leisure at the Temple to complete that work, he applied to Whitgift for removal to a more quiet station, and was accordingly presented to the living of Boscombe in Wiltshire, in 1591. On the 17th of July in the same year he was made a prebendary of Salisbury. At Boscombe he finished four books of the 'Ecclesiastical Polity,' which were published in 1594. On the 7th of July, 1595, he was presented by the queen to the living of Bishopsbourne in Kent, which he held till his death on the 2nd of November, 1600. He was interred in the church at Bishopsbourne, where a monument was afterwards erected to his memory by Sir William Cowper. Hooker's manner was grave even in childhood; the mildness of his temper was proved by his moderation in controversy; and his piety and learning procured him the general esteem of his contemporaries. His great work is his defence of the constitution and discipline of the

Church of England, in eight books, under the title of 'The Laws of Ecclesiastical Polity.' This work obtained during the author's lifetime the praise of a pope (Clement VIII.), and a king (James I.), and has ever since been looked upon as one of the chief bulwarks of the Church of England and of ecclesiastical establishments in general. The publication of the first four books has been mentioned above; the fifth was published in 1597. He completed the last three books, but they were not published till several years after his death. The account which Walton gives of the mutilation of the last three books is highly improbable, and no doubt can be entertained of their authenticity, though they are certainly imperfect.

Besides the 'Ecclesiastical Polity,' Hooker left some tracts and sermons.

The latest editions of his works are those printed at the Clarendon Press, Oxford (1820), and the edition of Mr. Hanbury, London, 1830. The latter contains the 'Christian Letter to Mr. R. Hooker,' occasioned by the publication of the 'Ecclesiastical Polity,' and Dr. Covel's 'Defence of the Five Books of Ecclesiastical Polity,' in answer to the 'Christian Letter.'

(Izaak Walton's *Life of Hooker*, with Strype's *Interpolations.*)

HOOLE, J. [TASSO.]

HOOPER, JOHN, one of the most venerated martyrs of the Reformation, was born in Somersetshire about 1495, and educated at Oxford, where, by study of the Scriptures and the works of the foreign reformers, he was converted to Protestantism. On this account he found it expedient to quit the university, and finally the kingdom, apparently about 1540. For some years he led a wandering life, part of which was spent in Switzerland, the stronghold of the Reformation, where he met with a most friendly reception from the chief divines. On the accession of Edward VI., in 1547, he returned to England, and settled in London, where he was very diligent, and greatly followed and admired as a preacher. In 1550 he was appointed bishop of Gloucester; but his assumption of the office was long delayed by his scrupulousness as to the use of the episcopal dress. By way of overcoming his reluctance he was confined to his own house, and finally committed, during some months, to the Fleet prison. Even the Swiss divines however regretted that his influence in the church should be marred by such considerations, and exhorted him to compliance. Finally the matter was compromised. In 1552 he received the bishopric of Worcester in commendam. 'While he was bishop,' Wood says, 'he preached often, visited his dioceses, kept good hospitality for the poorer sort, and was beloved of many. But when Queen Mary began to reign, in July, 1553, he was pursuivanted up to London, in the latter end of August, and committed to the Fleet, where, remaining some months, he was at length examined several times, and required to recant his opinions; but standing constant and resolute to them, was condemned to be burnt in Jan., 1555.' He suffered accordingly on the 9th of February, at Gloucester, bearing his torments, which were dreadful, with exceeding courage. His works are numerous, chiefly controversial. (Wood, *Ath. Oxon.*; Fox's *Martyrs*; Burnet, *Hist. Ref.*, &c.)

HOOPING-COUGH. This disease, to which, on account of the violence of the cough that attends it, the Latin term 'Pertussis' has been applied, and which from the recurrence of this cough in paroxysms has also obtained the popular designation 'chin or kink-cough,' appears to have been unknown to the antients. No mention is made of it in the medical writings of the Greeks, Romans, or Arabians; but during several centuries it has prevailed in the various countries of Europe, and, from the frequency of its occurrence and the serious consequences of which it is sometimes productive, has much occupied the attention of physicians.

It commences with the symptoms of simple catarrh, and is indicated by cough and the expectoration of a clear limpid fluid, by redness of the conjunctivæ, a watery discharge from the eyes and nostrils, hoarseness, and occasional sneezing. These symptoms are attended by some degree of fever, which in general however is very slight; the patient is languid and out of spirits, but is free from pain, or complains only of soreness in the anterior part of the chest. During this stage the disease may be readily confounded with a common cold, but there is already some peculiarity in the cough, which occurs more in fits, and is more sonorous than in the latter malady. At the end of a period varying from one to two weeks the affection assumes a somewhat different character; the fits of coughing become longer and more frequent; each fit is commonly announced by a sensation of tickling in the larynx and trachea, during which the inspirations are irregular and incomplete, especially in children, whose countenances are at this time expressive of fear and anxiety. At the moment the fit comes on they cling with firmness to the persons or objects around them; if asleep at the time of its accession, they suddenly start up and place themselves in a sitting posture. The efforts of coughing are now repeated in such quick succession as to suspend almost completely the act of breathing: during their brief intervals we can with difficulty perceive any inspiratory movements, excepting at times when the cough is momentarily interrupted by a prolonged inspiration attended by a peculiar *whooping* noise, which has supplied a name for the affection, and which constitutes its characteristic symptom. In consequence of the obstruction to the circulation occasioned by these long continued efforts of coughing, the face and neck become swelled, and of a deep red or violet colour; the veins on these parts are distended almost to bursting; the eyes prominent and bathed in tears; occasionally the patient becomes completely exhausted; the fit of coughing is interrupted for one or more minutes; it then recurs with the same violence, and the patient seems in imminent danger of suffocation, when the paroxysm is terminated by one or two long and *whooping* inspirations, and by the rejection of a limpid viscid fluid, which hangs in threads from the mouth, and to facilitate the discharge of which the patient inclines his body forwards. This fluid comes from the bronchi and pharynx, and sometimes also from the stomach; it is often mixed with portions of food which are rejected at the same time, and occasionally with particles of blood.

These paroxysms or fits of coughing continue for many minutes, and when they are very severe blood frequently issues from the nose, mouth, ears, or even from the eyelids; they recur at various and often very short intervals, generally however more frequently and with greater severity by night than by day, and they are excited by the slightest causes, as by food or exercise, by any agitation or mental emotion. When the affection exists in a state of simplicity it is attended, even in this stage, with very little or no fever; the appetite continues as good as or better than in health, and the little patient, whose play was interrupted by the approach of the fit, immediately returns to it when the paroxysm is over; and during the intervals of these paroxysms often shows no other indications of disease than are furnished by the puffiness of the face and the redness and tumidity of the lips, which the interruption of the circulation during the violent and long continued efforts of coughing has occasioned.

In the intervals of the fits the chest sounds well on percussion, and on auscultation the respiratory murmur is heard pure, or mixed only with a little mucous râle on the posterior part of the chest, as in common catarrh. During the paroxysm breathing is almost completely suspended, and no respiratory murmur is audible except in the very short intervals which exist between the expulsive efforts of coughing; the prolonged and noisy inspiration which constitutes the pathognomonic character of hooping-cough seems to be limited to the larynx and trachea, and gives rise to no respiratory murmur audible on auscultation of the chest.

It is chiefly during this stage that hooping-cough becomes complicated with other diseases affecting the head or chest, on which its danger mainly depends. In children at the breast the most common complication is cerebral congestion, giving rise to convulsions; in persons more advanced in life the viscera of the chest become more frequently implicated, and it is to inflammation of the lungs and pleura that death, when it occurs, is generally attributable.

After the affection has presented the characters which we have described for a period which varies from two or three weeks to many months, the paroxysms become shorter and less frequent, and the cough ceases to be characteristic, but still continues to terminate in vomiting and in the discharge of sputa, which now resemble those of catarrh. The paroxysms become more and more rare, in some cases recur at regular intervals, and finally cease, but for some time afterwards they are easily renewed by any unusual exposure to cold.

In the cases that prove fatal we find on dissection more or less redness of the mucous membrane of the larynx and trachea, especially towards the bifurcation of the bronchi; a swelling of the bronchial glands, and a viscid mucus adhering to the lining membrane of the trachea, œsophagus, and pharynx. In some cases a similar mucous coating has been met with on the lining membrane of the stomach. No other alterations have been discovered that can serve to characterize this affection. Cerebral congestion and inflammation of the lungs and pleuræ, to one of which the fatal termination of cases of hooping-cough is almost always attributable, occur merely as complications, and supply no explanation of the peculiar character of the disease.

The specific nature of the cough, and the insufficiency of the morbid changes we have already noticed to account for the phenomena of hooping-cough, have led pathologists to seek for their interpretation in the condition of the pneumogastric nerves, but hitherto without success. M. Broschet indeed has in two cases remarked in these a redness externally, and a yellowness of their tissue, but no similar appearances have been observed by other physicians.

Hooping-cough prevails epidemically, and chiefly attacks children from birth to the period of second dentition, but it occasionally occurs in adult and even in old age. Our own experience furnishes us with an instance in which the disease was well characterized in a person above the age of eighty.

It rarely affects the same individual more than once, although this sometimes happens. From this circumstance, and from the fact that most persons have the disease in childhood, it is extremely difficult to estimate the predisposing influence of age.

It occurs in every variety of climate, and in all seasons, but is more general and more severe in cold than in tropical climates, and is most prevalent in seasons most favorable to catarrhal affections. It is of longer duration when it comes on in autumn or winter, than when it makes its appearance in spring or summer; and like all other diseases that occur epidemically, it is much more severe in some years than in others.

Hooping-cough is one of those diseases that are communicable by contagion. It spreads very rapidly among children of the same family, and when it finds admission into a house very few of the young persons who have not previously had it escape; but they are protected from the disease if secluded from those previously infected. Our own experience furnishes us with two striking instances of the efficacy of this seclusion, both of which occurred during the past year. The disease was very prevalent in a populous village, and almost all the children were attacked, with the exception of those of the clergyman, who secluded his family of six children during the whole period of the epipemic. Not one of these children took the disease; they were confined to the house and to a small lawn surrounded by a high wall in the midst of the village. A similar exemption followed the adoption of the same measures in the family of the clergyman of the adjoining parish.

The contagious nature of hooping-cough, the circumstance that a person who has once experienced it is in general exempt from subsequent attacks, its regular march, and the peculiar and spasmodic character of the cough, are sufficient to show that it is a specific disease, and that it does not consist, as many pathologists have supposed, in a simple inflammation of the mucous membrane of the air-passages, although it is probable that an inflammatory state of this membrane constantly exists and forms an essential part of the disease.

No method of treatment has hitherto been discovered by which the progress of hooping-cough can be arrested. We may mitigate its severity and somewhat diminish its duration, but it will run a certain course, and this course, in spite of all our efforts, will often be long. At the commencement of the disease, if the patient is strong and plethoric, and the fever considerable, we may have recourse to bleeding, but in other cases it is not productive of any benefit; in some, by increasing the debility, it seems even to prolong the affection, and as a general rule should not be adopted. During the early stage of the disease the administration of emetics has appeared to be much more beneficial; in children they may be repeated every day, or every other day, for one or two weeks. Tartar emetic, on account of its solubility and the certainty of its operation, is the medicine best adapted to this purpose.

At a more advanced period of the disease great benefit is derived from the employment of narcotic and sedative medicines. Of these there is a great variety, each of which has had its advocates. We may particularly mention opium, hydrocyanic acid, and belladonna; but on account of the powerful influence of these drugs on the system, the greatest caution should be observed in their administration to children.

When the paroxysms are regularly intermittent, we may prescribe sulphate of quinine in the same doses, and almost with the same certainty of success, as in ague.

In protracted cases nothing is so efficacious in putting a stop to the cough as change of air, which often succeeds after all other means have been tried in vain.

At the commencement of the disease, and as long as any febrile symptoms continue, the diet should be of the mildest description; afterwards a more tonic and nourishing regimen may be allowed, not only with safety but with advantage.

Cerebral congestions and inflammations of the lungs and pleuræ, when they occur during the course of hooping-cough, must be treated in the same manner as when existing under ordinary circumstances.

HOOPOE. [PROMEROPIDÆ.]

HOORN, in the province of North Holland, the capital of the district of the same name, has the best harbour on the Zuiderzee. It appears to have been formerly a strong fortress, and is still surrounded with ramparts on the land side, but they are not calculated for defence. There are numerous gardens close to the town, which has a remarkably agreeable appearance, the streets being handsome, broad, clean, and regular, and the houses very neat. There are some manufactures of woollen cloths and paper-hangings, and the inhabitants carry on a brisk trade, especially in cattle, butter, and cheese, for which last article Hoorn is a staple place. The exportation of the produce of the fisheries, especially herrings, is considerable; and ship-building is carried on pretty extensively. The number of inhabitants is 10,000. Hoorn is the birth-place of the navigator Schoutens, who doubled Cape Horn in 1616.

HÔPITA'L, or HOSPITA'L, MICHEL DE L', born in 1505, near Aigueperse in Auvergne, was the son of Jean de l'Hôpital, physician to the Connétable de Bourbon, of whom he held a small estate. While L'Hôpital was studying law at Toulouse, his father was involved in the proscription of the Connétable, whom he accompanied to Italy; he was condemned to perpetual banishment, and his property was confiscated. His son, although only eighteen years of age, was arrested, examined, and kept for a short time in confinement. On being released, he went to Milan to join his father, who sent him to Padua to finish his studies. L'Hôpital remained in that celebrated university six years, during which the Connétable de Bourbon lost his life under the walls of Rome, and Jean de l'Hôpital found himself without a protector in a foreign land. He however took his son to Rome to see the coronation of Charles V., and it was in that city that the Cardinal de Grammont, the French ambassador, became interested in favour of the young man, and induced him to return to France, where he began to practise at the bar of the parliament of Paris. His merit, added to his having married the daughter of the lieutenant-criminel Morin, procured for him a seat on the bench of the counsellors of the parliament, where, by his assiduity, his learning, and his probity, he won the favour of the chancellor Olivier, and of Duchâtel, bishop of Tulle and librarian to Francis I. L'Hôpital was named ambassador to the Council of Trent, which had been just removed by the pope to Bologna; but the dissensions among the members of that assembly rendered his mission useless, and he was recalled to France by Henri II. The duchess of Berry, daughter of Francis I., a princess fond of learning, invited L'Hôpital to her court, and recommended him to her brother the king, who appointed him superintendant of the finances. L'Hôpital endeavoured to check prodigality, mismanagement, and corruption, by which course he made himself many enemies. There was another subject upon which he differed from the court party, and that was the persecution to which the Protestants were subject. L'Hôpital, with several of his friends in the parliament, such as Du Ferrier, Paul de Foix, Christophe de Thou, and others, petitioned Henri II. to suspend the proscriptions and executions until the newly-assembled council should decide on the religious controversy; but the king considered their remonstrances as rebellious, and he ordered Montgomery, the captain of his guards, to arrest Paul de Foix, Louis du Faur, Anne du Bourg, and other members of the parliament. Du Bourg, who had spoken the most boldly, was soon after hanged, and his body burnt. During the minority of Francis II., a special court, appropriately called the 'burning chamber,' was instituted to punish heretics. Tho Guises were now all-powerful in the state, and the chancellor Olivier himself signed the ordonnance by which the Duke de Guise was appointed lieutenant-general of tbe kingdom. Tho old chancellor died soon after, and Catherine de' Medici, alarmed at tbe power of the Guises, chose L'Hôpital, of whose integrity she was assured, to replace him in 1560. His office was not an enviable one in those times. He strenuously opposed the Cardinal de Lorraine, who wanted to establish the Inquisition in France, and he proposed instead of it to give to tbe bishops cognizance of matters of heresy within their respective dioceses. This resolution was proclaimed in the edict called 'De Romorantin,' wbich the cbancellor laid before tbe parliament to be registered, observing at the same time that opinions can only be subdued by exhortations and reasoning, and not by violence and persecution.

L'Hôpital's next thought was that of assembling the states-general, which had not met for eighty years, but the Guises opposed the proposal, which they feared would prove fatal to their power. L'Hôpital accordingly contented himself with assembling the nobility and high clergy at Fontainebleau. Francis II., with his wife Mary Stuart, presided in the assembly, and the chancellor made a report upon tbe state of the kingdom, and the religious and civil discontents which prevailed. Coligny next presented to the king two petitions from the Protestants of Normandy, and Montluc, bishop of Valence, and the archbishop of Vienne, strongly censured the system of persecution adopted against the Protestants; they spoke of the indulgence of the primitive church on similar occasions; they complained of the perpetual obstacles presented by the court of Rome to the convocation of a general council, which might restore peace to Christendom; and at last they proposed, as the only remedy to existing evils, the convocation of the states-general, and also of a national synod. The Guises consented to the first, but violently opposed tbe national synod as dangerous to the faitb and the unity of the church. L'Hôpital hastened to obtain an edict from the king, convoking the states-general for the 10th December, 1560, at Orleans, and meantime suspending all prosecutions on charges of beresy. But in the interval Francis II. died, and Catherine de' Medici, regent for her second son Charles IX., hesitated about opening the assembly of the states. But tho chancellor overcame her doubts and fears, and he opened the assembly with a speech in which he explained the numerous and important subjects which demanded the attention of the states, and above all he insisted on the claims of the Protestants, censuring the spirit of persecution as unchristian and impolitic: 'Let us do away,' said he, 'with those diabolical words of Lutherans, Huguenots, and Papists, names of party and sedition; do not let us change the fair appellation of Christians.'

Each of the three orders composing the states now chose its own orator, and it soon became apparent that no harmony could prevail in the assembly. The orator of the third estate, or commons, without being favourable to the Protestants, loudly censured the scandalous and negligent conduct of the Catholic clergy. The orator of the nobility, reflecting on the wealth and luxury of the church, demanded freedom of worship for the Protestants. The orator of the clergy maintained that heresy was a capital crime, and ought to be punished by the law, and at the same time he claimed exemption for his order from all taxes and other public burdens. The only useful result of the assembly was the passing of an ordonnance prepared by L'Hôpital, which abolished arbitrary taxes, regulated the feudal authority of the nobles, and corrected many abuses in the judicial system. Soon after, July, 1561, L'Hôpital obtained from the regent Catherine an edict, in the name of the king, ordering the release of all prisoners suspected of heresy. By another edict Catholics were forbidden, under pain of death, from forcing an entrance into the houses of Protestants under pretence of dispersing their meetings. The parliament of Paris opposed these measures; but the chancellor prevailed, and the edicts were enforced. L'Hôpital was present at the conference of Poissy, where Beza and other Protestant theologians argued on matters of doctrine against the Cardinal de Lorraine and other Catholic divines, but which ended, as such meetings generally end, in mutual recriminations. In January, 1562, L'Hôpital obtained from another assembly, consisting of deputations from all the parliaments of the kingdom, an edict of tolerance granting liberty of worship to the Protestants, except within tbe walled towns, and under the condition 'that they should not teach anything contrary to the council of Nicæa, or to the books of the Old and New Testaments.' But soon after, the massacre of Vassy by the attendants of the duke of Guise became the signal of fresh persecutions, followed by civil war. [GUISE.] After the death of tho duke of Guise, 1563, L'Hôpital prevailed upon Catherine to grant the edict 'of peace,' by which, among other conditions, all prisoners on both sides were released, and the Protestants were allowed tbo exercise of their religion within the towns which they had occupied during the war. He also prevailed upon Catherine to declare the majority of her son Charles IX., whom he afterwards induced to make a tour through the various provinces of the kingdom. The chancellor took this opportunity of reading some sharp lectures to the various parliaments, especially that of Bordeaux, which had encouraged persecution and civil war. In 1566 L'Hôpital again assembled the deputies from the various parliaments and the chief nobles at Moulins, where an ordonnance was issued for the reform of justice, which is one of the best judicial regulations adopted in France previous to the reign of Louis XIV Soon after the civil war broke out again, to the great sorrow of L'Hôpital, who endeavoured, during every cessation from actual fighting, to restore peace between the two parties. He thus became obnoxious to the Guises, who desired notbing less than the extermination of tbe Protestants. At last a bull came from Rome authorizing tbe king to levy 100,000 écus yearly on the revenues of the clergy, for tho purpose and on the condition of rooting heresy out of his kingdom. The chancellor opposed the bull; he besought the king and his mother not to inundate France again with blood; he seemed to have prevailed, but soon afterwards tbe seals were taken from him, and be retired to his country-house at Vignay, in 1568, deploring the calamities of his country, which he could no longer prevent. After some years of retirement the news of the St. Barthélémi massacre came to give the finishing blow to his exhausted frame. He was himself in danger of his life, but was spared through the influence of the duchess of Savoy, the former duchess de Berry, his early benefactress. His only daughter, who had embraced the Reformed religion, was saved by the widow duchess of Guise, who concealed her in her hotel at Paris. L'Hôpital survived tbat horrible tragedy only six months; he died at Vignay on the 15th March, 1573. An upright and enlightened magistrate in an age of the worst corruption and ignorance, a benevolent Christian amidst tbe most furious fanaticism, his memory is deservedly consecrated in the annals of his country. His epistles in Latin verse, reflecting on public and domestic occurrences, were published, and are not without poetical merit. Several of his harangues and discourses have also been published, as well as bis testament. His life has been written by Bernardi; and Villemain, in his 'Nouveaux Mélanges Littéraires,' has also written his biography.

HÔPITAL, GUILLAUME-FRANÇOIS-ANTOINE L', Marquis de Sainte Mesme and Count d'Entremont, commonly known as the Marquis de l'Hôpital, was born at Paris, in the year 1661, and died in 1704. He entered tho army at an early age, and served during several years in the capacity of captain of cavalry; but the weakness of his sight and his desire to prosecute the study of the mathematics with less interruption than was compatible with active service, induced him to quit a profession in which he migbt otherwise have followed the footsteps of his ancestors. Among other anecdotes which are related in attestation of his early acquaintance with the mathematics, it is said that, at the age of fifteen, happening to be in company with a number of savans at the house of the duke de Roannez, when great admiration was expressed of a solution which Pascal had recently given of a problem relative to the cycloid, L'Hôpital expressed his belief that the question was not beyond bis own powers, and two days afterwards he supported his pretensions by answering it on different principles The name of tbe marquis de l'Hôpital is intimately connected with the early history of the differential and integral calculus. In 1691 no knowledge whatever of the calculus existed in France, and indeed throughout the Continent it appears to have been known only to Leibnitz, and to the brothers John and James Bernoulli. About this time John Bernoulli arrived at Paris, and spent some time at the residence of L'Hôpital for the purpose of giving him instructions in the differential and integral calculus. With such assistance, he was not long in becoming one of the first mathematicians of Europe, and he soon after distinguished himself by his solution of the great problem in mechanics relative to the brachystochron, or curve of quickest descent [CYCLOID], which Bernoulli had proposed as a challenge to the geometricians of the day, and to which, at the end of ten months, only four solutions had been given, by Newton in England, Leibnitz in Germany, James Bernoulli in Switzerland, and L'Hôpital in France. Still however the calculus was regarded as a sort of mystery by most of those mathematicians by whom it was not actually opposed; and with the exception of the papers by Leibnitz dispersed in the Acts of Leipzig, there existed no work from which any information could be obtained. To remedy this defect he wrote and published his 'Analyse des Infiniment-Petits,' which appeared in 1696, Paris, 4to. 'The appearance of this work,' says M. Boucharlat, 'marked the epoch of a great revolution in science. Mathematicians hastened to initiate themselves into the wonders of the infinitesimal calculus, and doubts concerning its truth were advanced only by those who were blinded by their prejudices in favour of antient methods.' L'Hôpital has been accused by Montucla (*Histoire des Math.*, vol. ii., p. 397) of not having sufficiently acknowledged his obligations to John Bernoulli, from whom he is said to have derived the principal methods that are given in the work just mentioned; but M. Boucharlat is of a different opinion. (See also BERNOULLI, JOHN.) The work itself has gone through several editions, of which the latest, we believe, is that edited by Lefèvre, in 1781. At his death in 1704, when only 43 years of age, L'Hôpital left an 'Analytical Treatise on Conic Sections,' which was published in 4to. the following year, and was for a long time considered the best treatise on the subject.

HOPS. (Botany.) [HUMULUS.]

HOPS (Humulus lupulus of Linnæus) are extensively cultivated for the flowers or seed-vessels, which give flavour and permanence to beer, by being boiled with the wort in brewing. They impart a pleasant bitter and aromatic flavour, and prevent the too rapid progress of fermentation. Beer which is well hopped will keep long and become very fine, without any of those artificial means of fining which make the common brewers' beer so much inferior in quality to that which is home-brewed.

Hops were introduced into England from Flanders about the year 1524. The most extensive plantations are in Kent, Sussex, and Herefordshire; but they are also cultivated in Worcestershire, Wiltshire, Hampshire, Gloucestershire, Surrey, and several other counties.

The hop is a slender climbing plant, which requires a very rich mellow soil and careful cultivation. It is very tender, and the produce is precarious, sometimes giving a great profit to the grower, and at other times failing altogether. The greatest quantity of hops is raised in Kent, but the finest quality in the neighbourhood of Farnham in Surrey. The soil of a hop-garden must be rich to a considerable depth, or made so artificially. The subsoil must be dry and sound; a porous rocky subsoil, covered with two or three feet of good vegetable mould, is the best for hops. The exposure should be towards the south, on the slope of a hill, or in a well-sheltered valley. Old rich pastures make the best hop-gardens. They should be dug two or more spits deep, and the sods buried at the bottom, where they will gradually decay and afford nourishment to the slender roots of the plants which strike deep. A very large quantity of the richest rotten dung, at least 100 cubic yards per acre, should be well incorporated with the soil by repeated ploughings, till it is entirely decomposed and produces that dark tint which is the sure sign of an abundance of humus. The ground should be prepared by laying it up with the spade in high ridges before winter, to expose it as much as possible to the mellowing influence of the frost. A succession of green crops, such as rye cut green or fed off with sheep, early turnips fed off in autumn, or spring tares, are an excellent preparation, by cleaning the land. It is better to be two or even three years in preparing the ground and getting it perfectly clean, than to plant the hops in a foul or unprepared soil.

The young plants are raised in beds, and may be raised from seed; but it is more usual to plant the young shoots which rise from the bottom of the stems of old plants. They are laid down in the earth till they strike, when they are cut off and planted in the nursery-bed. Care must be taken to have only one sort of hops in a plantation, that they may all ripen at the same time; but where there are very extensive hop-grounds it may be advantageous to have an earlier and a later sort in different divisions, so that they may be picked in succession. The varieties most esteemed are the Grape Hop, the White Vine, and the Golden Hop. The ground having been prepared for planting, it is divided by parallel lines, six or more feet apart, and short sticks are inserted into the ground along these lines at six feet distance from each other, so as to alternate in the rows, as is frequently done with cabbage-plants in gardens. At each stick a hole is dug two feet square and two feet deep, which is filled lightly with the earth dug out, together with a compost prepared with dung, lime, and earth, well mixed by repeated turning. Fresh dung should never be applied to hops. Three plants are placed in the middle of this hole six inches asunder, forming an equilateral triangle. A watering with liquid manure greatly assists their taking root, and they soon begin to show bines. A stick three or four feet long is then stuck in the middle of the three plants, and the bines are tied to these with twine or the shreds of Russia mats, till they lay hold and twine round them. During their growth the ground is well hoed and forked up around the roots, and some of the fine mould is thrown around the stems. In favourable seasons a few hops may be picked from these young plants in the autumn, but in general there is nothing the first year. Early in November the ground is carefully dug with the spade, and the earth being turned towards the plants, is left so all winter.

In the second year, early in spring, the hillocks around the plants are opened, and the roots examined. The last year's shoots are cut off within an inch of the main stem, and all the suckers quite close to it. The suckers form an agreeable vegetable for the table, dressed like asparagus. The earth is pressed round the roots, and the cut parts covered so as to exclude the air. A pole about twelve feet long is then firmly stuck into the ground near the plants; to this the bines are led and tied as they shoot, till they have taken hold of it. If by any accident the bine leaves the pole, it should be carefully brought back to it, and tied till it takes hold again. A stand ladder should be at hand to do this, when the bine has acquired some height. The ground being well hoed and the earth raised round the plants, the produce this year will average 4 cwts. per acre, if the season is favourable.

Some hop-planters plough up or dig the ground before winter; others prefer doing it in spring, in order not to hasten the shooting, which weakens the plants. The same operations of pruning the shoots, manuring, and placing poles, which were performed the preceding year, are carefully repeated. Particular attention is paid to proportion the length of the poles to the probable strength of the bines; for if the pole is too long, it draws up the bine, and makes it bear less; if it is too short, the bines entangle when they get beyond the poles, and cause confusion in the picking. In September, the flower containing the seed will be of a fine straw colour, turning to a brown; it is then in perfection. When it is over ripe, it acquires a darker tint. No time is now lost, and as many hands are procured as can be set a-picking; great numbers of men and women go out of the towns in the hopping season, and earn good wages in the hop plantations. During the picking they sleep in barns and outhouses. In the picking, the poles are taken down, and the stems cut 3 feet from the ground; if they were cut shorter it would weaken the root, by causing it to bleed. The poles are laid sloping over a frame of strong wood 9 feet long and 4 feet wide, supported by legs 3 feet high; this is called a bin. A piece of coarse cloth is fixed to this frame by hooks, so as to form a bag, which does not reach the ground. Three men or women, or four boys or girls, are placed on each side of the bin, and pick the hops from two poles at a time. Where they are very careful of the quality of the hops, as at Farnham, they divide them into three sorts: the green, which are not quite ripe; the light yellow-brown, which are in perfection; and the very dark, which are past their prime. Some go even further, and make several qualities according to colour and fragrance: for this purpose there are several baskets. The dew should be off entirely before they begin; for otherwise the hops might become musty, or take too long drying, and loose their fragrance. The hops when picked are dried on a hair cloth in a kiln. When they appear sufficiently dry at bottom they are turned; it is however thought by some hop-dryers that the turning of the hops is apt to injure them, and that it is best not to do so; but in order that the upper part may be dried equally with the lower, a wooden cover lined with tin plates is led down over the hops on the hair cloth, to within a few inches of the surface; this reverberates the heat, and the whole is dried equally. The heat must be carefully regulated, in order that it may not alter the colour. When the leaves of the hops become brittle and rub off easily, they are sufficiently dried. They are then laid in heaps on the floor, where they undergo a very slight heating. As soon as this is observed, they are *bagged*. This is done through a round hole 25 or 30 inches in diameter, made in the floor of the loft where the hops are laid. Under this hole is a bag, the mouth of which is drawn through the hole, and kept open by a hoop to which it is made fast. The hoop is somewhat larger than the hole, and the bag remains suspended; a handful of hops is now put into each corner of the bag, and there tied firmly by a cord. A bushel or two of hops are put into the bag, and a man gets into it to tread the hops tight. The bag does not reach the floor below. As the hops are packed by the feet, more are continually added till the bag is full. It is now taken off the hoop, and filled up with the hands as tight as possible. The corners are stuffed as soon as the mouth is partly sewn up, and tied as the lower corners were; when sewed close and tight, it is stored in a dry place till the hops are wanted for sale.

The crop of the third year will average 8 cwt. per acre. In some very extraordinary seasons, on good land, 15 cwt. have been picked per acre: in Flanders, where they manure with urine and the emptyings of privies, this is not an uncommon produce.

Rape cakes, malt dust, and woollen rags are used with good success in hop-grounds; bones have been tried, but with an uncertain result.

The hop is a diœcious plant, *i.e.* some of the individuals are male plants, and others female, which have respectively flowers of a different construction and of different habitudes. The male or staminiferous flowers, which grow on stalks quite distinct from the female flowers, prepare the pollen, or fertilizing dust, and afterwards wither away, when this dust has escaped from the anthers, and been committed to the air, to be by it conveyed to the female flowers. The female flowers are in the form of strobuli, or cones, consisting of scales, which have at their base the germ of the future seed, and which have the habit of enlarging, as the scales of the fir-cones do, more particularly after the fertilization of the ovule, or future seed, by a quantity of the pollen falling upon it. Though the pollen, from its extreme lightness, can be wafted to a considerable distance, and some seeds in each cone may be so fertilized, yet it would be well to rear a number of the male plants among the others, or along the hedges of the hop-gardens, to ensure the fertilization of *all* the seeds. But as the farmers observe that the flowers of the male (termed, in Kent, seedling, blind, or wild hop; in Sussex, buck or cock hop) wither away, they generally extirpate them at the digging season, as unfruitful cumberers of the ground. That this is an error may be proved in various ways, but an appeal to the result of an opposite practice is the most convincing. A bushel of hops, collected from plants of the fourth year, raised from seed, weighed 36 pounds, there being male plants near; a second instance, where the plants were raised from cuttings, weighed 35 pounds; while a bushel, grown in a garden where the male plants were always eradicated, weighed only 22 pounds. Besides the greater quantity of hops thus obtained, the aroma is much greater (the *lupulin*, on which the aroma depends, is considered by Planché to be the unappropriated pollen dust which has alighted on the scales of the females), and the strength of the bitter much greater. After the period when the males have elaborated the pollen, and the strobuli of the females begun to enlarge, the males may be cut down, and the stalks employed to make cordage for hop-bags against the following harvest. In 1760 the Society of Arts awarded premiums for cloth made from the hop-bine. (Lance's *Golden Farmer*, London, 1831.)

The poles are an expensive article; those of chesnut are the most durable, and also the dearest. They should be put into a shed during winter: where this cannot be done, they are placed on end in the form of a cone, leaning against each other. If the tops of these cones had a cap of thatch, it would greatly protect them from the weather: whether it will be worth while to soak them in a solution of corrosive sublimate, according to Kyan's patent, remains yet to be proved; but if it should preserve them, every extensive hop-grower should have a tank for the purpose.

Besides the use of hops in brewing, they produce a bitter infusion and a tincture which are valuable in medicine for complaints in the stomach. A pillow made of hops has been used with success to produce sleep, where opiates had failed.

The excise duty upon hops is 18*s.* 8*d.* per cwt., and collected from the grower. From this circumstance has arisen the practice of quoting the probable duty of all the hops grown in England as an index of the probable result of the crop. The price of hops fluctuates greatly, and there are extensive and sometimes ruinous speculations in this article. Weyhill fair, near Andover, is the greatest mart for hops in the country. In 1837 the duty on hops amounted to 310,794*l.* 4*s.*, of which nearly one-half was contributed by the county of Kent: Sussex was the next in amount, and then Hereford, Worcester, and Hampshire. But the whole amount of land under this cultivation, and the produce, as indicated by the duties, will be best shown by the following statement of the number of acres of land in Great Britain under cultivation of hops in the year 1837, and the amount of duty chargeable on the produce in each of the Excise districts.

Districts.	Number of Acres.	Amount of Duty.		
		£	*s.*	*d.*
Barnstaple	6½	38	16	4
Bath	2½	22	10	2
Bedford	34	136	10	2
Bristol	2½	4	14	8
Cambridge	2	9	8	4
Canterbury	11,125½	60,692	3	8
Chester	¾	3	1	6
Cornwall	4¾	12	1	9
Coventry	¼		6	0
Derby	124	944	18	8
Dorset	30¼	48	5	0
Essex	325	1,533	5	4
Exeter	8	43	7	10
Gloucester	7½	44	2	8
Grantham	26½	155	9	10
Hants	1,691½	8,464	0	8
Hereford	10,602¾	48,237	17	4
Hertford	110	847	14	2
Isle of Wight	1	2	14	8
Lincoln	607¼	4,702	3	6
Lynn	6¾	16	5	1
Northampton	1½	14	13	0
Norwich	17¾	48	0	10
Oxford	15	67	15	4
Plymouth	4	6	6	8
Reading	7	30	6	0
Rochester	15,452¾	82,680	8	10
Salisbury	1,222	5,991	16	6
Salop	7	13	14	10
Stafford	½		6	4
Stourbridge	615¾	3,301	17	4
Suffolk	172¾	1,024	1	0
Surrey	16½	49	14	6
Sussex	12,068¼	80,873	2	2
Uxbridge	..	4	12	4
Wales—Middle	98¼	418	18	0
Wales—West	..		4	10
Wellington	17½	104	1	10
Worcester	1,888¾	10,204	3	0
York	..		2	10
	56,323	310,794	4	0

HORAPOLLO, or HORUS APOLLO, the author of a treatise on Egyptian Hieroglyphics. Several writers of this name are mentioned by Suidas, Stephanus of Byzantium under Phenebethis, Photius (p. 536, ed. Bekker), and Eustathius (Hom. *Od.* Δ); but it is doubtful to which of them the treatise on Egyptian Hieroglyphics should be ascribed. According to the inscription, which is found in most MSS., the work was originally written in the Egyptian language, and translated into Greek by Philip. Horus was the name of one of the Egytian deities, who was considered by the Greeks to be the same as Apollo. (Herod., ii., 144-156.) We learn from Lucian (*Pro Imag.*, sec. 27) that the Egyptians were frequently called by the names of their gods. But whatever opinion we may form respecting the author, it is evident that the work could not have been written before the Christian æra, since it contains allusions to the philosophical tenets of the Gnostics. The value of this work in interpreting existing hieroglyphics has been differently estimated. Champollion, and Leemans, in his edition of the work, are disposed to attribute greater importance to it than former critics had been willing to allow.

This work was printed for the first time by Aldus (Venice, 1505), with the fables of Æsop. The best editions are by Mercer, 1551; Hœschelius, 1595; De Pauw, 1727; and Leemans, Amst. 1834, who has discussed in his Introduction the date and authorship of the work.

HORARY (Astronomy). The horary motion of the sun or a planet is the arc which it describes in one hour, or the angle which that arc subtends at the eye of the spectator.

HORA'TIUS FLACCUS, QUINTUS, was born at Venusia, or Venusium, December 8, B.C. 65, during the consulship of L. Aurelius Cotta and L. Manlius Torquatus (*Carm.* iii. 21, 1; *Epod.* xiii. 6). His father, who was a *libertinus*, or freedman, had gained considerable property as a *coactor** (1 *Sat.*, vi. 6, 86), with which he purchased a farm in the neighbourhood of Venusia, on the banks of the Aufidus. In this place Horace appears to have lived till his eleventh or twelfth year, when his father, dissatisfied with the country school of Flavius (1 *Sat.*, vi. 72), removed with his son to Rome, where he was placed under the care of a celebrated schoolmaster, Orbilius Pupillus, of Beneventum, whose life has been written by Suetonius (*De Illustr. Gramm.*, c. 9). After studying the antient Latin poets (2 *Ep.*, i. 70, 71), Horace learned the Greek language (2 *Ep.*, ii. 41, 42). He also enjoyed during the course of his education the advice and assistance of his father, who appears to have been a sensible man, and who is frequently mentioned by his son with the greatest esteem and respect (1 *Sat.*, iv. 105-121; vi. 76-89). It is probable that soon after he had assumed the toga virilis, at the age of about seventeen, he went to Athens to pursue his studies (2 *Ep.*, ii. 43-45), where he appears to have remained till the breaking out of the civil war during the second triumvirate. In this contest he joined the army of Brutus, was promoted to the rank of a military tribune (1 *Sat.*, vi. 48), and was present at the battle of Philippi, B.C. 42 (*Carm.* ii. 7, 9). Though the life of Horace was spared, his paternal property at Venusia was confiscated (2 *Ep.*, ii. 49-51), and he repaired to Rome with the hope of obtaining a living by his literary exertions. Some of his poems attracted the notice of Virgil and Varius, who introduced him to Mæcenas, whose liberality quickly relieved the poet from all pecuniary difficulties. (1 *Sat.*, vi. 54-62; *Epod.*, i. 31, 32; *Carm.*, ii. 18, 11-14; *Carm.*, iii. 16, 37-38.)

We are informed by Suetonius, in his life of Horace, that he purchased a place as clerk in the treasury. From his introduction to Mæcenas till the time of his death Horace appears to have enjoyed exemption from all cares: he was intimate with Virgil, Tibullus, and other distinguished literary men in Rome, and was a great favourite of his patron Mæcenas and also of Augustus. He resided principally at Rome, or at his country-house in the Sabine valley, which had been given him by Mæcenas. He also had in the latter part of his life another country residence at Tibur, or, as it is now called, Tivoli. The fact of his having a house at the last place, though denied by some critics, is abundantly established by many passages in his works. (*Carm.*, i. 7, 10-14; ii. 6, 5-8; iii. 4, 21-24; iv. 3, 10-12; 1 *Ep.*, vii. 44, 45; viii. 1, 2.) Horace died on the 27th November, B.C. 8, when he had nearly completed his 58th year.

Many critics have maintained that each ode, each satire, &c., was published separately by Horace; but Bentley, in the preface to his edition of the poet's works, argues from the words of Suetonius, the practice of other Latin poets, and the expressions of Horace himself (*Carm.*, i. 1; ii. 20; iii. 30; *Epod.*, xiv. 7; 1 *Sat.*, x. 92; ii. 1; *Ep.*, i. 1; i. 20), that his works were originally published in books in the order in which they now appear. He maintains that the first book of the Satires was composed B.C. 40—38; the second book B.C. 35—33; the Epodes B.C. 32—31; the first book of Odes B.C. 30—28; the second book of Odes B.C. 26—25; the third book of Odes B.C. 24—23; the first book of Epistles B.C. 20—19; the 'Carmen Sæculare' and the fourth book of Odes B.C. 17—15; the second book of Epistles and the Epistle to the Pisos, called *De Arte Poetica*, were written last, but at what period is uncertain. The works of Horace have been printed in this order by Mr. Tate, under the title of 'Horatius Restitutus, or the Books of Horace arranged in chronological order,' Camb., 1832, 2nd edit., 1837, with a preliminary dissertation, in which he brings forward many reasons for adopting the order of Bentley.

The poetry of Horace is differently estimated according to the taste of each individual. In our opinion the Satires and Epistles, which are familiar moral discourses, and are hardly worthy of the name of poetry, according to the usual acceptation of the word, are by far the most valuable of his works. The Odes, which for the most part are little more than translations or imitations of the Greek poets, are generally written in a very artificial manner, and seldom depict the stronger and more powerful feelings of human nature. The best are those in which the poet describes the pleasures of a country life, or touches on the beauties of nature, for which he had the most lively perception and the most exquisite relish (*Epod.* 2); nor are his lyrical productions altogether without those touches which excite our warmer sympathies. But if we were to name those qualities in which Horace most excels, we should mention his strong good sense, his clear judgment, and the purity of his taste. Many readers, we are aware, attribute still greater merit to the poetry of Horace than we are disposed to allow.

The following are the most esteemed editions of Horace: —Lambinus, 1561; Heinsius, 1629; Bentley, 1711; Burmann, 1713; Sanadon, 1728; Mitscherlich, 1800; the edition of Baxter, edited by Gesner and Zeune, frequently printed; Döring, 1828-9; Braunhard, 1833. Horace has been translated into almost all the European languages, both in prose and verse. A few of the Odes and Satires have been well translated into English; but there is no good translation in English of the whole of his works. That of Francis (4 vols. 12mo., 1747) is a poor and lifeless performance.

HORDEIN, a peculiar vegetable product found by Proust in barley. It is a yellowish powder. When treated with nitric acid it yields oxalic and acetic acid, and traces of a bitter matter. Hordein is insoluble in water, and Proust states that whilst barley contains 55 per cent. of this substance, malt contains only 12 per cent. It is not found in pearl barley, and is therefore supposed to be contained in the husk only.

HO'RDEUM, the genus of plants to which the corn called Barley belongs. It is distinguished from Triticum, or the Wheat genus, by its spikelets having only one perfect floret in each, and by its glumes being somewhat unilateral and bearded; Rye, or Secale, differs in having two perfect florets to each spikelet, and in the same additional circumstances as Triticum. As many as fifteen species of Hordeum are distinguished by Professor Kunth, the latest writer upon the subject; in addition to which there are many varieties. The species are found wild in various places in both the Old and New World: as many as eight inhabit America. In the application of their botanical names to the cultivated Barleys there is some confusion, one writer distinguishing four species, another six, and some a greater number. It does not appear possible to determine, upon existing evidence, which of these opinions is most correct; the probability however seems to be that there are not more than four, or at the utmost six species, which may be readily distinguished by attention to the following circumstances. The one-flowered spikelets of Barley grow in threes, on opposite sides of the ear. If all the spikelets are perfect, the grains of corn are therefore necessarily arranged in six lines or rows; these rows may be very distinctly arranged, as in *H. hexastichum*, or they may be disposed in an irregular manner, as in *H. Ægiceras*.

* A *coactor* was a servant of the money-brokers, who attended at sales by auction, and collected the money from the purchasers.

But if the lateral spikelets of each parcel are imperfect all along the ear, the middle spikelet alone producing a grain of corn, the grains in that case will be in two rows only, as in *H. distichum* and *H. Zeocriton.* Of these two distinct forms, there are some in which the grain adheres to the paleæ, or husk, as in Common Barley, and others in which the grain is free from the husk, as in naked Barley. It is generally supposed that Barleys of the second kind are mere varieties of those of the first kind; but there is no proof of the correctness of the opinion, and probability is against it. These characters and a few others being attended to, cultivated Barleys may be arranged under the following heads:—

* *Two-rowed Barleys.*

1. H. distichum (Linn., *Sp. Pl.*, 125). Ear cylindrical; awns almost parallel with the ear; grains adhering to the husk. This is the common summer Barley of England, and that which cultivators seem to prefer; its ears are not so large as those of *H. hexastichum*, but the grains are heavier. It is commonly stated to be a native of Tartary; Colonel Chesney found it wild in Mesopotamia, upon the banks of the Euphrates.

2. H. gymnodistichum (Lowe's *Elements of Agriculture*, p. 238). Ear cylindrical; awns almost parallel with the ear; grains loose in the husk. Naked Barley, a species but little cultivated now, is of unknown origin. It is said to have been introduced into England in the year 1768; but it is reported to have preserved its characters unaltered from time immemorial in some parts of Europe.

3. H. Zeocriton (Linn., *Sp. Pl.*, 125). Ears conical; awns spreading away from the ear, in a flabelliform manner; grains adhering to the husk. From the spreading direction of the awns, the ears of this barley acquire a much broader figure at the top than at the bottom, on which account it has been called Battledore Barley; it also bears the name of Sprat Barley. It is little cultivated in England, because of the shortness of its straw; its native country is unknown.

** *Six-rowed Barleys.*

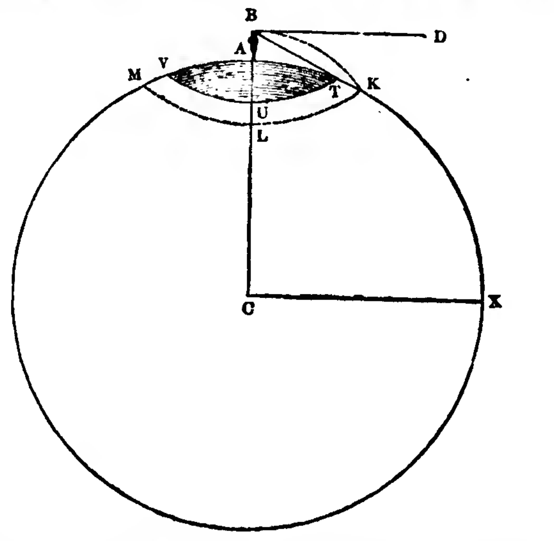
4. H. hexastichum (Linn., *Sp. Pl.*, 125). Ears cylindrical; awns very long, rough, and rigid, rather spreading away from the ear; grains adhering to the husk. It does not appear in what way the *H. vulgare* of Linnæus differs from this. Professor Lowe has justly remarked that there is no such thing as a Barley with the grains growing in four rows, the circumstance by which Linnæus defined his H. vulgare, and that all such appearances are merely imperfect states of H. hexastichum. The native country of this species is unknown; it is the bere, bigg, or winter Barley of farmers, and is particularly valuable for ripening quicker than the common two-rowed Barley; its grains are however lighter, and it is considered an inferior species to the last. To northern nations with short summers it is however invaluable.

5. H. gymno-hexastichum (Lowe's *Elements of Agriculture*, p. 238). Ear cylindrical; awns very long, rough, and rigid, rather spreading away from the ear; grains loose in the husk. The origin of this, the naked six-rowed Barley, is unknown. It is extremely productive, and in some parts of Europe it is reckoned the most valuable of all. The French call it, on account of its good qualities, *orge céleste.*

6. H. Ægiceras (Royle's *MSS.*). Ears cylindrical; florets arranged in a confused manner, not in rows; awns soft, short, hooded, and bent downwards; grains loose in the husk. A most curious species, found in the northern parts of India, and probably in Tartary, as its grains have been sent to England under the name of 'Tartarian Wheat.' Its appearance is more that of wheat than of barley, and its naked grains assist the resemblance. It is however a genuine species of *Hordeum.* It appears to be a productive plant, but little is as yet known of its quality in this climate.

Of most of the species there are many varieties, the most striking of which are those called 'Black Barleys,' on account of the dark colour of their husks. They are not of sufficient importance to require particular notice, except in works treating of agriculture in great detail. [Barley.]

HORIZON (ὁρίζων, bounding). The physical horizon is the apparent circle by which the spectator's view is bounded when he is upon a level and uninterrupted plain, such as the surface of the sea. It differs from the astronomical horizon in two points; firstly, because the physical horizon *dips*, as it is called, or is not at the same level as the eye; and, secondly, because the astronomical horizon always supposes the spectator to be at the centre of the earth, and not at the surface. If AB represent a spectator



standing upright, and C the centre of the earth, then if the circle VAX revolve round the axis BC, the physical boundary is the circle described by T, or TUV, and the astronomical horizon is the plane traced out by CX (indefinitely extended) drawn parallel to BD, or perpendicular to CB; and the angle DBT is called the *dip* of the physical horizon. In consequence however of the refraction of light, by which the rays are curved, as in the dotted line drawn from B, the physical horizon is thrown farther than in the explanation just given; for instance, to the dotted circle KLM. The effect of this is to make the distance AT greater by about its twelfth part. The rough rule for finding the distance of the apparent horizon at sea is: $1\frac{3}{10}$ of the square root of the height of the spectator's eye, *in feet*, gives the distance of the physical horizon *in miles.* Thus at a height of 100 feet, the horizon is 13 miles off.

The astronomical horizon divides the heavens into a visible and invisible part. Properly speaking it is the physical horizon which does this; but the distance of the fixed stars is so great, that the magnitude of the whole earth is but as a point, and the planes traced out by the revolutions of BD and CX may be confounded. It is not precisely the same thing with the planets, and least of all with the moon; but this belongs to Parallax. For the general use of the astronomical horizon, see Sphere, Doctrine of the.

The plane of the horizon at any place is perpendicular to the direction of a plumb-line, or parallel to the surface of any fluid at rest. At sea, when it is necessary to take the altitude of any heavenly body, the physical horizon is, in tolerably fair weather, sufficiently well defined for the purpose, and, with proper allowance for its dip, is used accordingly. But in land observations with a sextant or other instrument requiring an horizon, the surface of a fluid (generally mercury) is used, which is called an *artificial horizon*, but might more properly be termed an artificial portion of a horizontal plane. A very slight knowledge of optics [Reflexion] will show that the angle subtended at the eye by a star and its image in a fluid is double of the star's altitude: this angle, then, being measured and halved, the altitude of the star is found.

HORMISDAS, a native of Frusino, succeeded Symmachus in the see of Rome, A.D. 514. Theodorio was then king of Italy, and under his wise administration the country enjoyed peace and prosperity. Theodoric made valuable presents to Hormisdas to adorn the basilica of the Vatican. Cassiodorus, a contemporary writer, speaks in his letters of the magnificence displayed at Rome at the time; and also of the fights of wild beasts given in the amphitheatre, especially on the occasion of the consulship of Flavius Anicius Maximus, in which many of the fighters, or gladiators, as they were still called, lost their lives. Hormisdas repeatedly sent legates to Constantinople to the Emperor Anastasius II. and his successor Justinus, in order to put an end to the schism between the Greek and the Roman churches, which had originated with the patriarch Acacius. [Gelasius I.]

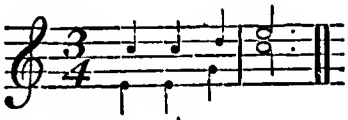
A reconciliation was effected, at least for a time. Hormisdas died in the year 523, and was succeeded by John I.

HORN, a musical wind-instrument, which in its primitive state, *i.e.* formed of the horn of an animal, or simply a shell, has been known from the most remote ages. Of the horns now in use, three are correctly denominated,—the French-Horn, the Bugle-Horn, and the Russian Horn. These are made of brass. The Basset-Horn (*Corno Bassetto*) and the English Horn (*Corno Inglese*), formed of wood, and partaking in no respect of what is generally considered the distinguishing character of the Horn, seem to be improperly named.

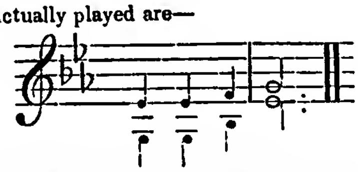
The *French Horn*, or now, *par excellence*, the *Horn*, is a tube of about ten feet, very narrow at top, widening considerably at the bottom, and bent in rings for the convenience of the performer, as well as to render it more portable. It is not provided with holes, as the flute, &c., the production of the various sounds depending upon the lips of the player, the more or less pressure of his breath, and the insertion of the hand in the bell, or wide end, of the instrument. As a simple tube, the Horn, governed by the laws of acoustics [ACOUSTICS], yields only the generating note, or tonic, and its aliquot parts, or harmonics, and, of course, would be confined to one key, but for the contrivances just mentioned, by which the length of the instrument is adjusted to the key required. This consists in *crooks* and *shanks*, or shifting pieces, added as wanted to the upper end of the tube; and thus the Horn may be employed in all keys.

Music for the Horn is always written in the key of C, an octave higher than played, and in the treble clef; and the key in which the instrument is to be tuned is indicated by the composer. Thus, if the piece be in E♭, the words '*Corno in* E♭' are prefixed to the horn part. Example, as written:

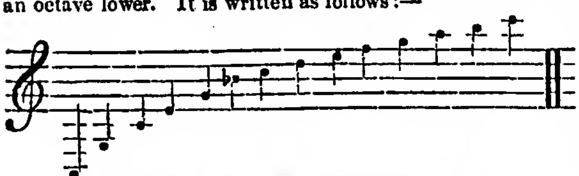
Horns in E♭.



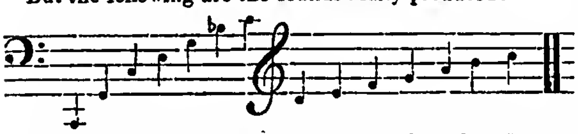
The notes actually played are—



The natural scale of the Horn is that of the trumpet, but an octave lower. It is written as follows:—

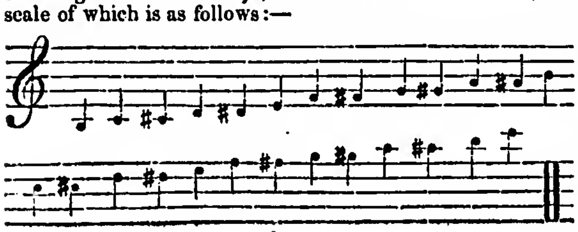


But the following are the sounds really produced:—



By introducing the hand into the *bell* of the Horn, a tolerably good semitonic scale can be produced; and by a recent improvement, consisting of two valves added to the instrument, the performer can command a still more perfect scale of semitones.

The *Bugle-Horn* is a tube of three feet ten inches in length, doubled up in a small compass. The *Keyed-Bugle*, or a Bugle-Horn with keys, is that now in common use, the scale of which is as follows:—



The *Russian Horn* is an unbent brass tube, conical in shape, of various dimensions: the deepest toned is eight feet long, and nine inches in diameter at the wide end, and the highest is two inches and a half in length, by one at the wide end. The former gives A, an octave below the first space in the base; the latter gives E, the third additional line above the treble; or—

Some of these horns, though not all, have keys, producing one or two semitones, but generally every note has its separate horn; and a band of Russian Horns counts almost as many individuals as diatonic notes in a scale of between four and five octaves.

Basset-Horn, or *Corno Bassetto*, see BASSET-HORN.

The *English Horn*, or *Corno Inglese*, is a deeper-toned oboe, but of rather larger dimensions, somewhat bent, the lower end very open, and is to the latter what the basset-horn is to the clarinet; or what the viola is to the violin. The tone of this instrument is extremely pathetic, and by the Italians is thought so much to resemble the human voice, that they sometimes call it the *voce umana*. The scale of the *Corno Inglese* (by which name it is most commonly known by musicians) is from A below the treble staff, to B♭ above, or—

including all the semitones, except the lowest A♯.

HORN, CAPE. [CAPE HORN.]

HORNBEAM, the common name of the tree called Carpinus Betulus by botanists.

HORNBILL, HORNBILL FAMILY. The *Buceridæ* are a family of birds, the construction of whose bill arrests the attention at first sight, and ornithologists have not been entirely agreed as to the situation which the form ought to occupy in the series.

It is not at all improbable, from the geographical distribution of the species, that some of the species were known to the ancients; but whether the Tragopan* of Pliny and Solinus, or the Tragopœmenes of Pomponius Mela, belonged to this genus is not clear. That the Rhinoceros bird of Hesychius and Varinus was one of the species is not unlikely. Aldrovandus, Jonston, and Bontius† give the form the same name, as do Ray and Willughby‡, the latter of whom gives two good figures of heads. Bontius also describes one of the species under the appellation of *Corvus Indicus*, and another as *Corvus rostro cornuto*. Petiver received the bill of one (which he figures) from Kamel, under the name of *Calao*. The description of the bird said by Jonston and others to have been killed as it was flying, when the Christians beat the Turks at the battle of Lepanto (Naupactum), agrees well with the characters of the genus.

Brisson gives the Hornbills the name of *Hydrocorax*, following, not improbably, Clusius, who speaks of one of them under the title of *Corvi marini genus*.

Linnæus, in his last edition of the *Systema Naturæ* (12th), places the Hornbills, genus *Buceros*, under the *Picæ*, between the Toucans (*Ramphastos*) and *Buphaga*. The feet he defines to be gressorial. Gmelin leaves *Buceros* in the same position.

Latham also places the Hornbills among the *Picæ*, Pies, with walking feet.

Lacépède removes the form far from the Toucans, placing it at the head of his *Platypodes* and in his 16th order (Bill

* The *Tragopan* of modern zoologists is a gallinaceous bird, considered by many to be intermediate between Meleagris and the typical Pheasants.

† 'Corvus Indicus cornutus, seu Rhinoceris Avis.'

‡ Willughby terms the Hornbill 'The Horned Indian Raven, or Topau, called the Rhinoceros Bird.'

dentilated), with the *Momots*, in his second division of his first subclass of birds, or those which have three anterior toes, and sometimes a hind toe, sometimes none.

M. Duméril's second family of his second order, *Passereaux*, or Passerine Birds, consists of the *Dentirostres*, or *Odontoramphes*, including two of the Hornbills, Momots, Plant-cutters (*Phytotoma*).

Illiger's *Dentirostres* come between the Passerine Birds and Crows, and belong to his 2nd order, *Ambulatores*, or and Walking Birds.

Cuvier places the *Buceridæ* at the end of the Syndactylous Passerine Birds; they are immediately preceded by the Todies (*Todus*). Next to the *Buceridæ*, in his system, come the Scansorial Birds (Les Grimpeurs), headed by the Jacamars (*Galbula*, Briss.), which are followed by the Woodpeckers. He speaks of the *Buceridæ* as large birds of Africa and the Indies, whose enormous bill renders them so remarkable and connects them with the Toucans, while their carriage and habits bring them near to the Crows, and their feet are those of the Bee-eaters and Kingfishers.

M. Vieillot arranges the Hornbills and Momots in his family of *Prionotes*, in the second tribe (*Anisodactyli*) of his second order of birds (*Sylvicolæ*.)

M. Temminck introduces the Hornbills among the Omnivorous birds, the second order in his arrangement.

Mr. Vigors places the *Buceridæ* in the aberrant group of his *Conirostres*. *Fregilus*, in the opinion of that ornithologist, by its curved and slender bill, leads immediately to the Birds of Paradise, which, in conjunction with the *Epimachus* of Cuvier, terminates Mr. Vigors's family of *Corvidæ*, and here, Mr. Vigors thinks, we shall find the passage from the *Corvidæ* to the *Buceridæ*. He speaks indeed with considerable hesitation as to the situation of *Epimachus*, but observes that being more united in its front toes than the *Corvidæ* in general, it holds a middle station, in respect to that character, between the two groups; while in the length and curvature of its bill it approaches, in conjunction with many of the *Paradiseæ*, to some of the extreme species of the *Buceridæ*, among which, he remarks, the *Buceros nasutus* of Dr. Latham may be instanced.

'We thus,' says Mr. Vigors, 'arrive at the singular family of *Buceridæ*, which seems to draw near to the preceding groups in its food and habits, as far at least as we can conclude from the very imperfect accounts which are transmitted of them. From the strength also of the formation of these birds, and the powers with which they are endowed, they seem to assert a title to a place in the vicinity of the group which is typical in the tribe. In one particular however we may detect a deviation from the more perfect structure of that type. The fore-toes of all are strongly united at the base, the external being joined to the middle as far as to the second articulation; an impediment which must considerably interfere with the free action of the member. This deficiency is, on the other hand, retrieved by the superior robustness and muscular conformation of the whole limb. An analogous defect, and an analogous mode of compensating for it, is observable in the *Ostrich*, a bird also, it is to be observed, closely allied to the typical group of its own family; and in both instances we may pronounce the deviation from the more regular or perfect conformation to be a defect rather to the eye of the observer, an infringement upon what he would conceive to form the *beau-idéal* of the typical character, than a defect in reality. We may here delay a moment to observe upon the causes that assign so totally remote a station from the present to the *Todidæ*, *Meropidæ*, and *Halcyonidæ*, whose gressorial feet, as they are technically called, are of precisely the same structure as those of *Buceros*. In them, the deficiency, accompanied by a corresponding weakness of the whole member, is real, and of sufficient consequence to deprive the bird of the means of using its legs and feet to advantage. The force and powers of these parts are in fact transferred to the wings, which are thus endowed with a more than usual share of strength, in order to afford the bird a more than usual assistance in the aërial mode of seeking its food which it is assigned by nature. In the *Buceros*, on the other hand, the gressorial feet are accompanied by a superior robustness, which counterbalances their inferiority in form. And hence the family may consistently maintain its station in the vicinity of the more perfectly formed and typical groups of the *Insessores* which are now before us. The tendency, already observed, which opposite points of the circle in which a series of affinities is united have to approach each other, accounts for the resemblance here pointed out between these otherwise discordant groups, and serves to explain the reason why the analogous relation between them has been mistaken for a relation of affinity by systematic writers, so far as to induce them to arrange all the gressorial birds in one connected group. Besides the genus *Buceros*, Linn., the protuberance on the bill of which varies in almost every possible shape in which fancy can embody it, the present family includes the *Momotus* of M. Brisson, which accords with the entire of that genus in its gressorial feet, and with several species of it, as the genus now stands, in the curved but somewhat shorter and more attenuated bill.' [MOMOT.]

In his remarks on the succeeding order, *Scansores*, Mr. Vigors observes, that besides the deviation from the more perfect formation of the foot in the *Buceridæ*, which prepares us for the more considerable deviation that takes place in the same particular among the *Scansorial Birds*, the large and disproportionate bill of that family is carried on to the *Ramphastidæ*, the first family of the *Scansores*, according to Mr. Vigors.

M. Latreille arranges the Hornbills among the *Syndactyles*, the fifth family of his second order (*Passereaux*, or Passerine Birds), in company with the *Bee-eaters*, *Momots*, *Kingfishers*, &c.

In the method of M. de Blainville, as carried out by his pupil M. Lherminier, the Hornbills appear among the *Normal Birds* (first subclass), and as the fourteenth family, between the Kingfishers and the Toucans.

M. Lesson in his 'Projet' places the *Buceridæ* as the last family of his *Insessores*, or *Grimpeurs*, arranging it in the third tribe (*Syndactyles*) of that his first order. The other families of the tribe are the Bee-eaters, *Meropidæ*; Kingfishers, *Halcyonidæ*; and Cocks of the Rock, *Rupicolidæ*.

Mr. Swainson arranges the *Buceridæ* among the *Conirostres*, together with the *Corvidæ*, *Sturnidæ*, *Fringillidæ*, and *Musophagidæ*. After noticing the peculiar conformation of the bill in the *Buceridæ*, he observes that in some of the species that organ is without the basal protuberances, so that they bear the nearest affinity to the Toucans, belonging to the Scansorial tribe, which is joined to the Conirostral. He considers that we have no bird which actually unites the two families in so perfect a manner as that by which the Toucans are blended with the *Fissirostres* through *Prionites*; and he remarks, that we should expect that a bird which might conduct us from the Toucans to the Hornbills would be of large size, and that it would present us with some of the gay colours peculiar to the Toucans, both in its bill and plumage; but that its feet should no longer exhibit the scansorial structure, inasmuch as that, as he has before remarked, we see, in the little power possessed by the Toucans of climbing, that nature is about to quit the scansorial structure. There is good reason to believe, he thinks, that such a bird is in existence, although at present only known to modern writers by a drawing executed in India, in the collection of Mr. Smith. Both Dr. Latham and Dr. Shaw, he adds, describe this bird under the name of the *Crimson Hornbill*, and he considers that the figure published by the latter carries internal evidence of its authenticity. Mr. Swainson sees in this bird the crimson colour, the long tail, and the dorsal collar, so prevalent in the genus *Pteroglossus*, joined to a miniature Toucan's bill, with a distinct band at the base, like the *Ramphastos Tucanus*, yet with the feet of a Hornbill. That this bird, and probably other annectant species, will hereafter be discovered in the vast and still unexplored regions of Central Asia, Mr. Swainson does not doubt. He speaks of the Hornbills as a small family, of which perhaps the typical form is now only known; and he looks upon them as being as much isolated as the Toucans and the Parrots. He adverts to their enormously large bills, generally furnished with an appendage or excrescence on their top, the use of which, he says, is unknown; nor has, he adds, the internal structure of this member been fully ascertained. The feet, he remarks, are generally so very short as to appear calculated only for perching. 'United,' continues Mr. Swainson, 'to the Scansorial Birds by means of the Toucans, they would seem to represent the *Rasores*; but the structure of their feet, more imperfect than any of the families in this order, forbids the supposition. This opinion we had long entertained from theory, but it has recently been confirmed by a singular fact in their economy, communicated by an officer long resident in India. It seems that all the species of *Buceros* he has met with in a live state are constantly in the habit of throwing their food up in the air and catching it before it is swallowed.' This propensity Mr. Swainson considers to be an incipient development of the fissirostral economy. We have only to add, that Mr. Swainson does not admit into the family of the *Buceridæ* the Momots (*Prionites*), which he places under a line drawn at the end of the family of *Trogonidæ*. (*Classification of Birds*, 1837.)

Organization.

Some light will be thrown on the proper place of the bird in the animal series by tho following account of the anatomy of a young *Buceros cavatus* by Mr. Owen, now Hunterian professor to the Royal College of Surgeons. The subject died in the Gardens of the Zoological Society of London at the Regent's Park, and Mr. Owen's paper was read to the Society in 1833. The tongue was very short, of a triangular form, and very smooth. The air-cells were very large, and that in front of the neck contained the œsophagus and the trachea. The œsophagus, as in the *Toucan*, was very wide, and of nearly equal diameter as far as the gizzard. The gizzard was thicker in its coats and of a more elongated form than that of the *Toucan*: its cuticular lining was very tough, and disposed in longitudinal ridges. After the duodenal fold the remainder of the intestinal canal was disposed in two similar folds, and then extended along the middle line of the back to the *cloaca*. There were no *cœca*. The coats of the intestines were stronger than is usual in *birds*, and the diameter of the canal was more considerable, diminishing however gradually from the commencement of the *ileum*, as far as the beginning of the *rectum*, and thence becoming wider to its termination. The whole length of the intestines was 5 feet; that of the bird, from the end of the bill to the vent, being 2 feet 2 inches, of which the bill measured 7 inches. The liver had the usual two lobes, of which the right was the largest. The gall-bladder was of considerable size. The *pancreas*, of an elongated slender form, had a small oval enlargement at its commencement at the lower end of the spleen, and a flattened oblong mass or head at the bottom of the duodenal fold: it accompanied the *duodenum* throughout its length, being folded on itself similarly to the intestine. Its secretion was conveyed into the intestine by three ducts; one from its head, which entered the *duodenum* at the bend of the fold; the others from the elongated lobes which terminated close together at the end of the fold between the insertions of the hepatic ducts; an arrangement, as Mr. Owen observes, corresponding with that described by Cuvier in his 'Leçons d'Anat. Comp.,' tom. iv., p. 55, as existing in the *Heron*. In the *cloaca* the rudimentary bladder was little more than a line in width, and the ridges bounding it above and below were confined to tho back part of the cavity. The *bursa Fabricii* (which Mr. Owen regards as analogous to the glandular pouch found in so many other classes) was of a triangular form, large, and surrounded, as usual, by a capsulo of muscular fibres.

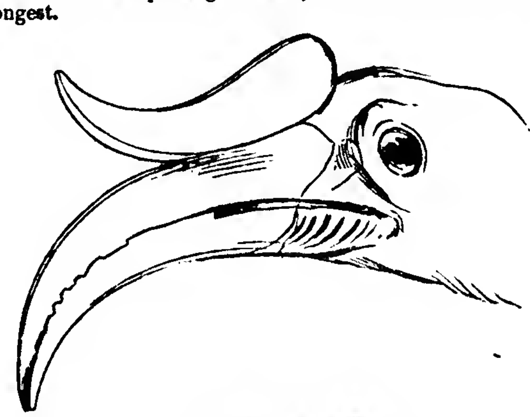
The muscles of the mandibles consisted of a *digastricus*, or of a muscle analogous to it, destitute, as is usual in birds, of a middle tendon, a temporal muscle of moderate size, and *pterygoidei externi* and *interni*, proportionally more developed. There is also a strong ligament occupying the place of the *masseter*, and a second, destined to prevent dislocation backwards, which passes from the *zygoma* directly backwards to the condyle, or articulate depression of the lowerjaw. Disproportionate, observes Mr. Owen, as this apparatus seems to the moving of so large a body as the bill of the *Hornbill*, it is yet fully adequate, the weight of that organ by no means corresponding with its size. The cavities in the bones, the arrangement of the columns supporting their *parietes*, and the air-cells, produce at the same time lightness and strength.

With respect to the other parts of the skeleton, Mr. Owen particularly noticed the extension of the air-cells into the distal bones of the extremities. He remarked that Mr. Hunter observes how, in the *Pelican*, the air passes not only into the *ulna* and *radius*, but 'into those bones which answer to the *carpus* and *metacarpus* of quadrupeds.' In the Hornbill Mr. Owen showed that the air passes also into the bones corresponding to the *phalanges*; and in the posterior extremity he demonstrated that it permeates the *tibiæ*, *tarsi*, and *phalanges*.

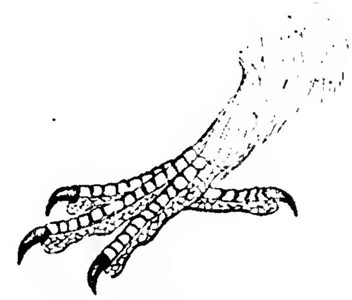
Mr Owen concluded by some remarks on the affinities of the *Hornbill* as deducible from its anatomy. Its nearest approach is to the *Toucan*. The *Toucan* however, in the want of a gall-bladder, agrees with the *Parrots*; the presence of that organ in the *Hornbill* places the bird in more immediate relation with the *Crows*. The disposition of the intestines, in long and narrow loops, also agrees with the *Raven*. The tongue, so remarkably varied in form and use among the *Scansores*, resembles in the *Hornbill* that of the carnivorous Birds. (*Proceedings of the Zoological Society of London*, 1833.)

Genus. Buceros.

Bill long, very large, compressed, more or less curved or falcated; base smooth, elevated, or rather surmounted by a casque or helmet-like protuberance; edges of the mandibles smooth or notched; point smooth; interior of the bill, especially the upper mandible and casque, very cellular; *nostrils* basal, on the surface of the beak, in a furrow, small, somewhat round, open, pierced in the corneous substance of the bill, covered at the base by a membrane. *Feet* short, strong, muscular; sole of the foot large. *Wings* moderate; the three first quills graduated; the fourth or fifth the longest.



Head of Buceros Rhinoceros.*



Foot of Buceros cavatus.

Geographical Distribution of the Genus.—The Old World, Africa, India and its islands, New Guinea.

Habits, &c.—Bontius, in his description of his *Corvus Indicus* (*Buceros Hydrocorax* of Linnæus), a native of the Moluccas and Banda, says, 'More Corvi nostratium graditur, indole a nostris corvis differt, quod non cadavere, sed potissimum nucibus myristicis avide vescatur; iisque insigne damnum infert. Caro eorum quoque delicata est, et assa saporem a pastu plano aromaticum habet (It walks like the crow of our countries, but differs much in disposition from our crows, inasmuch as it feeds not on carcasses, but most especially on nutmegs, and that greedily, doing a great deal of damage to them. Their flesh also is delicate, and when roasted has an aromatic flavour from their food).' Of the 'Corvus rostro cornuto' (*Buceros Rhinoceros* of Linnæus) he says that it lives on the carcasses and intestines of animals, and that it waits upon the hunters who kill wild cattle, boars and stags, to gorge itself with the entrails of those animals. Willughby, in his account of 'Bontius his Indian Raven,' says, 'It walks after the manner of our *Raven*, but differs from it in nature and disposition, in that it feeds not upon carrion or dead carcasses, but chiefly upon nutmegs, of which it is very greedy, making great destruction of that fruit, to the no small detriment of the owners. Its flesh is very delicate, and being roasted

* A section is figured in the article Birds, vol. iv., p. 227.

hath a plain aromatical relish, contracted from its food.' Of 'The horned Indian Raven, or Topau, called the Rhinocerot Bird,' he says, 'This horned bird, as it casts a strong smell, so it hath a foul look, much exceeding the *European Raven* in bigness.' * * * 'It lives upon carrion and garbage, *i. e.* the carcasses and entrails of animals.' Both these passages are taken from Bontius, as the reader will perceive. Cuvier considers them as omnivorous—'Ils prennent toute sorte de nourriture;' and he states that they eat tender fruits, hunt mice, small birds, and reptiles, and do not even disdain carcsases. The late Major-General Thomas Hardwicke, who contributed so largely to our acquaintance with Indian animals, in treating of *Buceros galeatus* (*Linn. Trans.*, vol. xiv.) gives the following description of the habits of the Hornbills:—'The progressive motion of the birds of this genus, although their feet are formed for walking, is always by jumping or hopping. I have kept several species alive, and they all moved in the same manner. In a state of nature these birds, in this part of Indis (Malacca), live on wild fruits. In confinement they feed freely on plantains and on boiled rice. At night they perch with great security, though the largeness of the foot seems better suited to rest on the ground.' M. Lesson sums up the habits of the Hornbills thus:—Those of Africa live on carrion; those of the East Indies seek for fruits, especially nutmegs, and their flesh acquires from them a delicious flavour. Their flight is performed by repeated strokes of the wings, and the air which they displace, joined to the clattering of their mandibles, occasions a great and very disquieting noise in the forests, when the cause is unknown. This noise, capable of inspiring terror, does not ill resemble those flaws of rough and sudden winds ('grains de vent brusques et subits') which arise so unexpectedly between the tropics, and blow so violently. The Europeans established at the Moluccas think that the furrows which are seen on the bill of the Hornbills are the result of age, and that each furrow signifies a year; whence the name of *Jerarvogel*, which they give to these birds. Mr. Swainson remarks that the Hornbills are gregarious noisy birds, generally of a very large size, and are restricted to the Old World; that they are omnivorous, feeding both on animals and vegetables; that some however seem only to partake of the latter food; while others, upon the authority of Le Vaillant, feed upon carrion. The *Buceros cavatus* dissected by Mr. Owen was observed to be more attached to animal than to vegetable food, and would quit any other substance if a dead mouse were offered to it. This it would swallow entire, after squeezing it twice or thrice with the bill; and no castings were noticed. Mr. Owen however adds that Petiver has borne testimony to its regurgitating habits.

Before we proceed to give examples of the family as it here stands, that is, as consisting of the *True Hornbills* alone, we may remark that if it should be clearly made out that some species live entirely on vegetable food, while others live on carrion, as has been asserted, there may be good grounds for elevating such species to the rank of genera; for such a total difference of food must in all probability be accompanied by a corresponding difference of internal structure and of general habits. M. Temminck may be considered as the author who has most successfully dissipated the obscurity in which the species were involved; and to his elaborate and beautiful works we refer the reader. We shall select as examples the following two species.

Buceros Rhinoceros.—This species is to be found in most collections, and though there may be some variety from age and circumstances, the bill will be generally found to be about ten inches long and of a yellowish white, the upper mandible red at the base, the lower black. The horn, or casque, varied with black and white. The body black, of a dirty white below and posteriorly; tail about twelve inches, the feathers white at the base and tip, black in the middle; feet and claws obscure grey.

Locality, India and the Indian islands (Sunda, for instance).

Buceros cavatus.—Throat, ear-coverts, circle round the eye, and a narrow band at the occipital edge of the protuberance of the beak, black; neck dirty straw-colour, the feathers of the back of the neck elongated; body and wings black, greater coverts and quill feathers tipped with white; thighs, upper and under tail-coverts, white; as is the tail also, with the exception of a broad black band about three inches from the tip; beak yellowish, inclining to scarlet at the tip, under mandible black at the base; tarsi black. (Gould.)

Food.—The food of the *Buceros cavatus*, like that of other Hornbills, consists of fruits, berries, flesh, and even carrion; in short, it may be considered as strictly omnivorous.' (Gould.)

Locality, India, Himalaya range, Java, and most of the islands of the Indian Archipelago.

Buceros Rhinoceros.

Buceros cavatus.

HORNBLENDE. [AUGITE.]

HORNBLENDE SCHIST. Under this term MacCulloch ranks a variety of mineral aggregates, in which hornblende abounds, and which are mostly but not universally of laminated structure. Hornblende schist is commonly associated with gneiss, less frequently with mica schist, and seldom forms alone any considerable mountain masses.

It follows the contortions of gneiss, and is traversed like it by granitc veins. (Glen Tilt.) Hornblende is rarely associated with argillaceous slate, as in Ben Lair, in Skiddew, Cader Idris, end near the granites of Cornwall. In these cases its origin may perhaps be due to the action of the contiguous heated granitic messes, and such rocks mey be considered 'metamorphic.' They are considerably different from the Hornblende schists of Glen Tilt, Iona, and Ross-shire. (MecCulloch on *Rocks*.)

HORNCASTLE. [LINCOLNSHIRE.]

HORNDON. [ESSEX.]

HORN-WORK, a fortification usually situeted in advance of the principal works of a place. The rampart of its front, on the plan, is similar to that which is formed on each side of the polygon, supposed to surround a regular fortress; and on each flank a line of rampart returning from the nearest extremity of the front terminetes on the ditch either of a bastion or ravelin on the enceinte of the place. The work is generally strengthened by a ravelin placed before the curtain between its two demi-bastions, and by a covered-way and glacis beyond the ditch; these return elong the branch or wing on eech side, and join tho covered-way and glecis of the collateral bastion or ravelin of the enceinte.

The invention of horn-works is referred to the commencement of the seventeenth century. At first the plan of their rampert had simply the form of the letter M, the uppor points being directed towards the country like horns; from which circumstance the work obtained its namo. They appear also to have been at first formed of eerth only, for the purpose of strengthening a place in deily expectation of a siege, when thero were no outworks end when the bastions were small and very distant from eech other. They were then constructed in front of the curteins, by the fire from whence the epproach of the enemy towards their flanks might be opposed.

But the feeble defence which was made by such works when attacked in front, and the advantage of occupying beyond the principal fortress some position from whence, during the siege, the enemy might be annoyed in forming his approaches, or which, if gained by the latter, might enable him to command the town, almost immediately induced engineers to give to the horn-work the form first described, end to extend it considerebly towards the country. Being however regarded hut as a work of secondery importance in the defence of a plece, the length of its front was seldom so great as that of the sides of the polygon on which the fortifications of the onceinte were constructed, and gonerally did not exceed 240 yards; which, since the relief of its rampart was necesserily neerly the same as that of the enceinte, scarcely allowed the ditch before its curtain to be effectively defonded. The lengths of the branches or wings were regulated by tho necessity of having the ditch and covered-wey in front of the salient angles of the demi-bastions within the range of a fire of musketry from the collateral works towards which the ramparts of the wings were directed; and occasionally the latter were broken, on the plan. so as to form short flanks from whence a fire might be directed towerds the nearest of those salient points.

That which has heen found occasionally useful is too frequontly, by an improper application, converted into a positive evil; this was the case with the works now being described; and at a very early period the multiplicity and injudicious disposition of them were subjects of animadversion among the best engineers. It often happened that they were constructed at great expense in situations where no end whatever was to be gained by them, and so close together that the defenders of their branches could not heve avoided firing upon one enother.

In proportion es the means employed in the attack of places were increased the earlier fortresses became incapable of affording room for the buildings necessary to lodge the troops, and contain in security the quantities of artillery and stores which the corresponding augmentation of the means of defence demanded; and hence it was sometimes found necessary to increase the extent of the advanced works ebout a place. This was done, at first, not by enlarging the dimensions of the half-bastions and curtain at the head of such works, but by making thet head to consist of two or more fronts of fortification, in which case they took tho neme of double, triple, &c., horn-works, but more generelly crown-works. At a later time however the importance of advanced works was more highly appreciated; and, both by an improved disposition of them and by giving to their fronts dimensions equal to those of the general fronts of the plece, they became not only free from the defects to which the old works were subject, but also capable of making a defence equal to that of a regular fortress.

The defects of the old horn-work consist in the expense of the construction being greater than is warranted by the benefit to he derived from them in the defence; in presenting to the enemy a front which, from its smallness, may he taken more easily than one of the fronts of the enceinte; in the revêtment of the latter being liable to be breached by a fire of ertillery directed along the ditches of their wings from batteries formed on the glacis opposite the salient angles of the work; and, lastly, in the comparative security with which en enemy, after beving made a lodgement in the work, might carry on his approaches in the interior in consequence of the protection afforded by the ramperts of the wings against any attempt of the enemy to impede him by sorties directed upon his flanks. It should be observed however that Vauban, who constructed meny such works, eppears to have entertained a favourable opinion of them. He gives the preference to such as are formed immediately in front of a bastion; the wings being directed neither to that work nor to the collateral ravelins, but towards the curtains adjecent to the bastion. By this meens the ditches of those wings are capable of being defended by the artillery of the curtains, while the revêtments of the latter ere covered by the tenailles so as to render it impossible to hreech them near the foot by e fire of artillery directed along those ditches. But his best epplication of a horn-work was made at Belfort, where he executed one entirely in edvence of the glacis of the place; in consequence of this disposition the revêtment of the enceinte is effectually secured against being breached till after the horn-work is taken; while, at the gorge of the latter, the height of the terreplein above the ground at the foot of the glecis ensures the work itself from being teken by an assault in that direction.

A nearly similer disposition was adopted hy Cormontaingne in executing the double crown-work at Metz. Beyond the glacis of that place, on one side, the ground rises with a gentle inclination, till, at some distance from thence, it forms one side of a deop valley; and along the brow are constructed, on noarly a straight line, three strong fronts of fortification. The ground is termineted on the left by an escarpment, which is crowned by a line of rampart with its covered-way and glacis; and on the right is a valley watered by a rivulet, which, being dammed, forms a lake capable of securing the works against an attack on that side. Each flank is further protected by a detached lunette, or redoubt: that on the right, being surrounded by water, is nearly inaccessible; and that on the left is strengthened by a system of counter-mines.

The ample capacity of tho bastions and the directions of their faces, which are such as to prevent them from being enfiladed; the contraction of the ground before the works, by which the enemy would be reduced to the necessity of making his attack on a smaller extent of front than that of the defenders; and finally, the measures taken to secure the flanks, justly entitle this fortification to the character of being the most complete of its kind in Europe.

HORNE, GEORGE, D.D., Bishop of Norwich, was horn November 1, 1730, at Otham, near Maidstone in Kent. At the age of thirteen he was sent to school at Maidstone, under the care of the Rev. D. Bye, and at fifteen was removed to University College, Oxford. He was afterwards elected a fellow of Magdalen; of which college he was appointed principal in 1768. In 1776 he was vice-chancellor; and was appointed dean of Canterbury in 1781, and hishop of Norwich in 1789. He died January 17, 1792, in his 62nd year.

Dr. Horne paid particular attention to the study of Hebrew and sacred literature; in which he adopted many of the principles of Hutchinson. His works, which are numerous, consist principelly of sermons and pamphlets relating to questions which bave long since been settled; of which a list is given by Jones in his edition of 'Horne's Works,' 6 vols. 8vo., 1795. The most celebrated of Horne's works is his 'Commentary on the Book of Psalms,' which was originally published at Oxford, 2 vols. 4to., 1776, and has since been frequently reprinted. (Jones's *Life of Horne*.)

HORNE TOOKE. [Tooke.]

HORNEMANN. [Africa; African Association.]

HORNE'RA, a genus proposed by Lamouroux to include a small recent stony Polypifer, which Solander ranked among the Millepores, and Lamarck among the Retepores. Like the latter genus, it has cells on one side only; they are arranged almost in quincunx, on diagonal lines; the opposite side is slightly furrowed. (Lamouroux, *Tableau Méthodique*.)

HORNET. [Vespidæ.]

HORNPIPE, a rustic musical instrument, still, we believe, known in Wales, consisting of a wooden tube, with holes, and a reed. At each end is a horn; one to collect the wind blown into it by the performer, the other to augment the sound. The Honourable Daines Barrington tells us (*Archæologia*, vol. iii., 1770) that 'the tone, considering the materials of which the instrument is composed, is really very tolerable, and resembles an indifferent hautbois.' In the Welsh language its name is *pib-corn*, which signifies, literally, *pipe-horn*. Sir John Hawkins quotes Chaucer to show that the Hornpipe was a real, not an imaginary instrument; but in the 'Tatler,' No. 157, is a proof not only of its reality, but its actual existence so late as 1710.

Hornpipe is also the name of a dance; and the honourable antiquary above mentioned is of opinion, in which we concur, that the dance-tunes still called *Hornpipes* were originally composed for the instrument known by the same name. Hawkins says that the Hornpipe was invented in this country. It appears,—from the *Dancing-Master*, 17th edit., 1721,—to have been in triple time, six crotchets in a bar. but the well-known tune, *The College Hornpipe*, is in duple measure.

HOROLO'GIUM (Constellation), the Clock, a southern constellation of Lacaille. It is cut by a line passing through Canopus to the southern part of Eridanus. Its principal stars (of which it is not worth while to make a table) are α and β, 34 of Piazzi and 229 of Lacaille, or 474 and 324 of the *Astron. Soc. Cat.*, both of the fifth magnitude.

HOROLOGY (from the Greek ὥρα, time, or hour, and λόγος, a discourse), an explanation of the principles of the measurement of time; but in its modern sense the term is usually applied as descriptive of that art which comprehends a knowledge of the action of the various machines used for the purpose of measuring time.

There can be no doubt that the heavenly bodies originally gave rise to the measurement of time, and that mankind were induced from an observation of their motions to adopt their present mode of dividing it. The space which elapsed between sunrise and sunset has from time immemorial been called a day, and that from sunset to sunrise a night. The day and night were subsequently divided into 24 equal parts called hours, an hour into 60 equal parts called minutes, and a minute into 60 seconds, &c. The moment the sun attains his greatest altitude is called noon for that day; and the time from one noon to the next is a solar day. But as solar days are of unequal length, and as men advanced in knowledge and civilization, many inconveniences must have arisen from this cause; it therefore became necessary to adopt another division of time, which, although an artificial one, is better adapted to the habits and necessities of a civilized community. The year, or one revolution of the earth round the sun, was therefore divided into 365 equal parts or days, the day into 24 equal hours, &c. And time thus divided was called mean time. The time as naturally divided by the apparent motion of the sun was called true or apparent time.

Sun-dials, which show apparent time, and clepsydræ, which give a rude approximation to mean time, were the earliest machines used in the measurement of time. These are treated of under their respective heads; we shall therefore in this article only treat of those pieces of mechanism which are used for the measurement of time, and are kept in motion either by the constant action of gravity through the medium of a weight, or by the elastic force of a spring, and which have received names varying according to the duties they have to perform: thus the term timepiece is applied to any piece which is intended merely to mark the time without striking the hour; a clock is one which, in addition to showing the time, strikes, every hour, on a bell or spring, a number of strokes corresponding to the hour of the day or night indicated by the hands at the time. Quarter clock is applied to one which also strikes the quarters as the hand successively arrives at them. A watch is a pocket timepiece; a repeater, a watch which by means of any mechanical contrivance can at pleasure be made to repeat the hour, or hour and quarters.

History of Clock and Watch making.—The early history of clocks and watches is enveloped in so much obscurity, that it would be almost impossible to point out any individual who could with propriety be called the inventor.

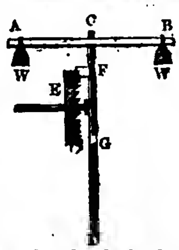
The term *horologium* is met with very early in different parts of Europe; but this word being formerly applied indiscriminately to a dial, as well as a clock, nothing decisive can be inferred from its use. The first author who has introduced the term as applicable to a clock that struck the hours appears to be Dante, who was born in 1265, and died in 1321. It would appear from this, that striking clocks were known in Italy as early as the latter part of the thirteenth or beginning of the fourteenth century. It appears also that a fine imposed on the chief-justice of the King's Bench in the 16th of Ed. I., or 1288, was applied to the purpose of furnishing a clock for the famous clock-house near Westminster Hall, which clock was the work of an English artist. In the reign of Henry VI., which commenced in 1422, it is said that the king gave the keeping of this clock to William Warby, dean of St. Stephen's, together with 6*d*. per day to be received at the exchequer. St. Mary's at Oxford was furnished with a clock in 1523, out of fines imposed on the students of the university.

Clock-making also flourished in Germany, particularly at Nürnberg, about the beginning of the sixteenth century. (Beckman's *History of Inventions*, vol. i.) The anonymous author of 'William, Abbot of Hirshau,' who lived in the eleventh century, has the following passage:—'Naturale horologium ad exemplum cœlestis hæmispherii excogitasse;' but the passage is too short to enable us to form any idea of the construction of the machine. The middle of the fourteenth century seems to be the time which affords the first certain evidence of the existence of what would be now called a clock, or regulated horological machine; for although the term horologia had been of frequent occurrence in preceding ages, there is every reason to believe it was applied to other horological instruments. The earliest authentic notices which we have been able to discover on this subject are the following:—

1. It is said the first clock at Bologna was fixed up in 1356. 2. Henry de Wyck, or Henri de Vic, a German artist, placed a clock in the tower of the palace of Charles V. about the year 1364. 3. Mention is made in Rymer's 'Fœdera,' of protection being given by Edward III. to three Dutch horologiers who were invited from Delft into England in the year 1368; and this appears to have been the probable introduction of clockwork into England. 4. Conradus Dasypodius gives an account of a clock erected at Strasburg about 1370. 5. According to Froissart, Courtray had a clock about the same period, which was taken away by the duke of Burgundy in 1382. 6. Lehmann informs us there was a clock at Spire in 1395. 7. Nürnberg had a clock in the year 1462; Auxerre had one in 1483, and Venice in 1497. 8. It also appears, from a letter written by Ambrosius Camaldulensis (lib. xv., epis. 4) to Nicolaus of Florence, that clocks were not very uncommon in private families on the Continent about the end of the fifteenth century, and there is good reason for supposing that they began to become general in England about the same period, for we find in Chaucer, who was born in 1328, and died about 1400, the following lines:—

'Full sickerer was his crowing in his loge,
As is a clock, or any abbey orloge.'

The conclusion to be drawn from the evidences here adduced is, that a regulated horological machine is neither of so antient a date as some writers suppose, nor yet the more recent invention of the last two centuries; and that the inventor is not certainly known. Ferdinand Berthoud has written more on the subject of clockwork than any other person, and he concludes his researches with the belief—for which there appear to be good grounds—that a clock, such as that of Henry de Wyck, is not the invention of one man, but a compound of successive inventions, each worthy of a separate contriver. Thus—1, Wheel-work was known and applied in the time of Archimedes; 2, A weight being applied as a maintaining power would in all probability have at first a fly similar to that of a kitchen-jack, to regulate the velocity; 3, The ratchet-wheel and click for winding up the weight without detaching the teeth of the great or main wheel from those of the pinion in which they were engaged, would soon be found an indispensable contrivance; 4. The regulation by a fly being subject to such great changes from the variations of density in the atmosphere, and the tendency of a falling body to accelerate its motion, would necessarily give rise to the alternating motion of the balance, with which invention an escapement of some kind must have been coupled; 5. The last-mentioned two inventions are most important ones, and would have induced such a degree of equability in the motion of the wheel-work as would lead the way to a dial-plate and its necessary adjunct—a hand or pointer; lastly, The striking part, to proclaim at a distance, without the aid of a person to watch, the hour that was indicated, completed the list of inventions. And the supposition that De Wyck's clock was a combination of the successive inventions of different individuals is confirmed by analogy, for the clocks and watches of the present day have been brought to their present degree of perfection by a series of successive inventions and improvements upon what may now be called the rude clock of De Wyck, which is the most antient clock of which we have a description. De Wyck's clock was regulated by a balance in the following manner:—The teeth of the crown-wheel E act on two small levers F G, called pallets, which project from and form part of an upright staff or spindle C D, on which is fixed the balance A B, and the mode of adjusting the clock to time was by shifting the two weights W W nearer to or farther from the centre.



Although this clock of De Wyck's, and indeed all those made with a balance for the regulator, without any regulating spring, must have been very imperfect machines, we find that so early as 1484 Walther, and after him the landgrave of Hesse, made use of a balance-clock for heavenly observations; and such seems to have been the comparative utility of the clock thus early for astronomical purposes, that Gemma Frisius proposed the use of a portable one for ascertaining the longitude at sea about the year 1530. In 1560 Tycho Brahe possessed four clocks, which indicated hours, minutes, and seconds, the largest of which had but three wheels, the diameter of one of them being 3 feet, and containing 1200 teeth, a proof of the imperfect state of clockwork at that period. Tycho also observed irregularities in his clocks dependent upon changes in the atmosphere, but does not appear to have been aware how they were produced.

In 1577 Moestlin had a clock which made 2528 beats in an hour, and by counting the number of beats made during the time of the sun's passage over a meridian, the sun's diameter was determined to be 34′ 13″. So early did clocks promote the study of astronomy, which in its turn gave rise to some most important improvements in clockwork.

One of the first additions to the mechanism already described was the alarum or alarm, a contrivance which is in use to the present time, though not for the purpose for which it was originally invented, that of arousing the priest to his morning devotions.

At what time the size of the antient clocks was reduced to a state of portability is uncertain, but it must have been prior to 1544; for in that year the corporation of master clock-makers at Paris obtained from Francis I. a statute in their favour, forbidding any one who was not an admitted master to make clocks, watches, or alarms, *large* or *small*. Before portable clocks could be made, the substitution of the main-spring for a weight, as the moving power, must have taken place; and this may be considered a second æra in horology, from which may be dated the application of the fusee; for these inventions completely altered the form and principles of horological machines.

The French up to the present time continue to make great numbers of portable clocks and timepieces without fusees; but the practice is a departure from principle which can never be tolerated where accuracy of performance is required. In the article CHRONOMETER are given the shape and properties of the fusee. The introduction of portable clocks gave rise to a new position of the balance by placing its verge or axis horizontally, and having its suspension on thin edges of hardened steel, called knife-edges, it being previously suspended by a string or thread; and for a long period after their introduction the pendulums of portable clocks continued to be suspended in the same way; and Berthoud pronounces the knife-edge suspension superior to that of a slender spring, which is the method adopted by English artists. In order that a pendulum should perform its duty with as little disturbance as possible from extraneous causes, it is necessary that it should possess considerable weight; and we think that M. Berthoud would hardly assert that a knife-edge is a proper support for a heavy body in continual motion.

Such was the state of clock-work when Galileo Galilei observed that heavy bodies, suspended by strings of the same length, made their vibrations, whether in long or short arcs, in very nearly, if not exactly, the same spaces of time, which isochronal property he published at Paris in 1639; and although he never applied the pendulum as a regulator to supersede the balance in clocks, yet his discovery was the prelude to a third æra in clock-work, namely, the origin of the pendulum-clock, which continues in use to the present time, and which, in its present most improved form, it seems almost impossible to excel. The honour of first applying the pendulum to a clock has been a matter of much contention, which our limits will not allow us to notice farther than to state, that one of these contests between Galilei and Huyghens gave rise to an excellent treatise on clock-work, 'De Horologio Oscillitario,' which laid the foundation of most of the subsequent improvements in clock-work, and in which it appears that he undoubtedly made, or directed the making of, a pendulum-clock before the year 1658. Huyghens, whether the inventor or not, undoubtedly applied it in the more masterly and scientific manner, and hence has generally been considered the inventor.

Notwithstanding what has been said above, justice to the memory of a countryman of our own, who appears to have a still better claim to the honour than either Galilei or Huyghens, obliges us to mention a London artist named Richard Harris, who invented and made a long-pendulum clock in 1641; and this assertion is supported by very satisfactory evidence. Very soon after the application of the pendulum to clocks the idea of Gemma Frisius was attempted to be realized by the ingenious Huyghens in the construction of a marine clock. He also discovered that its pendulum vibrated slower as it approached the equator, which has led the way to a subsequent discovery that the earth is not a globe, but an oblate spheroid. The discovery by the same individual that the isochronal property which Galilei ascribed to the pendulum was only true in circular arcs when the arcs remained the same (longer arcs requiring a somewhat longer time), gave rise to his cycloidal cheeks, which caused the ball of the pendulum to move in the involute of a cycloid, which, with the pendulum in a detached state, would produce perfect isochronism; but this invention, although beautiful in the extreme, both in theory and practice, as regarded the simple pendulum in a detached state, proved of no service in a clock pendulum. Other sources of error, arising from the alteration in length of the pendulum by heat and cold, and of the string by which it was suspended by moisture, and the impulse given by the clock to the rod through the medium of the fork or crutch (another invention of Huyghens), caused the before-mentioned cheeks to be abandoned.

In 1676, Barlow, a London clockmaker, invented the repeating mechanism by which the hour last struck may be known by pulling a string. Several artists followed in the same line, particularly Quare, in London, and Julien le Roy, Collier, Larçay, Thiout, &c., on the Continent. Clocks were soon after this made to show not only mean but apparent time. The principal artists employed in this more curious than useful part of horology were Sully, an English clockmaker, Father Alexander, a Benedictine, in 1698, Le Bon and Le Roy in 1717, Kriegseissen, Enderlin, L'Admiraud, Passemant, Rivar, Graham, and others.

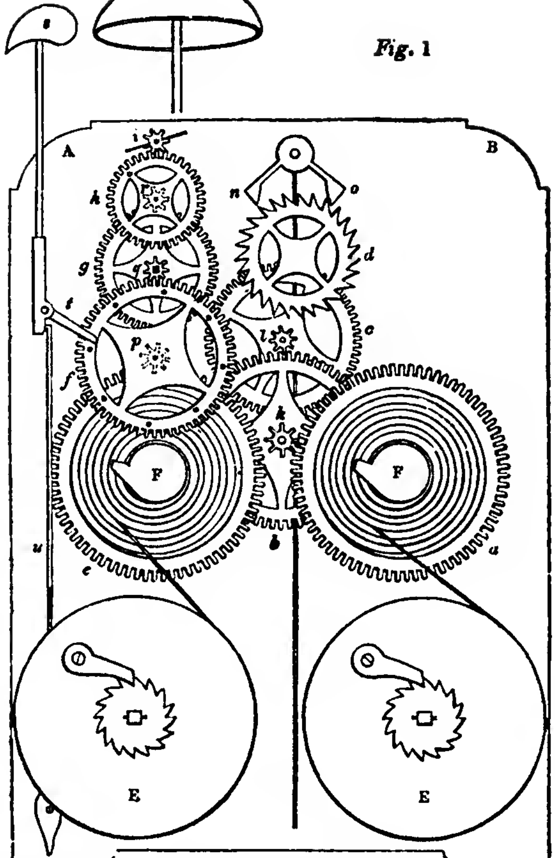
We now have to record an important addition to the improvements in clocks, namely, the invention of the anchor escapement, which, like most others that have stood the test of time, belongs to the English. Even Berthoud confesses this to have been the work of Clement, a London clockmaker, in 1680. The great advantage of this escapement over the old crown-wheel is, that it allows the escape to take place in a small angle of vibration, thereby preventing the necessity for the maintaining power acting upon the pendulum with so great a force as by the old plan, and, by the introduction of a heavy ball, leaving that to be done by the uniform power of gravity which before was dependent upon the impulse given by the wheel to the pallets. This change in the escapement introduced the practice of suspending the pendulum by a thin and flexible spring, another invention of Clement's; though this invention, both of the pendulum and spring, is also claimed by our ingenious countryman Dr. Hooke. The seconds pendulum, with this escapement, was called the royal pendulum.

Another æra in the history of clock-work may be said to have commenced with the beginning of eighteenth century. The expansion and contraction of metals had been known above fifty years; and although the use of the clock for astronomical purposes loudly called for some compensation for the lengthening and shortening of the pendulum by heat and cold, art had not yet supplied this desideratum, until, in the year 1715, George Graham, by substituting a jar of mercury for the pendulum-ball, succeeded in retaining the point of suspension and the centre of oscillation at the same distance from each other. The principal objection to this pendulum is its liability to breakage, of which its author felt the full force, and in consequence suggested the idea of the opposite expansions of different metals as a compensation for a pendulum. John Harrison immediately turned his attention to the subject, and by dint of perseverance, overcoming all the difficulties of his humble and retired situation, not only astonished the world by his improvements in horological machines, but absolutely constructed with his own hands a timekeeper which determined the longitude within such limits as to procure him the parliamentary reward of 20,000*l*. [HARRISON.] Although the anchor escapement previously mentioned was a great improvement upon all that had preceded it, still it was subject to objections, not one of the least of which was that at every vibration a considerable recoil took place. In order that the reader may comprehend this term, it is necessary to observe that the pendulum, being a heavy body, vibrates a considerable distance after the tooth has performed its office of impelling the pallet forward: as soon as the impulse is completed, the tooth falls from the pallet to which the impulse has just been given, and another tooth falls on the other pallet, which is at the time moving, together with the pendulum, in a contrary direction to that in which it will move when it receives its impulse from the tooth; and from the peculiar form of the pallets, a retrograde or backward motion is given to the wheel, which motion is called the recoil, and this escapement is thence called the *recoil escapement*. The inconveniences of this escapement were however removed (about the same time with the invention of Harrison's pendulum) by Graham, who introduced what is called the dead-beat escapement, which is both simple and effective; and we question whether, when well executed, its performance is not equal to that of any other that has ever been made: with this escapement, and with a gridiron or mercurial pendulum, having a heavy ball moving in a very small arc of vibration, timekeepers are made whose average variation is less than a quarter of a second daily.

Description of an Eight-Days' Spring-Clock.—A B C D (*fig.* 1) represents the front plate of a clock (which is supposed to be transparent), and is attached to another of similar form by five strong pillars, between which the wheels here shown are placed. E E are two barrels containing springs; the one on the right gives motion to the train of wheels called the going or watch train; the other to the striking train of wheels *e, f, g, h,* and fly *i*: *a* is the main wheel of 96 teeth, acting in the centre wheel-pinion *k* of eight leaves, to which is attached the centre wheel *b*, which revolves in an hour, and acts in the third wheel-pinion *l*, on which is fixed the third wheel *c*, acting in the swing or scape wheel-pinion *m* (not seen in the cut), to which is fixed the swing-wheel *d*, whose teeth act alternately on the two pallets *n* o, and thereby give motion to the pendulum by means of a piece attached to the arbor of the pallets, one end of which enters a slit made in the pendulum for its reception. F F are the two fusees, the use of which will be found in the article CHRONOMETER. The method in which the fusees are attached to their respective wheels *a* and *e* is shown in *fig.* 3, where is the main wheel of 96 teeth hollowed out to receive the click *b* and its spring *c*, which are attached to the wheel, the ratchet *d* being attached to the under side of the fusee by two screws. *e* (*fig.* 1) is the striking main wheel, having 84 teeth, which drives the pinion *p* of eight leaves, on which is the pin-wheel *f* of 64 teeth, into the rim of which are put eight pins to lift the hammer *s*, by acting upon its tail *t*; the pin-wheel *f* drives the pallet-pinion *q* of eight leaves, on which is fixed the pallet-wheel *g* of 56 teeth acting in the warning wheel-pinion *r* of seven leaves, on which is the warning-wheel *h* of 48 or 50 teeth, acting in the fly-pinion *i*. When in action a pin in the pin-wheel catches the tail of the hammer *t*, and raising it, the hammer-head *s* recedes from the bell; and as soon as the pin leaves the tail of the hammer, the force of the spring *u* acting on the lower part of the hammer produces a blow on the bell. The number of strokes on the bell is regulated by a contrivance which we shall now describe, and the mechanism of which is placed on the outside of the front plate of the clock, but is removed from the figure just described, to prevent confusion. (See *fig.* 2.) On the centre wheel-pinion *k* (*fig.* 1), whose arbor comes through the front plate about one and a half inches, is placed the minute wheel *a* (*fig.* 2), which revolves with the centre wheel in an hour, and carries the minute-hand of the clock: this wheel has a pipe nearly as long as the centre-wheel arbor, the upper end of which is squared to receive the minute-hand; and by means of a small spring beneath the wheel, which rests upon a shoulder just above the upper surface of the front plate, and acts against the under surface of the wheel, the wheel, together with the hand, is forced against a pin over the hand: the whole of the wheels in this group can therefore be turned forwards or backwards without disturbing the internal mechanism of the clock, or rather that part of it which is called the going or watch train, and which is that part on which the time-keeping depends: for the minute-wheel *a* gives motion to another minute-wheel *b*, which, as it must revolve also in an hour, has the same number of teeth as *a*. A pinion in the centre of the wheel *b* has six leaves, and acts in the hour-wheel *c* of 72 teeth, which is placed over the minute-wheel *a*, and consequently revolves once in 12 hours, and has screwed to its socket, at the upper end, the hour-hand. To the socket of the hour-wheel, about one-eighth of an inch above the wheel, is fixed a piece in which are 12 steps, each of which includes an angle of 30°, or a twelfth part of a circle; this piece is called the snail, and is represented by *d*, the use of which we shall shortly describe: *e* is a rack whose centre of motion is a stud or pin *f*, on which it acts by means of a pipe about half an inch long, and on to the upper end of which is riveted the rack-tail *g*, in which is a short pin *h*, pointing perpendicularly downwards to the front plate of the clock. This rack lies about the tenth of an inch above the front plate; but the pipe which acts on the stud is long enough to carry the rack-tail just clear of the snail when the rack is forced back by the spring *i*, whilst the pin *h* is long enough to strike against the steps in the snail, and yet so short as to be perfectly free of the hour-wheel *c*. *k* is the rack-hook moving freely on a stud; *m* the lifting piece, also moving freely on a stud *p*; *n* is the tail of the lifting-piece firmly pinned on to the other part, and moving with it; *o* is called the gathering pallet, which has a square hole through it, and is fixed upon the square end of the arbor *q* of the wheel *g* (*fig.* 1), which revolves once for every blow given by the hammer, as will be seen by referring to the number 64 in the pin-wheel, the number of pins which act on the hammer being eight, and the number in the pinion *q* being eight also. It must be borne in mind that a pin in the warning-wheel *h* always stands in the same position when the striking part is at rest, which is the position represented in *fig.* 1. On the end of the lifting-piece is a small piece *q* (*fig.* 2), which passes through a slit in the front plate, and resting on the bottom of the slit, keeps the lifting piece in its proper position. The gathering pallet *o* rests on a pin *r* in the rack, and thereby prevents any motion in the internal wheel-work of the striking train.

Mode of Action:—As the hand approaches the hour, a pin in the wheel *b* (*fig.* 2) raises the lifting-piece, the other end of which coming in contact with the rack-hook, lifts it out of the rack-teeth; the rack falls by the force of the spring *i* until the pin *h* in the tail comes against one of the steps in the snail, which are numbered 1, 2, 3, 4, &c., which correspond with the number of teeth which each step will allow the rack to fall past the centre of the gathering pallet *q*, which by the fall of the rack is released from the pin *r*: the striking wheels now run forward a very short distance, the pin in the wheel *h* (*fig.* 1) coming in contact with the piece *q* (*fig.* 2) on the end of the lifting-piece, and arresting their further progress (this is called the warning). As

Fig. 1



Eight-Days' Clock.

Fig. 2.

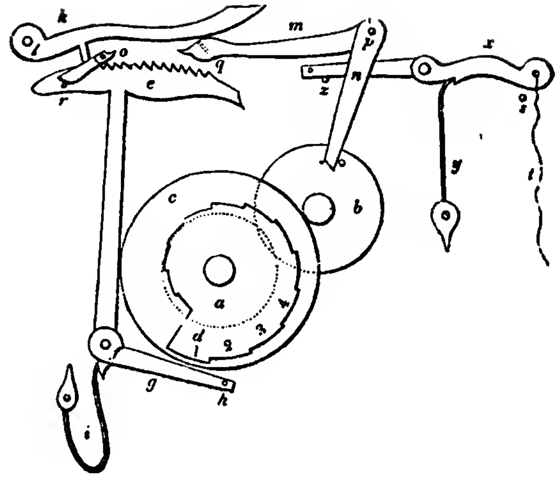
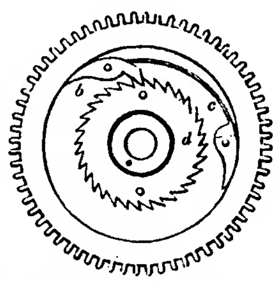


Fig. 3.



Striking Mechanism and Fusee-Wheel.

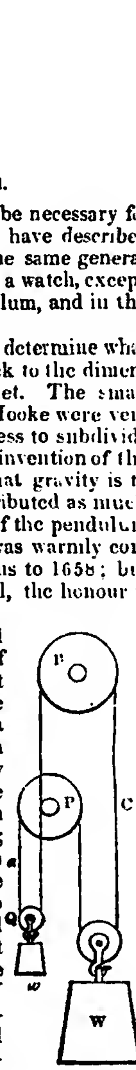
soon as the hand arrives at the hour, the pin in wheel *b* will have passed the tail of the lifting-piece, which will fall, and with it the piece *q*, which again releases the striking-train, and the pins in the wheel *f* (*fig.* 1), acting on the hammer-tail, cause the clock to strike; the number of strokes being regulated by the number of teeth to be taken up by the pallet *q* (*fig.* 2), one being taken up by the short end of the pallet for every revolution of the wheel *g* (*fig.* 1), on whose arbor it is fixed. The rack in *fig.* 2 is retained in its situation by part of the rack-hook, which falls successively into different teeth as they are taken up. The long end of the pallet *q* passes over the rack, meeting with no obstruction till all the rack-teeth are taken up, when it comes in contact with the pin *r*, where it remains till the next hour, when the pin *h*, by falling upon another step of the snail, causes a different number of rack-teeth to pass the pallet *q*, and a different number of strokes is the result: *x* is a piece called the pull-piece, by pulling a string at the end of which the lifting-piece is raised, and the clock is made to repeat the hour last struck at any required time: *y* is a spring to force the pull-piece *x* against the pin *z* fixed in the plate of the clock; *s* is another pin to limit the motion given to the pull-piece *x* when the string *t* is pulled.

After what has been advanced, it might be supposed that the clock had received its finishing stroke as regarded its further improvement; but even after this, we find so many alterations, if not improvements, in the escapement, mode of compensation, &c., that to notice only those which have produced some sensation at the time of their introduction would fill a volume. The principal contrivers of clock escapements are Grignon, Mudge, Cummins, Nicholson, Hardy, Harrison, and others, in England; and on the Continent, Julien and Peter le Roy, Sully, Du Tertre, De Bethune, Le Paute, Amant, Robin, Berthoud, &c. Since, Graham and Harrison, Ellicot, Cummins, Nicholson, Troughton, Smeaton, Reid, Ritchie, Ward, and Captain Kater have each given us a compensation pendulum. The inventors in France have been Regnauld, Deparcieux, J. le Roy, Cassini, and Berthoud.

Watch.—Having entered at some length into the history of those inventions which have contributed to the present perfection of the art of horology, it will not be necessary for us to say much concerning watches. We have described a watch to be a pocket timepiece, and the same general principles apply equally to both a clock and a watch, except that the regulation in the former is a pendulum, and in the latter a balance and spring.

It would be a matter of some difficulty to determine what artist first reduced the portable spring-clock to the dimensions of a watch to be worn in the pocket. The small clocks prior to the time of Huyghens and Hooke were very imperfect machines; they did not even profess to subdivide the hours into minutes and seconds until the invention of the balance-spring, which is to the balance what gravity is to the pendulum, and its introduction has contributed as much to the improvement of watches as did that of the pendulum to clocks. The honour of this invention was warmly contested by the last-named individuals previous to 1658; but so far as priority of publication is concerned, the honour is due to Hooke.

Maintaining Power.—When clocks and watches had acquired a certain degree of accuracy in their performance, the time lost in winding up (especially when it had to be done every twenty-four hours) became a matter of importance, and there have been several inventions to remedy this evil. By Huyghens the clock was kept going while winding by means of an endless cord, as in figure 'Endless Cord.' B is the clock-barrel; C, that portion of the line which comes from the barrel to the weight; P, a pulley for the line to run over; Q, a pulley for the line to run under, and to which is attached a small weight *w*. It will be seen by inspection that the hand applied to that part of the line marked *a* will be able to raise the weight W without depriving the barrel B of any portion of the power by which it is urged forward, and which power in this arrangement is equal to one half of the weight W.



Endless Cord.

The *forcing spring* (*fig.* 1) gives another plan, in which a

Fig. 1.

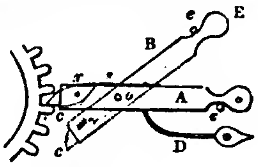
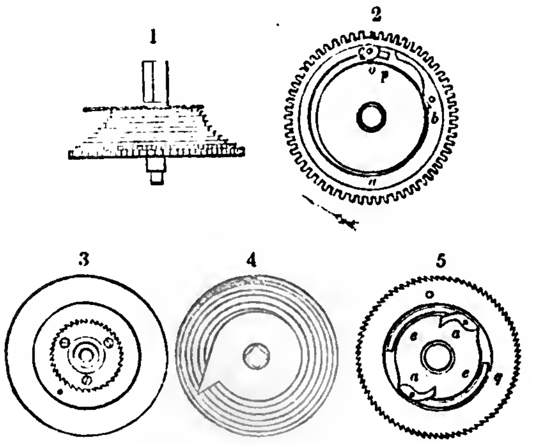


Fig. 2.

lever A, whose centre of motion is o, has a notch cut in its end, into which is jointed a small lever *c*, whose centre of motion is *x*; this small lever is kept in its proper position against the bottom of the notch, as shown in A, and also in B (which is only another position of the lever), by a slight spring *s*. D is a strong spring which acts constantly on the lever A, having a tendency to force it into the position represented by B, in which it is not in action. Previous to winding the clock up, the end E of the lever is depressed, and brought from position B to that of A, and in its progress in passing a tooth of the wheel the small lever *c* assumes the position represented in *fig.* 2, which it is allowed to do by the very slender spring *s*. As soon as the tooth is passed, the pressure of *s* obliges the lever *c* to return to its original place, and by the pressure of its opposite end on the bottom of the notch in which it is inserted, the lever A is prevented from regaining its former position by the pressure of the piece *c* on the tooth of the wheel, until the wheel shall have advanced so far as to have allowed its escape, when the lever regains its position B, where it remains till another winding becomes necessary. It will by this time have become evident that so long as *c* remains on a tooth, the wheel will be urged forward by the action of the spring D. *e*, *e* are two pins which are fixed in the plate of the clock, and serve to determine the quantity of motion given to the lever A.

But Harrison's contrivance for the same purpose is the one now in general use, both in clocks and watches, and is admirably adapted to the purpose, as it requires no attention from the person who has to wind up the machine, like the last, but is always in its place, and ready for action the moment the operation of winding is commenced. We shall describe this as applied in a watch. When this principle is applied to a fusee, it is termed a going fusee; but *maintaining power*, as a more comprehensive term, is now generally applied.

Maintaining Power, Going Fusee.—Into the hollow of the fusee-wheel is placed a circular spring *a b c*, which is secured to the wheel by a pin at about one-fourth of its circumference from the end *a*, viz. at *b*; the wheel has a short notch cut through it, near the other end of the spring; the spring passes over this notch, and by means of a pin *c*, fixed firmly in the spring and projecting through the notch in the wheel, a motion is allowed to the spring, which in extent is equal to the difference between the length of the notch in the wheel and the thickness of the pin which passes through it, and it is the reaction of this spring through the short distance already mentioned which maintains the motion in



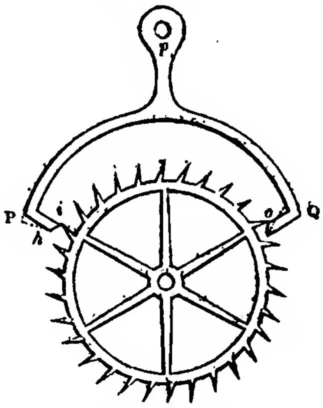
Harrison's Maintaining Power.—Going Fusee.

1. Fusee, auxiliary ratchet, and fusee-wheel, attached; 2, fusee-wheel and auxiliary spring, separate; 3, 4, upper and under sides of the fusee, separate; 5, auxiliary ratchet *g*, with clicks *a a*, and springs *e e*, attached.

the watch during the time of winding up; as will be seen when all the parts of this contrivance have been described. Instead of any click and spring being attached to this fusee-wheel, as has been shown in *fig.* 1, in our description of an eight-days' clock, a circular disc of steel, rather larger than the bottom of the fusee, and smaller than the fusee-wheel, having very fine ratchet-teeth cut in its edge, and two clicks *a a* and springs *e e* on its upper surface, in which the ratchet fixed on the under side of the fusee, and called the fusee-ratchet, acts. The steel-ratchet is called the auxiliary-ratchet, and its teeth stand in a direction opposed to those of the fusee-ratchet. We will now suppose the auxiliary ratchet to be laid on to the fusee-wheel over the spring *a b c*; a hole in its centre passing over a short pipe in the centre of the fusee-wheel retaining it in its situation, and the pin *c*, which we have described as projecting through the notch in the fusee-wheel, also projecting upwards just equal to the thickness of the auxiliary-ratchet, through which it likewise passes; the pin exactly fitting the hole in the ratchet. In this situation the wheel and ratchet are ready to receive the fusee with its ratchet; but it must be borne in mind, that though the pin *c* fits exactly in the hole in the auxiliary-ratchet, and thereby prevents it from turning round, it does not prevent its having as much motion as the spring itself has in the notch in the fusee-wheel; the spring must also be conceived to have been forced into its place with the pin pressing strongly against the end of the notch o. The fusee is now attached to the wheel by passing its arbor through the hole in the centre of the wheel, and is secured in its place by a pin and collet on the opposite side, which prevent their separation, at the same time allowing the fusee to turn with a moderate degree of force. In this state the fusee, &c. must be considered as placed within the frames of the clock or watch in connection with the other part of the train of wheels, &c. A click, or, as it is sometimes called, a detent, is also placed between the frames, and by means of a slight spring is made to act in the teeth of the auxiliary-ratchet.

Mode of action:—The chain being put on, the watch is wound up, say one turn. As soon as the force by which it has been wound up is taken off, the main-spring, through the medium of the chain, pulls the fusee, and with it the auxiliary-ratchet, in the direction of the arrow; but before the watch can commence its motion the fusee-wheel must be acted upon, which will be the case as soon as the pin *c* in the end of the notch o shall have been brought by the force of the main-spring into the position *p*; and in effecting this several teeth of the auxiliary-ratchet will have passed under the detent before mentioned. If the power be again applied to wind up the watch, the main-spring, during the time that power is applied, ceases to act on the auxiliary-ratchet, which would be brought back to its original position by the endeavour of the spring *a b c* to regain its former situation, having the pin *c* at o, but the detent, which is in a tooth of the auxiliary-ratchet, prevents its return; in consequence of which the spring *a b c* re-acts on the fusee-wheel to which it is attached at *b*, and forces the fusee-wheel in the direction of the arrow with sufficient strength to maintain the motion in the watch during the time of winding-up. The space through which the spring *a b c* acts in the notch o *p* with sufficient force to maintain the motion of the watch is about equal to two teeth of the fusee-wheel, and the time in which the fusee-wheel goes through a distance equal to two teeth varies in different watches from 10 to 12 minutes, a time more than sufficient for the operation of winding. It will have occurred to the reader that as the detent is at all times in action upon the auxiliary-ratchet, the instant the power applied in winding is taken off the pin *c* regains the position *p*, and the spring *a b c* is ready to act with all its energy as soon as rewinding is commenced; so that in winding a watch with a common key, where the hand is taken off on an average ten times, there are ten portions of time during which the motion is kept up by the main-spring of the watch, and ten portions during which it is kept up by the spring *a b c*.

Escapement.—The word escapement is a term applied to a combination of parts in a clock or watch, which has for its object the conversion of the circular motion of the wheels into a vibratory motion, as exhibited in the pendulum, and in the description we are about to give includes the scape-wheel, the pallets with their arbor or axis, and a bent lever attached thereto, called the crutch, which last piece maintains the motion of the pendulum. In a watch this combination consists of the scape-wheel, together with all those parts lying between it and the balance, and which are concerned in converting the circular motion of the wheels into the alternating one of the balance. In Graham's dead-beat escapement the distance between the centre of motion p of the pallets and the centre of the scape-wheel is equal to one diameter of the scape-wheel, and the pallets take

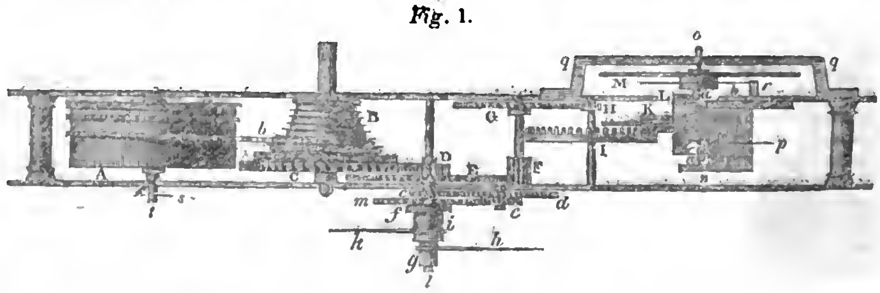


Dead-Beat Escapement.

over ten teeth of the wheel: this we believe to have been Graham's mode; and custom has so far converted it into a rule, that we have met with many clock-makers who considered it highly improper, if not wholly at variance with the inherent principle of the escapement, to adopt any other mode of construction. But Mr. Vulliamy has shown that which every one acquainted with the elements of mathematical and mechanical science may easily comprehend, viz. that a dead-beat escapement may be made in which the pallets shall include any number of teeth, less than half the number contained in the wheel, which may be found convenient; his being a general rule, of which Graham's is one particular case. Mr. Vulliamy determines the centre of motion of the pallets by drawing two tangents to those two points in the circumference of the wheel which are opposite the centres of the pallets; these tangents being produced, will intersect each other, and the point of intersection is the place for the centre of motion of the pallets. The above-named gentleman has also given a very good method for ascertaining the inclined plane which forms that part of the pallet called its face, and on which the tooth acts during the time it is giving impulse to the pendulum. We say his method is good, for by it the artist, in drawing off his escapement, is enabled not only to determine the precise quantity of the angle of escapement, but to divide that angle with mathematical precision between the two pallets, so that each shall lift the pendulum through a perfectly equal arc. In this figure the tooth i has just given impulse to the pallet P and escaped from it; the tooth o has in consequence fallen upon that part of the pallet Q called its arc of rest, which, in both pallets, is formed by a circle struck from the centre of motion p of the pallets. The impulse given by i causes the pendulum, and with it the pallets, to vibrate some distance after i has left P and o has fallen on Q; but the arc of rest being concentric with the centre of motion of the pallets, the wheel ceases to rotate, or remains dead, until the pendulum by its returning vibration lifts the pallet Q so high as to allow the tooth o to get upon the face or inclined plane of the pallet, upon which it then acts, driving up the pallet, and with it the pendulum, until the tooth o escapes from the pallet Q, when another tooth h, on the opposite side of the wheel, falls on the arc of rest of the pallet P, which arc is in this pallet on the outside, and on which the tooth rests until by the return of the pendulum the pallet P is lifted so high as to allow h to get on the inclined plane or face of the pallet P, upon which it acts, raising the pallets, and with them the pendulum, till it escapes and gains the position i, when the same process is repeated, the wheel alternately giving impulse to one pallet and resting on the circular part of the other, which we have denominated the arc of rest. When the pendulum is in a state of rest some one tooth is always resting on one of the circular arcs; the pendulum being put in motion brings a pallet into a position to receive an impulse from the wheel-tooth, when the process already described commences.

Vertical Watch.—We shall now give a description of a common vertical watch. *Fig.* 1 represents the watch as it would appear if the dial (which is here omitted) was turned downwards. A is the barrel; B, the fusee; b, the chain by which motion is communicated from the barrel to the

Fig. 1.



fusee, on which is the great or fusee wheel C acting on the centre-wheel pinion D, on which is riveted the centre wheel E, the arbor of the pinion D being prolonged through the plate of the watch as far as l: the centre wheel E and its pinion D revolve in an hour. Upon that part of the arbor D which is on the outside of the plate or frame is placed the cannon-pinion c, which has a hole quite through it for the reception of the centre-wheel arbor, on which it turns spring-tight; the degree of tightness may be felt by applying a key to turn the hand of a common watch. The cannon-pinion is secured in its place by a small pin through the end of the centre-wheel arbor l, the end g of the pinion being squared to receive the minute-hand h; the cannon-pinion has 12 leaves acting in the minute-wheel d, of 48 teeth, causing the latter to revolve once in four hours. Concentric with d, and attached to it, is its pinion e, having a hole through their common centre, through which passes a stud fixed on the plate, through the end of which, near letter e, should be put a small pin to retain the wheel in its proper place, but which is very frequently omitted. The pinion e, having 14 leaves, drives the hour-wheel m, of 42 teeth, once round in 12 hours, and which is placed over the cannon-pinion by its socket f, which has a hole through it for the cannon-pinion to pass through; on this socket is fixed the hour-hand. It will be perceived that by this arrangement the cannon-pinion, minute-wheel d, and pinion e, and hour-wheel m, together with the hands, can all be turned backward or forward without affecting the interior mechanism of the watch, simply by the application of a key to the squared end of the cannon-pinion. The assemblage of wheels, &c. thus put in motion is called the motion-work of the watch; that between the plates, the movement,—our description of which we will now continue. The centre-wheel E gives motion to the third wheel-pinion F, to which is attached the third wheel G, acting upon the contrate-wheel pinion H, on which is placed the contrate-wheel I, acting in the pinion K of the balance-wheel L, which is also called the scape-wheel. In page 298 we have explained the mode by which the balance-wheel teeth act upon the pallets $a\ a$ so as to cause an alternating motion in the balance M. (By an oversight in the drawing, the teeth of the balance-wheel L have been placed the wrong way.) One end of the balance-wheel arbor works in a piece called the dovetail, which is inserted in a piece p, called the potence, which is firmly attached by a screw to one of the plates of the watch; the other end works in a piece called the follower, which is inserted in another piece riveted into the plate called the counter-potence, both which are left out of the figure to prevent confusion. Another part of the potence, called the foot, n, receives one end of the balance arbor or spindle, called the verge (on which are the pallets *a a*); the other end works in a hole in the pin o, which passes through the centre of the cock *q q*, which is secured to the upper plate of the watch; *b* is the pendulum-spring (also called the regulating-spring and hair-spring), one end of which is secured to a stud *r* fixed in the plate, and the other pinned fast to a small collet, which goes spring-tight unto the axis of the verge, and is seen just under the balance. The following *figs.* 2, 3, 4, represent some of the

Fig. 2.

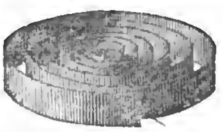


Fig. 3.

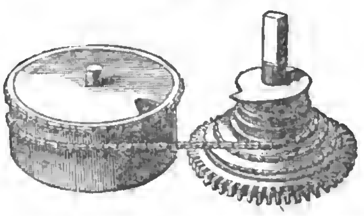
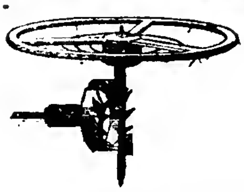
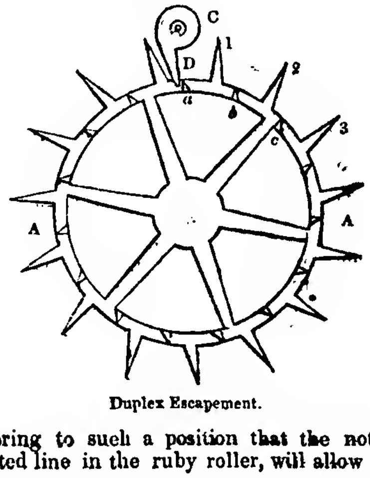


Fig. 4



parts separately:—2, the main-spring in a relaxed state, as it would appear out of the barrel, to which, when in, one end of it is attached, the other being held by a hook in the arbor of the barrel, which comes through the plate, as shown in *fig.* 1, and is kept from turning by a ratchet *s* and click *t*, the spring being wound up by the chain acting on the barrel and pulling it round, which operation is performed by turning a key placed on the squared end of the fusee-arbor. The effort of the spring to unbend itself after being wound up causes the barrel to revolve in a contrary direction to that in which it moved whilst winding up, and thereby gives motion to the fusee, and with it the fusee-wheel and the rest of the train. *Fig.* 3 represents the barrel and fusee, with the chain attached. *Fig.* 4 shows the balance-wheel, balance, and verge, with the hair-spring attached to it.

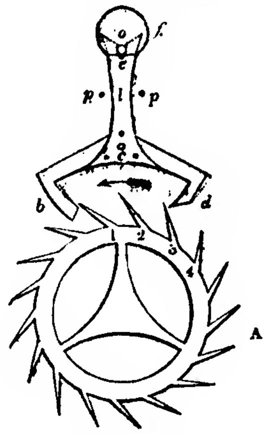
Duplex Escapement.—AA is the scape-wheel, 1, 2, 3 being the teeth of repose, and *a*, *b*, *c* the teeth of impulse, which are triangular, and stand perpendicular to the plane or surface of the wheel. CD, the impulse pallet, fixed upon the arbor of the balance, and standing just above the surface of the wheel AA, receives its motion from the teeth *a*, *b*, *c*, &c. After the tooth *a* has passed the pallet CD, the tooth *b* comes in contact with a small roller made of ruby, and placed on the lower part of the axis of the balance, where it remains till the balance is brought back by the



Duplex Escapement.

balance-spring to such a position that the notch, shown by the dotted line in the ruby roller, will allow the tooth 1 to enter it, and thereby pass the balance-arbor, or escape, which it does by the wheel AA being constantly urged in the direction from 3 to 1. As soon as tooth 1 escapes from the notch, tooth *b* gives a fresh impulse to the pallet CD, and the act of escapement is thus repeated; the wheel moving forward one whole tooth, and the balance making two vibrations for each impulse given by the upright teeth.

Lever Escapement.—The figure represents a detached lever-escapement, in which the lever *l* is placed on the pallets in a position at right angles to that in which it is usually placed in a watch, by which means we think the principle will be more apparent to the general reader. AA is the scape-wheel moving in the direction of the arrow; *b d* the pallets, whose centre of motion is *c*; to the pallets is pinned the lever *l*, in which is the guard-pin *e*, pointing upwards from the lever *l*; the roller *f* is fixed on the axis of the balance, and stands just above the lever *l*, having a piece cut off from its circumference to allow the guard-pin *e* to pass and repass the roller, which it does when the escape takes place; o is a ruby pin fixed in the roller, and pointing downwards through the notch in the end of the lever *l*. When the balance is quiescent, the pin o is in the notch in the end of

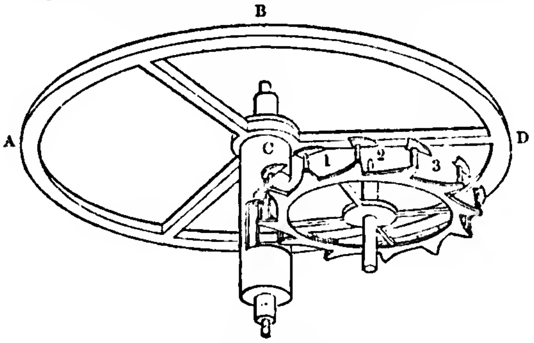


Lever Escapement.

the lever *l*, and the guard-pin *e* in the position shown in the figure, where the tooth 1 acts on the pallet *b*, which causes the balance to vibrate, the guard-pin *e* proceeds a short distance to the right of its present position, and the lever is prevented from returning by the guard-pin *e* coming in contact with the circular edge of the roller, if any sudden jerk which the watch might receive should overcome the locking which takes place in this escapement, and which will be presently described. The effect of the locking is to retain the pin *e* at a very small distance from the edge of the roller during the vibration of the latter; for if the pin *e* rubbed against the roller during the vibration, the friction occasioned thereby would materially affect the motion of the balance, if not altogether stop the watch, and moreover the escapement would cease to be a free or detached one. When an impulse is given by a tooth to the other pallet *d*, the lever *l* impels the ruby pin o to the left hand, where precisely the same effects take place with regard to the guard-pin *e*, &c., as have been already described.

If the pallets *b* and *d* were of the form shown by the dotted lines (which are supposed to be circular arcs concentric to the centre of motion *c* of the pallets), it is evident it would be a perfect dead beat, like the clock-escapement previously described; but in order, after the escape has taken place, that the guard-pin *e* may be retained at a small distance from the roller, that part of each pallet on which the tooth rests when it falls on the pallet is taken off, as shown in the figure; and as the faces of the wheel-teeth are considerably undercut, the wheel advances a small distance, after having fallen on that part of either of the pallets which is within the dotted line. This further advance of the wheel draws the pallet down towards the centre of the wheel, and thereby keeps the guard-pin *e* at a slight distance from the edge of the roller *f*. By this advance of the wheel and drawing down of the pallets after the teeth have fallen upon them is produced what is termed the locking of the pallet, which means holding the pallets and lever *l* in such a position that the guard-pin shall be very near to but not quite touch the edge of the roller. If the watch should receive a jerk so violent as to effect the partial unlocking of the pallet, the pin would for an instant of time touch the roller *f*, but the constant effort of the wheel to go forward would immediately relock the pallet and bring the guard-pin *e* away from the edge of the roller. As soon as the balance has performed so much of the returning vibration as to bring the ruby pin o into the notch in the lever, the momentum of the balance, acting through the medium of the ruby pin o upon the lever, moves it a short distance, and thereby lifts the pallet outwards from the centre of the wheel and unlocks it, during which unlocking the wheel retrogrades (before it can get upon the face of the pallet to give a fresh impulse) just as much as it had previously advanced after falling on the pallet. By this retrograde motion the tooth gains the inclined plane or face of the pallet, gives a new impulse, and the same process is repeated by another tooth on the opposite pallet, of falling on, advancing to lock, retrograding to unlock, and then giving impulse to the pallet; *p p* are two pins, called banking-pins, against which the lever *l* presses when locked, and which prevent the guard-pin *e* from being drawn too far away from the edge of the roller *f*, when the locking takes place. This escapement admits of a very large angle of vibration, and when well executed performs very well.

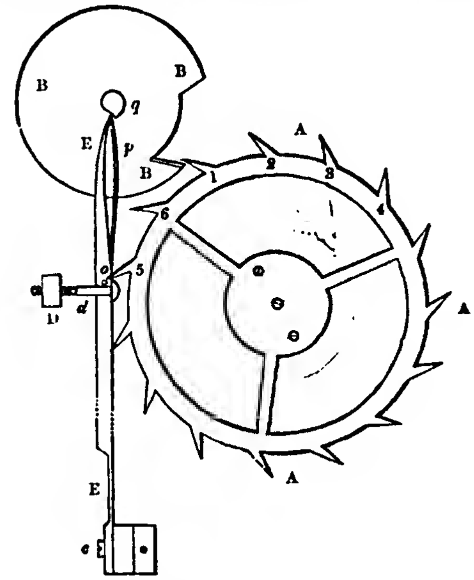
Horizontal Escapement.—ABD represents the balance on its axis, which is a hollow cylinder C cut away in its circumference, as shown in the figure; the teeth of the escape-wheel form a series of inclined planes, which stand on stems perpendicular to the plane of the wheel, the inclined part forming the extreme edge or acting-face of the tooth. These planes coming in contact alternately with the two edges of that part of the cylinder which has the least



Horizontal Escapement.

portion of its circumference taken away, when a tooth is in the cylinder, the point rubs against the internal surface until the balance by its vibration gets into such a situation that the inclined plane can act upon its edge, when it impels the cylinder in the direction from D to A, until the highest part of the plane escapes from the inside of the cylinder, and the next tooth falls upon the outside, where it continues to rub until the balance completes its vibration and has returned so far as to permit the point of the tooth, which has been rubbing on the outside of the cylinder, to get upon its edge, where it gives impulse to the cylinder, and when its heel escapes, the point falls on the inside of the cylinder, and the former process is repeated. That part of the cylinder on which the inclined planes act occupies about 210 degrees of a circle, 150 degrees being taken away; the part below the place of action has a still greater portion of its circumference taken away, which is done for the purpose of enabling it to clear that part of the plane of the wheel which supports the stem, and against which, but for this contrivance, the edge of the cylinder would strike during the vibration of the balance. 1, 2, 3, &c., are teeth of the horizontal or scape-wheel, one of which is seen inside the cylinder; the dotted lines represent the face or inclined plane of the tooth, which is just coming in contact with the edge of the cylinder; the direction of the motion of the wheel is from 1 to 3; the proportion of the cylinder to the wheel is such, that a tooth of the wheel, when in the cylinder, may just have sensible shake, and the outside diameter must be sensibly less than the distance between two teeth. We have thought it unnecessary to give a more particular description of this escapement, as its use has been almost wholly superseded by that of the lever.

Detached Escapement, such as is used in a modern chronometer.—A A A is the scape-wheel, made either of brass or steel, the teeth 1, 2, 3, 4, &c. of which are considerably undercut on the face; the steel-roller or main-pallet B B B, which is fixed on the arbor of the balance, has an opening in it, the face of which is also much undercut as shown near B, and has set in it a piece of hard stone, such as a ruby, for the points of the teeth to act upon; S is a stud firmly fixed to one of the plates of the timekeeper, and to which stud the detent-spring E E is secured by a screw *c:* this spring is made extremely slender and weak in the part E near the stud, and it is only by the yielding of this thin part of the detent-spring that any motion can be given



Detached Escapement.

to the detent for the purpose of unlocking the wheel, so that some part of this spring may be considered as the centre of motion of the detent; D is a stud also fixed to the plate of the watch, into which is inserted a screw *d*, against the head of which the detent rests; o is a ruby pin inserted in the detent, pointing downwards from the detent, so that one of the teeth of the wheel which is supposed to pass under the detent may rest on the pin, and in this state the wheel is said to be locked; the screw *d* serves also to adjust the distance of the ruby pin from the centre of the wheel, and consequently the strength of the locking: to the inner side of the detent is attached a very delicate spring, called the lifting-spring, which rests upon and extends a little beyond the end of the detent. Concentric with the main pallet, and just above it, is a small lifting-pallet *q*, which should be flat on its face or lifting-side, and rounded off on the other side.

Mode of action:—In the position given in the figure, the lifting-pallet *q* is just coming with its face in contact with the lifting-spring *p*, which in the course of vibration it lifts and with it the detent (on whose point the lifting-spring presses), so as to raise the pin o clear of the wheel-tooth 5. By the time the wheel is free from the ruby-pin, the main-pallet has advanced so far as to be ready to receive an impulse from the tooth 1; and before the tooth escapes the lifting-pallet *q*, parts with the spring *p*, and the detent resumes its place on the head of the screw *d*, in which position the ruby-pin receives the point of tooth 6, as soon as tooth 1 has escaped from the ruby-face of the main-pallet BBB. The balance, having performed this vibration by the impulse given to the main-pallet, returns by the force of the balance-spring, and with it the lifting-pallet *q*, the rounded side of which, pressing against the lifting-spring *p*, raises it from the detent, and passes without disturbing the detent, which is not again lifted till the balance has completed the present vibration, and returning for the next, again brings the face of the lifting-pallet in contact with the lifting-spring, which (with the detent) it raises, and the act of escaping again takes place, the balance making two vibrations for every impulse, as in the duplex. This escapement, which was invented by Earnshaw, stands unrivalled for simplicity and for performance.

For further details connected with the subject of this article see PENDULUM.

HORREBOW, PETER, a Danish astronomer, was born in the year 1679. After studying medicine for several years he became the pupil of the celebrated mathematician and astronomer Olaus Roemer, whom, in 1710, he succeeded as professor in the University of Copenhagen. The duties of this office he continued to discharge with great credit till about the year 1740, when he resigned in favour of his son Christian. Horrebow died at Copenhagen in 1764, at the advanced age of eighty-five years. His works are: 'Clavis Astronomiæ, seu Astronomiæ pars Physica,' Copenh., 1725, 4to., an attempt to explain the formation of the planets on the system of Descartes; 'Copernicus triumphans, sive de Parallaxi Orbis Annui Tractatus Epistolaris,' ib. 1727, 4to., in which he imagines himself to have proved, from Roemer's observations, that Sirius and α Lyræ have each 30″ of annual parallax; 'Atrium Astronomiæ, sive Tractatus de inveniendis Refractionibus, Obliquitate Eclipticæ, atque Elevatione Poli,' ib. 1732, 4to.; 'Basis Astronomiæ, sive Astronomiæ pars Mechanica,' ib. 1735, 4to.; 'Consilium do novâ Methodo Paschali ad perfectum Statum perducendâ, ac deinceps omnibus Christianis commendanda,' ib. 1738; 'Elementa Philosophiæ Naturalis,' ib. 1748, 4to.; besides a few papers upon astronomical subjects in the 'Acts of Leipzig.' His works were collected and reprinted in 1740—41, at Copenhagen, in 3 vols. 4to. To his 'Basis Astronomiæ' is prefixed the 'Life of Roemer,' in which he has omitted nothing that could tend to perpetuate the memory of his predecessor.

HORREBOW, CHRISTIAN, son of the above, died in 1776, and besides a Latin treatise on Spherical Trigonometry, he has left: 'Repetita Parallaxios Orbis Annui Demonstratio, ex Observationibus Ann. 1742 et 1743 deducta,' Copenh., 1744, 4to.; 'De Parallaxi Fixarum Annuâ et Rectascensionibus quam post Roemerum et Parentem demonstrat Auctor,' ib. 1747, 4to.

(Montucla, *Hist. des Mathém.*, tom ii.; and the *Biographie Universelle.*)

HORROCKS, JEREMIAH, often spelled Horrox, an astronomer who has obtained a lasting celebrity, though he died at the age of twenty-two, or thereabouts. During the time in which the court and parliament were occupied in the disputes which led to civil war, four men, three of them very young, and all personally acquainted with each other, were employed in advancing the theory and practice of astronomy. Three of them died very young, and their names had almost perished, and would probably have been lost, but for the more than usual talents of Horrocks. We have therefore reserved for this article the account of all the four. They were made known to each other by Christopher Townley, of Carr in Lancashire, who was the particular friend of Edward Sherburne, the translator of Manilius (1675). This latter writer thus obtained some particulars of them, from which, with other sources, our account is taken.

1. Jeremiah Horrocks was born, it is supposed, about the year 1619, at Toxteth near Liverpool. His father, a man of moderate means, placed him, before 1633, at Emanuel College, Cambridge, and there he soon began to turn his attention to astronomy. In the prolegomena to his astronomical writings he describes the difficulties under which he laboured in finding even so much as direction to good authors. A treatise by Gellibrand led him to purchase the writings of Lansberg, on which he afterwards greatly regretted that he had wasted his time. Subsequently he became acquainted with those of Tycho Brahé and Kepler. Though his papers which he left behind him contain many good observations and ingenious remarks, he must now be considered as known by two particulars. He was the first who saw Venus on the body of the sun, and he was the first who remarked that the lunar motions might be represented by supposing an elliptic orbit, provided that the excentricity of the ellipse were made to vary, and an oscillatory motion given to the line of apsides. [GRAVITATION.] Newton afterwards showed that both suppositions were consequences of the theory of gravitation, and (book iii., prop. 35, scholium) attributes to Halley a part of what is really due to Horrocks, as explained by Flamsteed. But Horrocks has been more than avenged by the foolish statement of Martin, in his 'Biographia Philosophica,' that Newton made Horrocks's theory the 'groundwork of all his astronomy.' This palpable misconception was copied by Dr. Hutton into his Mathematical Dictionary.

The account given by Horrocks of his observation of Venus, November 24, 1639, entitled 'Venus in Sole visa,' was printed by Hevelius at the end of his 'Mercurius in Sole visus,' published at Danzig in 1662. The remainder of the works of Horrocks were published by Dr. Wallis, London, 1672, some copies bearing the title-page 'Opera Posthuma,' and others 'Opuscula Astronomica.' The lunar theory of Horrocks was there developed by Flamsteed, but Wallis afterwards added the original letter to Crabtree, in which it was contained, but only to some copies, which therefore exhibit certain pages (pp. 465-470) twice over. Lalande states that he had a copy with a third title-page, dated 1678, and containing some additional tracts of Wallis. This publication contains various astronomical tracts, with extracts from the letters of Horrocks to Crabtree. It is understood that the University of Oxford is about to publish some letters of Dr. Wallis relating to this subject, from the collection of Lord Macclesfield.

The death of Horrocks took place January 3, 1641 (old style). Costard (*Hist. Astron.*) calls him a young clergyman, but we cannot find that he was in orders. In the 'Companion to the Almanac' for 1837 will be found a list of the astronomical works in his possession, taken from a list written by himself at the end of his copy of Lansberg's 'Tabulæ Perpetuæ,' which was preserved by his friend Townley. The spelling of his name is taken from his own handwriting in this work.

2. William Crabtree, who died a few months after his friend Horrocks, at a very early age, was a clothier at Broughton near Manchester, and many of his observations were printed by Wallis in the work above cited, and afterwards in the discussion about Gascoygne, presently to be mentioned.

3. William Milbourn, curate at Brancespeth near Durham, was, according to Sherburne, well versed in algebra, having extracted the approximate root of an equation of the fifth degree before he had seen Hariott's work. In astronomy he had, by his own observations, detected the errors of Lansberg's tables, and verified those of Kepler. His observations were destroyed by the Scots in the year 1639, and some tables which he had sent to London for publication were, in 1675, in the hands of Sir Jonas Moore.

4. William Gascoygne, of Middleton in Yorkshire, was killed, also at an early age, fighting for Charles I. at Marston Moor. He invented methods of grinding glasses, and Sherburne states that he was the first who used two convex glasses in the telescope. When Auzout announced, in 1666, his invention of the micrometer, Richard Townley, nephew of Christopher above mentioned, presented Hook with a modification by himself of a similar instrument made by Gascoygne; and it appeared from a letter written by Crabtree to Horrocks, that Crabtree had seen Gascoygne use an instrument of the kind. It appears now to be generally admitted that Gascoygne was the original inventor of the wire micrometer, of its application to the telescope, and of the application of the telescope to the quadrant; but that the invention was never promulgated, even in England, until the undoubtedly independent inventions of Auzout and Picard had suggested their publication.

Sherburne particularly mentions these four, with some others of less note, in consequence of an assertion of Wallis, in his edition of Horrocks, that there were very few of that day in the north of England who cultivated the sciences. Among tho lesser stars was Jeremiah Shackerley, whose 'Tabulæ Britannicæ,' published at London in 1653, were compiled mostly from papers of Horrocks, which were afterwards destroyed in the great fire of London. The rest of Horrocks's papers were rescued by Dr. John Worthington, afterwards rector of Hackney, from Crabtree's representatives. A lately published work informs us that 'Crabtree, the friend of Horrocks, is supposed to have perished in the civil wars; the papers of Horrocks himself were burned, after his death, by a marauding party of soldiers.' We imagine that the death of Crabtree is here confounded with that of Gascoygne, and the papers of Horrocks with those of Milbourn.

HORSE. The family of horses, *Equidæ*, consist of quadrupeds whose form is altogether peculiar. They have but a single finger or toe terminating each extremity; and this finger or toe is incased in a horny-hoof, or shoe. But though the *Equidæ* possess but one well developed toe, there are on each side of the metacarpus and metatarsus two small rudimentary processes which represent two lateral toes. The following is the form of dentition belonging to this family of Pachyderms:—

Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{7-7}{6-6}$: = 42.

We shall not detain the reader with the various fabulous species recorded in the descriptions and figures of some authors; such as the Bisulcated Horse with a mane extending the whole length of the animal from head to tail, and figured by Jonston as the *Æthiopisch Pferd, Equus Æthiopicus*, or the *Wald Esel, Onager*, figured by the same author with a unicorn-like horn in the midst of its forehead. These may be classed with the figures of monstrous horses collected by Aldrovandus, a horse with a human head and face for example, and another with hands by way of anterior extremities, which, as he says, according to Suetonius, belonged to Julius Cæsar, and would suffer no one else to mount him:—'Caius Julius Cæsar utebatur equo insigni pedibus prope humanis, et in modum digitorum ungulis fissis,' &c. This last was probably a case of malformation of the hoof; but the painter has given the animal two human hands, with four fingers and a thumb on each, and nails to match. Leaving then these romantic writers, we proceed to draw the reader's attention to the views of some of the modern and more sober-minded zoologists.

Linnæus, in his last edition of the *Systema Naturæ* (12th), left the Horse (*Equus*) among his *Belluæ* (the sixth order of *Mammalia* in his arrangement), in company with the genera *Hippopotamus, Sus*, and *Rhinoceros*. His genus *Equus* consists of the following species: *E. Caballus, E. Asinus*, and *E. Zebra*, and is thus defined by him—Incisor *teeth* (*Dentes primores*) six above erecto-parallel, six below more prominent; canines (*Laniarii*) solitary, included, remote on each side. *Feet* with an undivided hoof.

Gmelin, in his edition of the *Systema Naturæ* (13th), added to the above definition, 'Teats 2, inguinal,' and divided the genus into two sections—1, species with bisulcated feet; 2, species with solidungulous feet. The first section consists of one species only, *E. bisulcus*, the 'Equus pedibus bisulcis' Molin., 'Hist. Nat. Chil.' This was most probably a Llama. The second section embraces the following species: *Equi Caballus, Hemionus, Asinus, Zebra, Quagga.*

Cuvier places the *Solipèdes* at the end of his Mammiferous Pachyderms, and makes this family to consist of only one genus, *Equus*, with the following species:—*Caballus, Hemionus, Asinus, Zebra, Quagga*, and *Montanus.*

Mr. Gray, in his 'Revision of the Family *Equidæ*' (*Zool. Journ.*, vol. 1), observes that the older authors speak of the Horse, Mule, Onager, Ass, and Zebra, the last of which they generally describe as having the body (corpus) striped with black, brown, and white bands, three inches broad, but take no notice of the colour of its legs; but in Jonston's figure they are distinctly banded. After referring to the other figures in Jonston and to Molina's *Gnemel*, or *Huemul, Equus bisulcus* of Gmelin, which, if it exists, Mr. Gray considers to be probably a species of Llama (*Auchenia*), he notices the figures in Edwards's 'Gleanings,— the species recorded by Linnæus, Pallas, and Burchell,— the *Quagga* sent by Captain Gordon from the Cape to Amsterdam, where it was first described and figured from his drawing in the Dutch edition of Buffon, and afterwards in the supplement of the French editions, and *L'Ane Isabelle* of Le Vaillant. With regard to the last, which is described as being of a plain Isabella colour without any band, Mr. Gray observes, that nobody since Le Vaillant's time, as far as he can learn, has mentioned it, and he asks whether it may not be an albino variety of the *Zebra* or *Quagga*, as the ass is sometimes found of yellowish white, without any cross, in its domesticated state. To this however Mr. Gray adds that a year or two ago (he writes in 1824), as he was informed by Mr. Cross, a specimen said to be of this species was brought to this country.

Mr. Gray thus defines the Family of *Equidæ*:—'This family (which is distinguished from all other animals by its undivided hoof, formed of the two anterior toes soldered together, its simple stomach, and its female having the teat placed on the pubes) may be divided into two very distinct types of form; the one, the Asses and the Zebras, which are always whitish and more or less banded with blackish-brown, and always have a distinct dorsal line, the tail only bristly at the end, and have warts only on the arms and none on the hind legs; and the true horses, which are not banded, have no dorsal line, are furnished with warts on their arms and legs, and have long hair on the tail, from its insertion to its extremity.' He further proceeds with his definition thus: '*Equidæ; Solidungulæ* antiquorum, Cuvier, &c. Genus *Equus*, Linn.:—Dentes incisores, $\frac{6}{6}$; canine (mares), $\frac{1-1}{1-1}$; molars, $\frac{6-6}{6-6}$ = 40. Pedes ungulâ indivisâ.' Mr. Gray then divides the family into two genera, viz.: 1, *Equus*, consisting of the Common Horse and its varieties, *Equus Caballus*; 2, *Asinus*, embracing the following species: 1, *Hemionus*; 2, *vulgaris* (and its varieties); 3, *Quagga*; 4, *Burchellii*; 5, *Zebra.*

M. Lesson states that the *Solipèdes*, or *Equidæ*, of Gray, comprise only the genus *Equus*, which Mr. Gray has proposed to advance to the rank of a family under that name, comprising the genera *Equus* and *Asinus*; but, adds M. Lesson, there is nothing to induce us to admit a division which reposes only on superficial characters.

Mr. Bell is of a different opinion, and in his 'British Quadrupeds' follows Mr. Gray in considering the Ass as belonging to a distinct genus from the Horse, and he adopts Mr. Gray's family-name *Equidæ*. Mr. Bell makes the following remarks on the character of the Ass and its nearest congeners as compared with those of the Horse, upon which it had been thought necessary to establish them as distinct genera in the family. After admitting the truth of the observation that, in the absence of any knowledge of the original condition of the Horse, the question can only be considered with reference to the characters of a domesticated and probably much altered race, he reminds the reader, nevertheless, that as the distinctions upon which the division in question is founded are structural, there is less danger of error than if they had been only those of colour or of general form, and thus proceeds: 'The character of the tail is one of the most striking points upon which this distinction rests. In the Horse, the whole of this part is covered with long hair, totally concealing its actual form; whilst in the whole of the others, the Ass, the Zebra, the Quagga, the Dzigtai, &c., it is only clothed with long hair towards the extremity. The mane of the Horse also is long and flowing; that of all the other species is short and upright. In the former animal, the hinder as well as the fore legs are furnished with those warty callosities, which in the others, without exception, are found only on the fore-legs. Waiving some other particulars of minor importance, there is one character which, if not in itself to be considered of primary value, is yet interesting, and not unimportant as a collateral distinction: I mean the general tendency of the coloration and marking in the two forms. In the Horse's coat there is an obvious disposition to the formation of small round spots of a different shade or hue from that of the ground, and this is the case whether the general colour be black, chestnut, or grey; in the genus *Asinus*, on the contrary, the markings are invariably disposed in stripes. The Zebra, the Quagga, and the Mountain Zebra are examples too familiar to require more than this allusion; and in the common Ass, not only is the same tendency evinced by the cross-mark on the shoulders, but in the young Ass there are frequently observed some obscure darkish bands on the legs. These tendencies to a peculiar character of coloration and marking are well worthy of especial notice in the mammalia, among which will be found numerous instances bearing upon the distinction of approximating forms. In birds and insects it is still more general and striking, and has always attracted the attention of naturalists; but in the present class it has certainly been too much overlooked.'

Geographical Distribution of the Equidæ.—Although the Horse, the Ass, and the Mule are now spread over the whole face of the civilized earth, and although the Horse is found wild, or rather has reverted to a wild state, in both the New and the Old World, there can be no doubt that the form which we are now considering was originally entirely confined to the latter portion of the globe, where the truly wild species of the family, the Zebra, the Quagga, &c., are still to be found in all their native freedom. And this leads us to consider the time and the place where the Horse was first subdued by the powerful hand of man. Mr. Bell, who appeals to the sacred scriptures in proof that the Horse is of Eastern origin, is of opinion, from the same authority, that the Egyptians were probably the first who broke the proud spirit of this noble animal and reduced it to obedience and servitude. The books of *Genesis* and *Exodus* abound with passages which prove that the Horse had been long under the dominion of man at the date of the events then recorded. It was expressly prohibited (*Deut.*, xvii. 16) that the king should multiply horses to himself, or should cause the people to return to Egypt, to the end that he should multiply horses. Solomon however does not seem to have regarded this prohibition, for his stables were filled with these noble animals; he had 40,000 stalls of horses for his chariots, and 12,000 horsemen. (1 *Kings*, iv. 26.)

The grand description in *Job* (xxxix. 19-25) is familiar to most, but Egypt (1 *Kings*, x. 28), and not Arabia, seems to have been the source whence Solomon's supplies were obtained. In very early Egyptian monuments the horse is seen in battle, and under circumstances which denote long subjugation and experienced training.

It seems to be quite clear that the wild horses of Tartary are as much the descendants of a domesticated race as the wild horses of America, whose ancestors were introduced by the Spaniards; nor have we any evidence to show the time when the Horse existed in a primitive state of nature.

Equidæ.

Genus. Equus.

Natural History and Dentition of the Horse.—It has already been observed that the native country of the horse is unknown. From very remote periods he has been found in almost every part of the Old World, but his appearance on the continents and the islands of the New World, whether of the Atlantic or Pacific Ocean, is of comparatively recent date. Everywhere he is recognised as the most useful of the servants of man, and he yields in intelligence to the dog alone. In the earlier ages of the world he seems to have been devoted to the purposes of war or of pleasure, while the ox was our agricultural servant; but his beauty, and strength, and tractability, have now connected him, directly or indirectly, with almost all the purposes of life. If he differs in different countries in form and in size, it is from the influence of climate and cultivation; but otherwise, from the war-horse, as he is depicted on the friezes of antient temples, to the stately charger of Holstein and of Spain, or from the fleet and beautiful Arabian, to the diminutive Shetlander, there is an evident similarity of form and destination which clearly stamps his common origin.

He is naturally and of choice an herbivorous animal. His thin and muscular lips, his firm and compressed mouth, and his sharp incisor teeth, are admirably adapted to seize and to crop the grass; and although we know nothing of him in his natural state, yet when he has escaped from the bondage of man, and follows his own propensities, the grass is his chosen food. In his domesticated state however he was destined to live partially or chiefly on other aliment, and that of a much harder kind—the various species of corn; therefore while man and the carnivorous animals can only champ and crush their food, a provision is given to the horse, in the structure of some of the bones of the face, by means of which he can comminute and grind down his food as perfectly as in the best contrived mill.

The teeth of the horse require some lengthened consideration, not only from their admirable adaptation to this purpose, but as indicating, by the various changes which they undergo, almost beyond the possibility of error, the age of the animal. He may, when young in years, be reduced nearly to the decrepitude of age by the barbarous usage of those who ought to be his most zealous protectors; the cavity above the eye may be deepened, the under lip may fall, the limbs may be bowed, and the feet may be battered and distorted,—but it is not easy to alter the character of the teeth.

The colt is generally dropped with the first and second molar and grinding teeth having forced their way through the gum. When he is about seven or eight days old the two central front or incisor teeth, above and below, appear. At the expiration of five or six weeks the two next incisors may be seen. At three months they will have overtaken the central ones, and both pairs will have nearly attained their natural level. A third grinder will then have appeared; and a little before or after the eighth month the third nipper, above and below and on each side, will be seen. The colt will now have his full complement of front or cutting teeth.

These teeth are beautifully adapted to their purpose. They have in front an elevated cutting edge of considerable sharpness. It is formed of enamel, a polished substance almost too hard to be acted upon by the file, which covers the tooth. This elevated edge is bent somewhat inwards and over the tooth, so that there is a depression behind it which gradually becomes stained by the food and constitutes what is called 'the mark' in the mouth of the colt or horse.

This elevated edge of enamel, hard as it is, is gradually worn down in the act of nipping and cutting the grass; and as it wears away the hollow behind becomes diminished, and is at length totally obliterated. By the degree in which this mark is effaced, the horseman, not only with regard to the first, but the permanent teeth, judges of the age of the animal. This obliteration begins to be manifest at a very early age. At six months it is sufficiently evident in the four central nippers. At a year and a half the mark will be very faint in the central nippers, diminished in the other two, and the surface of all of them will be flattened.

At twelve months a fourth grinder protrudes, and a fifth at the expiration of two years.

These are all temporary teeth. They were only to last during a very early period of the life of the animal; and when his jaws were considerably expanded, they were destined to give way to another set, larger, firmer, and that would probably last during life. The permanent teeth had been long growing in the socket beneath the temporary ones, and had been pressing upon their roots, and that pressure had caused an absorption of these roots, until at length they lost all hold and were displaced.

When the animal is about three years old the central pair of nippers, above and below, are thus removed, and two fresh teeth, easily distinguishable from the first by their increased size, make their appearance, so that a three-year-old colt is easily recognised by these two new and enlarged central nippers.

A three-year-old colt has his form and energies much more developed than a two-year-old one, and is considerably more valuable; therefore some dishonest breeders endeavour to pass him upon the unwary as being a year older than he really is, and they accomplish this in an ingenious but cruel manner. This cannot however be effected until a portion of the second year is past, when the permanent teeth below are beginning to press upon the roots of their predecessors, and then the breeder extracts the central milk-teeth. Those below having no longer anything to resist their progress, grow far more rapidly than they otherwise would do, and the scoundrel gains four or five months in the apparent age of his colt.

Can this trickery be detected? Not always, except by him who is well accustomed to horses. The comparatively slow wasting of the other nippers, the difference of the development of these nippers in the upper and under jaw—for the breeder usually confines his roguery to the lower jaw, the upper one being comparatively seldom examined—these circumstances, together with a deficiency of general development in the colt, will alone enable the purchaser to detect the attempted cheat.

The honest mouth of a three-year-old horse should be thus formed:—the central teeth are palpably larger than the others, and have the mark on their upper surface evident and well defined. They will however be lower than the other teeth. The mark in the next pair of nippers will be nearly worn away, and that in the corner nippers will begin to wear.

At three years and a half the second nippers will be pushed from their sockets, and their place gradually supplied by a new pair; and at four and a half the corner nippers will be undergoing the same process. Thus at four years old the central nippers will be fully grown; the next pair will be up, but will not have attained their full height; and the corner nippers will be small, with their mark nearly effaced. At five years old the mark will begin to be effaced from the central teeth, the next pair will be fully grown and the blackness of the mark a little taken off, and the corner pair will be protruding or partly grown.

At this period, or between the fourth and fifth year, another change will have taken place in the mouth; the tushes will have begun to appear. There will be two of them in each jaw, between the nippers and the grinders, considerably nearer to the former than the latter, and particularly so in the lower jaw. The use of these tushes in the domesticated state of the horse is not evident; but they were probably designed as weapons of offence in the wild state of the animal. Attempts are too frequently made to hasten the appearance of the second and the corner teeth, in the same manner as described with regard to the first, and the gum is often deeply lanced in order to hasten the appearance of the tush.

At six years old the mark on the central nippers will be diminished, if not obliterated. A depression and a mark of rather brown hue may remain, but the deep blackened hole in the centre will no longer be found. The other incisors will also be somewhat worn, and the tush fully developed.

At seven the mark on the next pair of incisors will have nearly disappeared, and the tush will be rounded at the point and the edges.

At eight the mark will have disappeared from all the incisor teeth, and the tush will be evidently rounder and blunter.

At this period another piece of trickery is occasionally practised. The breeder had, till the animal was five years old, been endeavouring to give him an older appearance than his years entitled him to, because in proportion as be approached the period when his powers were most perfectly developed his value increased; but now he endeavours to conceal the ravages of age. The horse is cast, and with a sharp-pointed steel instrument a little hole is dug on the surface of the corner incisor, to which a red-hot iron is afterwards applied. An indelible black mark is thus left on the tooth. Sometimes the roguery is carried further; the next tooth is slightly touched with the engraver and the cautery; but here the dishonest dealer generally overreaches himself, for the form and general appearance of a six-year-old horse can rarely be given to one who has passed his eighth year. The eighth year having passed, it is difficult to decide on the exact age of the horse. The incisors of the upper jaw are then the best guides. At nine years the mark is said to be worn away from the central teeth; at eleven, from the next pair; and at twelve, from the corner ones. The tush likewise becomes shorter and blunter.

There are many circumstances which render a decision as to the age of the horse very difficult after the marks are effaced from the lower incisors, and even before that period. Horses always kept in the stable have the mark much sooner worn out than those that are at grass, and it is impossible to form any calculation at all as to crib-biters.

Of the age to which the horse would naturally arrive it is impossible to say anything satisfactory. Many have exceeded thirty, and some of them even forty years; but, from ill usage and over exertion, the majority come to their end before they have seen nine or ten years.

The Proper Conformation of the Horse.—A very general account only can be given of this, for it varies essentially with the breed and destination of the animal. There are some points however which are valuable in horses of every description. The head should not be disproportionally large, and should be well set on, *i.e.* the lower jaw-bones should be sufficiently far apart to enable the head to form that angle with the neck which gives free motion and a graceful carriage to it, and prevents its bearing too heavy on the hand. The eye should be large and a little prominent, and the eyelid fine and thin. The ear should be small and erect, and quick in motion. The lop-ear indicates dullness or stubbornness; and when it is habitually laid too far back upon the neck, there is too frequently a disposition to mischief. The nostril in every breed should be somewhat expanded: it can hardly be too much so in the racer, the hunter, the roadster, and the coach-horse, for this animal breathes only through the nostril, and would be dangerously distressed when much speed is required of him, if the nostril could not dilate to admit and to return the air. The neck should be long rather than short. It then enables the animal to graze with more ease, and to throw his weight more forward, whether he is in harness or galloping at the top of his speed. It should be muscular at its base, and gradually become fine as it approaches the head. The withers should be somewhat high in every horse, except perhaps that of heavy draught, and it does not harm him, for there is larger surface for the attachment of the muscles of the back, and they act at greater mechanical advantage. A slanting direction of the shoulder gives also much mechanical advantage, as well as an easy and pleasant action, and a greater degree of safety. It must not however exist in any considerable degree in the horse of draught, and particularly of heavy draught. The chest must be capacious, for it contains the heart and the lungs, the organs on which the speed and endurance of the horse depend. Capacity of chest is indispensable in every horse, but the form of the chest admits of variation. In the waggon-horse the circular chest may be admitted, because he seldom goes at any great speed, and there is comparatively little variation in the quantity of air required; but in other horses the variation is often fearful. The quantity of air expended in the gallop is many times that required in hard work. Here we must have depth of chest, not only as giving more room for the insertion of the muscles on the action of which the expansion of the chest depends, but a conformation of the chest which admits of that expansion. That which is somewhat straight may be easily bent into a circle when greater capacity is required; that which is already circular admits of no expansion. A few words more are all that our limits permit us to add, and they contain almost all that is necessary to be added on the conformation of the horse. 'The loins should be broad, the quarters long, the thighs muscular, and the hocks well bent and well under the horse.'

General Management of Horses.—The foal, as soon as it is dropped, should be turned with its dam into a sheltered and good pasture, in which there is a hovel for occasional retreat from the wind and the rain. Some hay or corn, or both, should be allowed, if it is early in the season, or the grass has scarcely begun to shoot. There is nothing so detrimental to the colt as insufficient food. It should be regarded as a fundamental principle in breeding, that if the growth is checked by starvation, beauty and energy and stoutness will rarely be displayed in after-years.

In five or six months, according to the growth of the foal, or the convenience of the farmer, the weaning may take place. The colt should be removed from his former haunts to some distant rick-yard, or confined to a stable, until he becomes a little reconciled to the loss of his dam.

In the ensuing spring the *breaking* may commence; a process on which will materially depend the temper and value of the horse, and the pleasure of the rider. The foal should be handled and haltered, and led about by the servant who has the chief care of him, and whose conduct towards him should always be kind. 'The principle,' says the author of 'The Horse,' 'on which the after-usefulness of the animal is founded, is early attachment to and confidence in man, and obedience, resulting principally from these.'

With regard to the racing colt, the processes of breaking and training are injuriously and cruelly completed in the second year, and thousands of horses are irreparably injured by this early exaction of labour and speed: but in the hunter, the hackney, the agricultural and the carriage horse, the serious part of this business is not entered upon until the third year.

A horse is well broken when he has been taught implicit and cheerful obedience to his rider or driver, and dexterity in the performance of his work. A dogged, sullen, spiritless submission may be enforced by the cruel and brutal usage to which the breaker so frequently has recourse; but that prompt and eager response to the slightest intimation of the rider's will—that manifest aim to anticipate every wish, that gives to the horse so much of his value, must be built on habitual confidence and attachment. The education of the horse should be that of the child. Pleasure should be as much as possible associated with the early lessons; while firmness, or, if need be, coercion, must establish the habit of obedience.

The breaking being accomplished, the management of the horse will vary according to his breed and destination; but the good usage of our domesticated slaves should be regarded as a principle that ought never to be violated. The agricultural horse is seldom overworked, and on large farms is generally well fed; perhaps, in many cases, too much above his work. This however is an error on the right side. A very slight inspection of the animal will always enable the owner to determine whether he is too well or not sufficiently fed. The size of the horse, and the nature of the work, and the season of the year, will make considerable difference in the quantity and the quality of the food. The following accounts will sufficiently elucidate the general custom: 'Mr. Harper, of Bank Hall, Lancashire, ploughs seven acres per week, the year through, on strong land with a team of three horses, and allows to each weekly two bushels of oats, with hay, during the winter six months, and during the remainder of the year one bushel of oats per week, with green food. Mr. Ellman, of Glynde in Sussex, allows two bushels of oats, with pease-haulm or straw, with but very little hay, during 30 winter weeks. He gives one bushel of oats with green food during the summer.'* There is very little difference in the management of these two gentlemen, and that probably arising from circumstances peculiar to their respective farms. The grand principles of feeding with reference to agricultural horses are, to keep the animal rather above his work, to give him good and wholesome food, and, by the use of the nose-bag, or other means, never to let him be worked more than four or five hours without being baited.

The horse of quick work, the stage-coach horse and the poster, should be allowed as much as he will eat, care being taken that no more is put into the manger than he will readily dispose of. The quantity actually eaten will depend on the degree of work and the natural appetite of the horse, but it may be averaged at about 66 pounds of chaff, 17½ pounds of beans, and 77 of oats per week. When the work is unusually hard, the quantity of oats may be diminished, that of beans increased, and a portion of barley added.

During the sporting season the hunter is well fed, and with that kind of food which contains a great proportion of nutriment in little compass. A small quantity of hay, rarely more than eight or ten pounds per day, is allowed, and less than that on the day before work. The quantity of corn may vary from 14 to 16 lbs. daily. There is a prejudice in most hunting stables, and probably well founded, against chaff, and it is seldom that the beans and oats are bruised. A bran-mash is given after a day of more than usual fatigue, and is serviceable at other times, when there has not been more than ordinary work, provided that at least two days are suffered to elapse before the horse is again taken into the field.

No horse should be urged on after he has exhibited unequivocal symptoms of distress, such as a drooping pace, a staggering gait, a heavy bearing on the hand, a rapid inspiration like a hurried sigh, and a peculiar convulsive action of the diaphragm, as though the heart were violently beating against the side. The loss of blood, the administration of some cordial medicine, and slow leading to the nearest stable, are the best restoratives at the moment of distress; although the cordial would be absolutely destructive a few hours afterwards, when inflammation had commenced.

The hunting season having passed, the horse used to be turned into the field as soon as the grass had begun fairly to sprout, and there, with his feed or two feeds of corn daily, and his hovel, into which he might retreat from the sun or the storm, he remained until the middle of June, or the flies began to be troublesome. It was delightful to see how much he enjoyed this short period of liberty; and well had he earned it. Of late years however it has become the fashion to confine him to his box, whence he stirs not except for an hour's walking exercise on the road, until he is taken into training for the next winter's business.

Nothing can be so erroneous or cruel as this. There are few horses that have not materially suffered in their legs and feet before the close of the hunting season. There cannot be anything so refreshing to their feet as the damp coolness of the herbage which they tread at that period, and there is no physic which so safely and effectually as the spring grass carries off every humour that may be lurking in their frame.

The training of the hunter for his work is a simple affair. It is, by means of exercise and of physic, getting rid of all superfluous fat and flesh, without debilitating him. The physic is useful; it is indispensable; but the chief thing is gradually to accustom him to the exertion of every power that he possesses, without too much hurrying his breathing or overstraining or injuring him.

The training of the race-horse is of a similar character, but it is far more severe, for his strength, his speed, and his endurance must be tested to the utmost. The hunter has to carry his rider gallantly and well through perhaps a long burst, and if he tires, and the sportsman has the good sense and humanity to cease to urge him on, the greatest evil is some temporary suffering to him, and disappointment to his master; but if the race-horse breaks down, or if his capabilities have not been accurately calculated, the most serious loss may be sustained. Thence arises the necessity of straining and of testing every power in the preparation of the turf horse; and thence too it happens, from the strange and impolitic sacrifice of the endurance of the modern racer to speed during short distances, that so many young horses break down and become perfectly useless in their training.

* 'Agricultural Survey of Sussex,' pp. 378 and 381.

The *watering* of the horse is a very important but disregarded portion of his general management. The kind of water has not been sufficiently considered. The difference between what is termed *hard* and *soft* water is a circumstance of general observation. The former contains certain saline principles which decompose some bodies, as in the curdling of soap; and prevent the solution of others, as in the making of tea, the boiling of vegetables, and the process of brewing. It is natural to suppose that these different kinds of water would produce somewhat different effects on the animal frame, and such is the fact. Hard water, freshly drawn from the well, will frequently roughen the coat of the horse unaccustomed to it, or cause griping pains, or materially lessen the animal's power of exertion. The racing and the hunting groom are perfectly aware of this; and so is the horse, for he will refuse the purest water from the well, if he can obtain access to the running stream, or even the turbid pool. Where there is the power of choice, the softer water should undoubtedly be preferred.

The temperature of the water is of far more consequence than its hardness. It will rarely harm if taken from the pond or the running stream, but its coldness when recently drawn from the well has often been injurious. It has produced colic, spasm, and even death. It should therefore be exposed for some hours, either in the stable or in some tank.

There is often considerable prejudice against the horse being fairly supplied with water. It is supposed to chill him; to injure his wind, or to incapacitate him for hard work. It certainly would do so, if, immediately after drinking his fill, he were galloped hard, but not if he were suffered to quench his thirst more frequently when at rest in the stable. The horse that has free access to water will not drink so much in the course of a day as another who, to cool his parched mouth, swallows as fast as he can, and knows not when to stop.

When on a journey a horse may with perfect safety be far more liberally supplied with water than he generally is. An hour before his work commences he should be permitted to drink a couple of quarts. A greater quantity might be probably objected to. He will perform his task far more pleasantly and effectively than with a parched mouth and tormenting thirst. The prejudice both of the hunting and the training groom on this point is cruel as well as injurious. The task or the journey being accomplished, and the horse having breathed a few minutes, another quart, or even two, will be delightfully refreshing to him, and will never do him harm. His corn may then be offered to him, which he will readily take; and before he has eaten the whole of it two or three more quarts of water may be given.

Towards the close of the day the speed of the traveller should somewhat abate, and the horse should arrive at his resting-place as dry and as cool as circumstances will permit. If he is hot he must be walked about awhile, or the perspiration will return in the stable. If he is wet he must be carefully rubbed dry. The sooner this is done the better; and after he is clothed, watered, fed, and bedded, he should as soon as possible be left to his repose. Professor Stewart, of Glasgow, has lately published a very useful work on the 'Stable Economy, or General Management of Horses.' We abridge his account of 'the kinds of work, and the preparation for them.'

Travelling.—The horse should undergo some degree of training as to the pace, the distance, and the burden. When there has been no preparation the stages must at first be short, and the pace gentle. For a journey of 300 miles the horse may travel from 20 to 25 miles a day, resting on the Sunday, and doing the work in two stages, at the pace of six miles an hour. This requires a seasoned horse, and the number of working hours per day is about four.

Hunting requires speed and stoutness. The pace seldom exceeds twelve miles an hour, and the run is short, soon over, or interrupted; yet soft sinking ground, hills, and leaps make this pace severe even on the best horses. The time for preparation varies from two to four months. On the day before work the horse should have exercise enough to empty the bowels. If he is a good feeder he should have no hay within eight hours of starting, nor water within four hours, nor corn within three hours; but if he has five or six miles to go to cover, these restrictions are less necessary. The working days will vary according to his condition and the hardness of the running. He may be able to go out every second day, and sometimes not more than once in six or seven. His spirits and appetite, and the state of his legs, will decide this. Even on the blank days some exercise should be taken in order to evacuate the bowels and create an appetite.

Coaching.—Tho horses are best prepared for their work by good feeding and gradual increase of speed and distance. The ordinary length of a stage is eight miles; so that a horse is required for every mile, or a coach running between two places forty miles distant employs forty horses to take it away and bring it back. The pace being calculated at from nine to eleven miles an hour, no horse works quite an hour in the day, and some not more than three-quarters of an hour, except that, occasionally, an able horse may perform a double journey in order to relieve a sick companion. No horse therefore leads so easy a life as an English coach-horse in a well regulated establishment. The muscular exertion is severe while it lasts, but it is soon over. The excitement however of high keep and excessive exertion gradually wears the horse down, and it is rarely that he continues in a fast coach more than four years. (Nimrod, *On the Road.*)

Carting.—Cart-horses usually work from eight to ten hours, six days in the week. The pace varies from two miles to three and a half per hour, and the weight rarely exceeds 24 cwt., besides the cart, which probably is seven or eight more. All beyond this in weight or in time of work is cruel.

Ploughing.—The average work is about eight hours in the day. The severity of it depends on the pace, the nature of the soil, and the breadth of the furrow-slice. The pace is from a mile and a half to two miles per hour; the furrow varies from eight inches to eleven, and the distance travelled is from twelve to sixteen miles. The horse and the man can well support this as long as the ploughing season continues.

Diseases of Horses.—It may be readily supposed that the animal doomed to the manner of living just traced in every variety of the horse will be peculiarly exposed to numerous forms of suffering. Every natural evil will be aggravated, and many new and formidable sources of pain and death will be superadded.

Interest and humanity require that we should become acquainted with the nature and causes and remedy of the diseases of the horse. Only a slight sketch of them can be given here, but sufficient perhaps to enable tho owner to recognise their existence, to avoid their causes, or to induce him to apply to the proper quarter for their removal or alleviation.

The principal diseases of the horse are connected with the circulatory system. From the state of habitual excitement in which the animal is kept, in order to enable him to execute his task, the heart and the blood-vessels will often act too impetuously. The vital fluid will be hurried along too rapidly, either through the frame generally or some particular part of it, and there will be *congestion,* accumulation of blood in that part, or there will be *inflammation,* either local or general, disturbing the functions of some organ or of the whole frame.

Congestion.—Take a young horse on his first entrance into the stables; feed him somewhat highly, and what is the consequence? He has swellings of the legs, or inflammation of the joints, or perhaps of the lungs. Take a horse that has lived somewhat above his work, and gallop him to the top of his speed: his nervous system becomes highly excited—the heart beats with fearful rapidity—the blood is pumped into the lungs faster than they can discharge it—the pulmonary vessels become gorged, fatigued, and utterly powerless—the blood, arrested in its course, becomes viscid, and death speedily ensues. We have but one chance of saving our patient, viz. the instantaneous and copious abstraction of blood; and one means of preventing the recurrence of this dangerous state, namely, by not suffering too great an accumulation of the sanguineous fluid by over-feeding, and, by regular and systematic exercise, inuring the circulatory vessels to prompt and efficient action when they are suddenly called upon to exert themselves. The cause and the remedy are sufficiently plain.

Again, the brain has functions of the most important nature to discharge, and more blood flows through it than any other portion of the frame of equal bulk. In order to prevent this organ from being oppressed by a too great determination of blood to it, the vessels, although numerous, are small, and pursue a very circuitous and winding course. A horse highly fed, and full of blood, is suddenly and sharply exercised: the course of the blood is accelerated in every direction, and to the brain among other parts. The vessels that ramify on its surface or penetrate its substance are completely distended and gorged with it. Perhaps they are ruptured, and the effused blood presses upon the brain; it presses upon the origins of the nerves on which all sensation and motion depend, and the animal suddenly drops powerless. A prompt and copious abstraction of blood, or in other words a diminution of this pressure, can alone save the patient. Here is the nature, the cause, and the treatment of *apoplexy.*

Sometimes this disease assumes a different form. The horse has not been performing more than his ordinary work, or perhaps he may not have been out of the stable. He is found with his head drooping and his vision impaired. He is staggering about; he falls, and lies half unconscious, or he struggles violently and dangerously. There is the same congestion of blood in the head, the same pressure on the nervous origins, but produced by a different cause. He has been accustomed habitually to overload his stomach, or he was, on the previous day, kept too long from his food, and then he fell ravenously upon it, and ate until his stomach was completely distended and unable to propel forward its accumulated contents. Thus distended, its blood-vessels are compressed, and the circulation through them is impeded or altogether suspended. The blood is still forced on by the heart, and driven in accumulated quantity to other organs, and to the brain among the rest; and there congestion takes place, as just described, and the animal becomes sleepy, unconscious, and, if he is not speedily relieved, he dies. This too is apoplexy; the horseman calls it *stomach staggers.* Its cause is improper feeding. The division of the hours of labour, and the introduction of the *nose-bag,* have much diminished the frequency of its occurrence. The remedies are plain,—bleeding, physicking, and the removal of the contents of the stomach by means of a pump contrived for that purpose.

Congestions of other kinds occasionally present themselves. It is no uncommon thing for the blood to loiter in the complicated vessels of the *liver,* until the covering of that viscus has burst, and an accumulation of congealed black blood has presented itself. It is the same with the *spleen.* It constitutes the *swelled legs* to which so many horses are subject when they stand too long idle in the stable. Congestion is the source of many of the accumulations of serous fluid in various parts of the body, and particularly in the chest, the abdomen, and the brain.

Inflammation is opposed to *congestion,* as consisting in an active state of the capillary arterial vessels; the blood rushing through them with far greater rapidity than in health, from the excited state of the nervous system, by which they are supplied.

Inflammation is either *local* or *diffused.* It is confined to one organ, or to a particular portion of that organ; or it involves many neighbouring ones, or it is spread over the whole frame. In the latter case it assumes the name of *fever.* Fever is general or constitutional inflammation, and is said to be *sympathetic* or *symptomatic* when it can be traced to some local affection or cause, and *idiopathic* when we cannot so trace it. The truth probably is that every fever has its local cause, but we have not a sufficient knowledge of the animal economy to be able to discover it.

Inflammation may be considered with reference to the membranes which it attacks.

The *mucous membranes* line all the cavities that communicate with the external surface of the body. There is frequent inflammation of the membrane of the mouth. *Blain,* or *Glossanthrax,* is a vesicular enlargement which runs along the side of the tongue. Its cause is unknown. It should be lanced freely and deeply, and a little aperient medicine administered. *Barbs,* or *paps,* are smaller enlargements, found more in tho neighbourhood of the bridle of the tongue. They should never be touched with any instrument: a little cooling medioine will generally remove them. *Lampas* is inflammation of the palate, or enlargement of the bars of the palate. The roof of the mouth may be slightly lanced, or a little aperient medicine administered; but the sensibility of the mouth should never be destroyed hy the application of the heated iron. *Canker* and *wounds in the mouth*, from various causes, will be best remedied hy diluted tincture of myrrh, or a weak solution of alum. *Foreign bodies in the gullet* may generally he removed hy means of the probang used in the hoove of cattle; or the œsophagus may he opened, and the obstructing body taken out. It is on the mucous membranes that *poisons* principally exert their influence. The *yew* is the most frequent vegetahle poison. The horse may he saved hy timely recourse to equal parts of vinegar and water injected into the stomach, after the poison has been as much as possihle removed hy means of the stomach-pump. For arsenic or corrosive suhlimate there is rarely any antidote. *Spasmodic colic* is too frequently produced by exposure to cold, or tbe drinking of cold water, or the use of too much green meat. The horse should be walked ahout; strong friction used over the belly, and spirit of turpentine given in doses of two ounces, with an ounce each of laudanum and spirit of nitrous æther, in warm water or ale. If the spasm is not soon relieved the animal should be hled, an aloetic hall administered, and injections of warm water with a solution of aloes thrown up. This spasmodic action of the bowels, when long continued, is liable to produce *introsusception*, or *entanglement*, of them, and the case is then hopeless. *Superpurgation* often follows the administration of a too strong or improper dose of physic. The torture which it produces will be evident hy the agonised expression of the countenance, and tbe frequent looking at the flanks. Plenty of thin starch or arrowroot should he given hoth by the mouth and hy injection; and, twelve hours having passed without relief being experienced, chalk, catechu, and opium should he added to the gruel. *Worms* in the intestines are not often productive of much mischief, except they exist in very great quantities. Small doses (two drachms) of emetic tartar with a littlo ginger may be given to the horse half an hour before his first meal, in order to expel the round white worm; and injections of linseed-oil or aloes will remove the ascarides, or needle-worms.

The *respiratory passages* are all lined by the mucous membrane. *Catarrh*, or *cold*, inflammation of the upper air passages, should never he long neglected. A few mashes or a little medicine will usually remove it. If it is neglected, and, occasionally, in defiance of all treatment, it will degenerate into other diseases. The larynx may hecome the principal seat of inflammation. *Laryngitis* will be shown by extreme difficulty of breathing, accompanied by a strange roaring noise, and an evident enlargement and great tenderness of the larynx when felt externally. The windpipe must he opened in such case, and the hest advice will be necessary. Sometimes the subdivisions of the trachea, before or when it first enters the lungs, will be the part affected, and we have *bronchitis*. This is characterized by a quick and hard hreathing, and a peculiar wheezing sound, with the coughing up of mucus. Here too decisive measures must be adopted, and a skilful practitioner employed. So should he in *distemper*, *influenza*, and *epidemic catarrh*, names indicating the same disease, and produced hy atmospheric influence, varying to a certain degree in every season, but in all characterized hy intense inflammation of the mucous surfaces, and hy rapid and utter prostration of strength, and in all demanding the abatement of that inflammation, and yet no expenditure of vital power.

Cough may degenerate into *inflammation of the lungs*; or this fearful malady may be developed without a single premonitory symptom, and may prove fatal in twenty-four or even in twelve hours. It is mostly characterized by deathy coldness of the extremities, expansion of the nostril, redness of its lining membrane, singularly anxious countenance, constant gazing at the flank, and an unwillingness to move. A successful treatment of such a case can he founded only on the most prompt and fearless and decisive measures. The lancet must be freely used; counter-irritants must follow as soon as the violence of the disease is in the slightest degree abated; sedatives must succeed to them, and fortunate will he be who often saves his patient after all the decisive symptoms of pneumonia are once developed.

Among tne consequences of these severe affections of the lungs are *chronic cough*, not always much interfering with the usefulness of the horse, but strangely aggravated at times by any fresh accession of catarrh, and too often degenerating into *thick wind*, which always materially interferes with the speed of the horse, and in a great proportion of cases terminates in broken wind. It is rare indeed that either of these diseases admits of cure, nor does that obstruction in some part of the respiratory canal, and varying in almost every horse, which produces the peculiar sound termed *roaring*.

Glanders, the most destructive of all the diseases to which the horse is exposed, is the consequence of hreathing the atmosphere of foul and vitiated stables—the winding up of almost every other disease, and, in every stage of it, most contagious. Its most prominent symptoms are a small but constant discharge of sticky matter from the nose, an enlargement and induration of the glands beneath and within the lower jaw, on one or hoth sides; and, before the termination of the disease, chancrous inflammation of the nostril on the same side with the enlarged gland. Its contagiousness should never be forgotten, for if a glandered horse is once introduced into a stahle, almost every horse in it will sooner or later hecome infected and die.

The urinary and genital organs are also lined by mucous memhranes. The horse is subject to *inflammation of the kidneys* from eating musty oats or mowburnt hay, from exposure to cold, and from injuries of tbe loins. Bleeding, physic, and counter-irritants over the region of the loins should he had recourse to. *Diabetes*, or *profuse staling*, is difficult to treat. The inflammation that may exist should first be subdued; and then opium, catechu, and the uva ursi administered. *Inflammation of the bladder* will be best alleviated hy mucilaginous drinks of almost any kind. *Inflammation of the neck of the bladder*, evinced by the frequent and painful discharge of small quantities of urine, will yield only to the abstraction of blood aud the exhibition of opium. A catheter may he easily passed into the hladder of the mare, and the urine evacuated, but it will require a skilful veterinary surgeon to effect this in the horse. A *stone in the bladder* is readily detected by the practitioner, and may he extracted with comparative ease The sheath of the penis often hecomes diseased from the presence of corrosive mucous matter; it may easily he removed with warm soap and water.

To the mucous membranes belong the conjunctival tunic of the eye, and the diseases of the eye generally may be here considered. A *scabby itchiness* on the edge of the eye-lid may be got rid of by a diluted nitrated ointment of mercury. *Warts* should he cut off with the scissors, and the roots touched with lunar caustic. *Inflammation of the haw* should he abated hy the employment of cooling lotions, hut that useful defence of the eye should never, if possible, he removed. Common *ophthalmia* will yield as readily to cooling applications as inflammation of the same organ in any other animal; hut there is another kind of inflammation, commencing in the same way as the first, and for a while apparently yielding to treatment, hut which changes from eye to eye, and returns again and again, until blindness is produced in one or both organs of vision. The most frequent cause is hereditary predisposition. The reader cannot be too often reminded that the qualities of the sire, good or bad, descend, and scarcely changed, to his offspring. How *moon-blindness* was first produced no one knows; hut its continuance in our stables is to he traced to this cause principally, or almost alone, and it pursues it course until cataract is produced, for which there is no remedy. *Gutta serena* (palsy of the optic nerve) is sometimes observed, and many have been deceived, for the eye retains its perfect transparency. Here also medical treatment is of no avail.

The serous membranes are of great importance. The brain and spinal marrow, with the origins of the nerves, are surrounded by them; so are the heart, the lungs, the intestinal canal, and the organs whose office it is to prepare the generative fluid.

Inflammation of the Brain.—Mad staggers fall under this division. It is inflammation of the meninges, or envelopes of the brain, produced hy over-exertion, or hy any of tho causes of general fever, and it is characterised by tbe wildest delirium. Nothing but the most profuse bloodletting, active purgation, and hlistering the head, will afford the slightest hope of success. *Tetanus*, or *Locked Jaw*, is a constant spasm of all the voluntary muscles, and particularly those of the neck, the spine, and the head, arising from the injury of some nervous fibril—that injury spreading to the origin of the nerve—the brain becoming affected, and universal and unbroken spasmodic action being the result. Bleeding, physicking, blistering the course of the spine, and the administration of opium in enormous doses, will alone give any chance of cure. *Epilepsy* is not a frequent disease in the horse, but it seldom admits of cure. It is also very apt to return at the most distant and uncertain intervals. *Palsy* is the suspension of nervous power. It is usually confined to the hinder limbs, and sometimes to one limb only. Here bleeding and physicking, and antimonial medicines, and blistering of the spine, are the most rational applications, but they too often utterly fail of success. *Rabies*, or madness, is evidently a disease of the nervous system, and once being developed is altogether without cure. The utter destruction of the bitten part with the lunar caustic, soon after the infliction of the wound, will however, in a great majority of cases, prevent the development of the disease.

Pleurisy, or inflammation of the serous covering of the lungs and the lining of the cavity of the chest, is generally connected with inflammation of the substance of the lungs; but it occasionally exists independent of any state of the lungs. The pulse is in this case hard and full, instead of being oppressed; the extremities are not so intensely cold as in pneumonia, the membrane of the nose is little reddened, and the sides are tender. It may be of importance to distinguish between the two, because in pleurisy more active purgation may be pursued, and the effect of counter-irritants will be greater, from their proximity to the seat of disease. Copious bleedings and sedatives here also should be had recourse to. It is in connexion with pleurisy that a serous fluid is effused in the chest, the existence and the extent of which may be ascertained by the practised ear, and which in many cases may be safely evacuated.

The heart is surrounded by a serous membrane, the pericardium, that secretes a fluid, the interposition of which prevents any injurious friction or concussion in the constant action of this organ. If this fluid increases to too great a degree, the action of the heart may be impeded or destroyed—this is *dropsy of the heart:* it is difficult to detect, and more difficult to cure. The heart itself is often diseased; it sympathises with the inflammatory affection of every organ, and therefore is itself occasionally inflamed. *Carditis*, or *inflammation of the heart*, is characterised by the strength of its pulsations, the tremour of which can be seen, while the sound can be heard at a distance of several yards. Speedy and copious blood-letting will afford the only hope of cure in such a case.

The outer coat of the stomach and intestines is composed of a serous membrane, the peritoneum, which adds strength and firmness to their textures; attaches and supports and confines them in their respective places, and secretes a fluid that prevents all injurious friction between them. This coat is exceedingly subject to inflammation, somewhat gradual in its approach; the pulse quickened, but small; the legs cold; the belly tender; there being constant pain, and every motion increasing it, there also being rapid and great prostration of strength. These symptoms will sufficiently characterise *peritoneal inflammation*. Bleeding, aperient injections, and extensive counter-irritation will afford the only hope of cure.

The time for *castration* varies according to the breed and destiny of the horse. On the farmer's colt it may be effected when the animal is not more than four or five months old, and it is comparatively seldom that a fatal case then occurs. For other horses much depends on their growth, and particularly on the development of their fore quarters. Little improvement has been effected in the old mode of castrating, except the opening of the scrotum, and the division of the cord by the knife, instead of the heated iron.

Synovial or joint membranes are interposed between the divisions of the bones, and frequently between the tendons, in order to secrete a certain fluid that shall facilitate motion and obviate friction. Occasionally the membrane is lacerated, and the synovia escapes. This is termed *opened joint*, and violent inflammation rapidly ensues. The duty of the practitioner is to close this opening, and as quickly as possible. Nothing is so effectual here as the old application of the cautery. A great deal of inflammation and engorgement is produced around the opening, partially, if not altogether, closing it; or at least enabling the coagulated synovia to occupy and obliterate it. Perhaps, in order to assure the desired result, the whole of the joint should be blistered; a bandage should then be firmly applied, and kept on as long as possible. If after this there is any eruption of the synovia, the cautery must again be had recourse to.

The Navicular Disease is a bruise, or inflammation, or perhaps destruction, of the cartilage of the navicular bone, where the flex or tendon of the foot passes over it in order to reach the coffin-bone. The veterinary surgeon can alone ascertain the existence and proper treatment of this disease. *Spavin* is an enlargement of the inner side of the hock. The splent bones which support the inferior layer of those of the hock sustaining a very unequal degree of concussion and weight, the cartilaginous substance which unites them to the shank bone takes on inflammation, it becomes bony instead of cartilaginous, and the disposition to this change being set up in the part, bony matter continues to be deposited, until a very considerable enlargement takes place, known by the name of *spavin*, and there is considerable lameness in the hock joint. The bony tumour is blistered, and probably fired, but there is no diminution of the lameness until the parts have adapted themselves, after a considerable process of time, to the altered duty required of them, and then the lameness materially diminishes, and the horse becomes, to a very considerable extent, useful. *Curb* is an enlargement of the back of the hock, three or four inches below its point. It is a strain of the ligament which there binds the tendons down in their place. The patient should be subjected to almost absolute rest; a blister should be applied over the back of the tumour, and, occasionally, firing will be requisite to complete the cure. Near the fetlock, and where the tendons are exposed to injury from pressure or friction, little bags or sacs are placed, from which a lubricating mucous fluid constantly escapes. In the violent tasks which the horse occasionally has to perform these become bruised and inflamed, and enlarged and hardened, and are termed *windgalls;* they blemish the horse, but are no cause of lameness after the inflammation has subsided, unless they become very much enlarged. The cautery will then be the best cure. Immediately above the hock enlargements of a similar nature are sometimes found, and, as they project both inwardly and outwardly, they are termed *thorough-pins*. They are seldom a cause of lameness, but they indicate great and perhaps injurious exertion of the joint. On the inside of the hock a tumour of this kind, but of a more serious nature, is found. It is one of these enlarged mucous bags, but very deeply seated, the subcutaneous vein of the hock passing over it. The course of the blood through the vein is thus in some measure arrested, and a portion of the vessel becomes distended. This is a serious evil; for, from the deep-seatedness of the mucous bag, it is almost impossible to act effectually upon it. It is termed *bog* or *blood spavin*.

The cellular tissue which fills the interstices of the various organs, or enters into their texture, is the seat of many diseases. From the badness of the harness, or the brutality of the attendant, the poll of the horse becomes contused. Inflammation is set up, considerable swelling ensues, and an ulcerative process soon commences, and chasms and sinuses of the most frightful extent begin to appear. The withers are probably bruised, and the same process takes place there, and sinuses penetrate deep beneath the shoulder, and the bones of the withers are frequently exposed. These abscesses are termed *poll evil* and *fistulous withers*, and in the treatment of them the horse is often tortured to a dreadful and disgraceful extent. A better mode of management has however been introduced: setons are passed through the most dependent parts; no collection of sanious fluid is permitted to exist, and milder stimulants are applied to the surface of the ulcer.

An abscess of a peculiar character is found between the branches of the lower jaw in young horses: it is preceded by some degree of fever. It is usually slow in its progress, but at length it attains a considerable size, including the whole of the cellular tissue in that neighbourhood. There is one uniform mass of tumefaction. This is *strangles*. It seems to be an effort of nature to get rid of something which oppresses the constitution, and the treatment of it is now simple and effectual. It is encouraged by fomentations and by blisters: it is punctured as soon as the fluctuation of a fluid within it can be fairly detected, the pus speedily escapes, and there is an end of the matter.

To one disease of the absorbent system a brief reference must be made.

Farcy.—While the arterial capillaries are engaged in building up the frame, the absorbents are employed in removing that which not only is useless, but which would be poisonous and destructive. They take up the matter of glanders and of every ulcerating surface, and they are occasionally irritated, inflamed, and ulcerated, from the acrimonious nature of the poison which they carry. The absorbents are furnished with numerous valves; the fluid is for awhile arrested by them, and there the inflammation is greatest, and ulceration takes place. This is the history of the farcy cords and buds. Farcy is a highly contagious disease, whether or not it be connected with glanders. It however occasionally admits of cure from the application of the cautery to the bud, and the administration of the corrosive sublimate or the sulphate of iron internally.

The skin of the horse is subject to various diseases. Large pimples or lumps suddenly appear on the skin, and, after remaining a few days, the cuticle peels off, and a circular scaly spot is left. This is called *surfeit.* The cause is obscure, but principally referrible to indigestion. A slight bleeding will always be serviceable; physic rarely does good, but alteratives composed of nitre, black antimony, and sulphur will be very beneficial. *Mange* is a disease of a different character. It is the curse of the stable into which it enters, for it will almost certainly affect every horse. Thorough dressings with Barhadoes tar and linseed oil, in the proportion of one of the former to three of the latter, will be the most effectual external application, while alteratives and physic should be given internally. *Hide-bound* is a very appropriate term for the peculiar sticking of the hide to the ribs when a horse is out of condition. The subcutaneous adipose matter is all absorbed. The alterative above recommended will be very useful here. *Grease* is an undue secretion of the fluid which was designed to lubricate the skin of the heels, and that secretion being also altered in quality. The hind legs begin to swell, a fluid exudes from the heels, the hairs of the heels become erect like so many bristles, and the skin of the heel is hot and greasy. Soon afterwards cracks appear across the heel: they discharge a thick and offensive matter, and then deepen. They spread up the leg, and so does the tumefaction of the part. In process of time the skin, inflamed and ulcerated, undergoes an alteration of structure; prominences or granulations appear on it, assuming the appearance of a collection of grapes, or the skin of a pine-apple. They increase, and a fœtid discharge appears from the crevices between them.

The cause is generally neglect of the horse. He is suffered to stand in the stable with his heels cold and wet, and this must necessarily dispose them to inflammation and disease.

In the first stage of grease, bran or turnip or carrot poultices will be serviceable, with moderate physic. Then astringents must be employed, and the best are alum or sulphate of copper in powder, mixed with eight times the quantity of Bole Armenian, and sprinkled on the sores. These should be alternated every three or four days. The grapy heels are a disgrace to the stable in which they are found, and admit not of radical cure.

As to the structure, shoeing, and diseases of that admirable organ the foot of the horse, the reader is referred to Goodwin 'On Shoeing,' Blaine's 'Veterinary Outlines,' and the treatise on 'The Horse,' published by the Society for the Diffusion of Useful Knowledge.

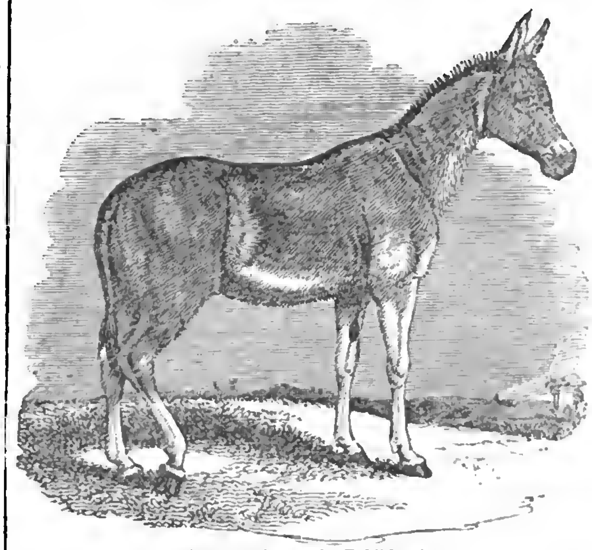
Genus. Asinus. (Gray.)

Asinus Hemionus, *Equus Hemionus* of Pallas; the *Dshikketei*, *Dzigguetai*, *Dzigithai*, or *Dziglai*,—*Yototse* of the Chinese.

Description.—Mule-like in form, with the head and ears large; colour Isabella yellow; mane, tail, and dorsal line black. Mr. Gray observes that the hair of the winter coat is very long, and that of the summer short.

Locality, Central Asia; the sandy deserts of Mongolia, on the borders of Tibet and China, where Pallas met with it in troops. M. Duvaucel saw it wild in Hindustan; and M. Lesson adds that it is said to be very common in the Himalaya chain. There is a living Dshikketei in the gardens of the Zoological Society at the Regent's Park.

Asinus vulgaris. [Ass, vol. ii.] We have to add to the article quoted, that the Ass of Dukhun (Deccan) is very little larger than a good mastiff or Newfoundland dog, according to Col. Sykes. (*Zool. Proc.*, 1830-31.)



Asinus Hemionus (the Dshikketei).

Asinus Quagga, the Quagga. Less than the Zebra, with the hinder parts higher, and the ears shorter. Fur of the head, neck, mane, and shoulders blackish brown banded with white, the ground colour gradually becoming paler, and the bands less distinct and diffused, as we proceed along the back, till it is greyish on the rump; the dorsal line is black, margined on each side with a white line. Belly, tail, and legs white; ears with two irregular black bands and white tip. The young is pale brown, with the mane, a few scattered spots, and the dorsal line of a deeper colour, the latter of which is slightly extended down the tail. The belly and legs whitish grey, with a dark ring just above the hoof. The forehead, cheeks, neck, and mane marked with transverse whitish bands, which are visible in peculiar positions on the back also. (Gray.) Associates in troops, but does not herd with the Zebras.

The Quagga.

Locality, Southern Africa, near the Cape of Good Hope Mr. Gray observes, that according to Captain Gordon, Quaggas are employed by the natives for the purposes of draught, but he goes on to remark that as Buffon very justly observes, it is curious that he could only get a young specimen. Mr. Gray further states that an individual at Exeter 'Change was not very docile, being much more wild than the Zebra; its name, he adds, is derived from its voice, which resembles the barking of a dog.

Mr. Gray informs us (loc. cit.) that when the skin of the animal, which he considers to be and which agrees with M. Buffon's figure of the young of this species (except in having the brown ring above the hoof), was shown to Professor Temminck by Mr. Children, he declared it to be the *Ane Isabelle* of Le Vaillant; but with all due respect to the knowledge of M. Temminck, who, Mr. Gray observes, so greatly excels in the knowledge of species, he is sorry that he cannot agree with that naturalist in this instance, although he allows that M. Temminck ought to know Le

Vaillant's animals better than any other person, as that celebrated traveller constantly corresponded with M. Temminck. 'If it be that animal,' Mr. Gray continues, 'Le Vaillant must have overlooked the bands, and I can hardly call it Isabella colour.'

Asinus Burchellii (Gray), Burchell's Zebra. Body white; head with numerous narrow brown stripes, which gradually unite together and form a bay nose; the neck and body with alternate broad stripes of black and narrow ones of brown, the latter of which nearly fill up the interspaces between the black stripes, and only leave a narrow whitish margin. The dorsal line is narrow, and becomes gradually broader in the hinder part, distinctly margined with white on each side. The belly, legs, and tail quite white; the mane alternately banded with blackish and white. Mr. Gray, whose description this is, has given a figure of the animal (*Zool. Journ.*, vol. i., pl. ix., fig. 1) from the skin in the British Museum, which was brought home by Mr. Burchell.

Locality, Southern Africa; the flat parts near the Cape. (Burchell.)

In the catalogue of the African Museum, lately (1838) dispersed, No. 24 was stated to be *Equus Burchellii*, the same animal, we presume, as that described by Mr. Gray under the name of *Asinus Burchellii*. 'This,' says the catalogue, is the young of a species intermediate between the South African Quaga and the Zebra, which was found occurring in herds in every district north of the Orange River visited by the expedition. In the districts south of the river, on the other hand, it is very rarely met with, its place in the colony being supplied by the *Equus Quagga* of Linnæus. It is an animal that admits of being tamed to a certain extent with considerable facility, and occasionally a half-domesticated specimen is exposed for sale at Cape Town, with a rider on its back. The persons however who have had most opportunities of becoming acquainted with its character regard it, even in the most tractable state to which it has yet been reduced, as wicked, treacherous, obstinate, and fickle.'

Mr. Gray remarks that the hoofs, as Mr. Burchell very justly observes, offer a good distinguishing character between the Zebra of the Mountains and that of the Plains. In the latter, *A. Burchellii*, the edge of the hoof is narrow and sharp, the hinder part is flattish, and the centre is extended and concave; and in the former or true Zebra the edge and hinder part are thick and convex, and the centre deep and contracted. Figures of the hoofs of the two species are given in the plate above quoted, Figs. 2. and 3.

Asinus Zebra, the Zebra. White, with close narrowish black bands on the body, neck, and legs, and brown ones on the face; nose, bay; dorsal line indistinct from the others. Belly and inside of the thighs bandless. Tail blackish. Mane erect, thick, bushy, banded with white. Ears with two black bands and white tips. The Zebras live in troops, on hard dry herbs, and are incapable of being tamed unless they are taken very young. (Gray.)

Locality, Mountainous districts near the Cape (Burchell and others), Congo, Guinea, and Abyssinia (Ludolph).

Mr. Gray considers this species to be the *Equus montanus* of Mr. Burchell.

The Zebra.

HYBRIDS.

The offspring of the male Ass (*Asinus vulgaris*) and a Mare is a *Mule*, which has generally the form, in a great degree, of the dam, and the head, ears and tail of the sire. The Spanish mules are well known for their symmetry, sureness of foot, and unwearied activity, and are the produce of a breed of asses far beyond those of this country in stature, shape, and general appearance. The *Hinny*, which is the offspring of the Horse and the female Ass, is altogether inferior, and is less esteemed than the *Mule*. Hybrids have also been produced from the Horse and the Ass breeding with the Zebra or the Quagga. Two mules that belong to the Zoological Society are the offspring of the Ass and the Zebra. The earl of Morton bred a female hybrid from a fine male Quagga and a Mare of nearly pure (seven-eighths) Arabian blood.

It may be expected that we should here notice the question as to the power of reproduction in animals so bred between different species. Mr. Bell, in his 'British Quadrupeds,' has treated this subject in his usual luminous manner. After observing that the inquiry how far the power possessed by two animals of producing young on the one hand, or fertile young on the other, bears upon the generic or specific identity of the parents, is one of the greatest interest in the investigation of zoological relations, he proceeds thus:—'It has been supposed, and with very considerable probability, that the production of male and female progeny which are fertile *inter se* is to be considered in itself a positive proof that the parents are of the same species, how much soever they may differ in external form and appearance. It is well known that there are many instances of animals undoubtedly distinct producing young, which become fertile in conjunction with one or other of the parent kinds. This has been proved in the case of several species both of gallinaceous and natatorial birds in a domestic state; but there is not, I believe, on record a single instance of a male and female of such hybrid progeny being mutually fertile. On the other hand, the production of sterile hybrids between distinct species of the same group is a circumstance so commonly occurring, as to require only an allusion; and a reference to the present animal' (the *Mule*) 'is a sufficient illustration of the fact. But the power of reproduction even of such progeny is considered by some as indicative of a generic relation between the parent species, and has been urged as an argument against the separation of the Horse as a distinct genus from the Ass and its congoners. Before this observation however can be allowed to have any weight, it rests with the objectors to define the precise meaning and limits of a *genus*; and until this has been done, which has never yet been satisfactorily attempted, such an argument is a mere begging of the question. The Mule has been occasionally known to produce young with the Horse or the Ass: these cases are however extremely rare, and serve as illustrations of the statements which I have already made, as there is no instance on record of two Mules having bred together.' Mr. Bell notices the following fact, as one which must doubtless be placed to the account of this power of reproducing in the Mule. A small Mare was turned into a paddock in the Gardens of the Zoological Society of London (Regent's Park), in company with a male white Ass, and a male hybrid between the Zebra and the Ass. She had a foal which was distinctly marked with black stripes across the legs.

While upon this subject, we may as well advert to the curious point, that the characters of the male parent of the mother's first progeny show themselves in her subsequent offspring by other males, however different those males may be in form or colour. Mr. Bell observes that this truth has already been illustrated by him when treating on the Dog and on the Hog, and he adds that it receives a remarkable and interesting confirmation from the case of the Mare (belonging to the earl of Morton) quoted by him and above alluded to. In that case the Mare was young, and after producing the female hybrid by the Quagga, had first a Filly, and afterwards a Colt, by a fine black Arabian Horse. They both resembled the Quagga in the dark line along the back, the stripes across the forehead, and the bars across the legs: in the Filly the mane was short and stiff, like that of the Quagga; in the Colt it was long, but so stiff as to arch upwards and hang clear of the sides of the neck: in other respects they were nearly pure Arabian. This and other such cases should not be forgotten by breeders of animals, who are anxious about the perfection of their stock, and should make them particularly careful as to the male influence which first makes its impression on the female.

Fossil Equidæ.

Remains of *Equidæ* occur abundantly in the third period of the Tertiary series (Pliocene of Lyell), in the fresh-water deposits, in what is called diluvial detritus, in superficial gravels, sands, and clays, in the Ossiferous Caverns, in the osseous breccia, in the Epplesheim sand, &c. Bones of the horse occurred, but not abundantly, among the remains found by Captain Cautley lying on the slopes among the ruins of fallen cliffs, and partly in situ in the sandstone in the Sewalik Mountains at the southern foot of the Himalayas, between the Sutlej and the Ganges. Some species, which we shall proceed presently to enumerate, have been recorded, but we must not forget the opinion of one well qualified to judge on the point, that there are not sufficient data for specific distinctions. Cuvier informs us that he had carefully compared the skeletons of many varieties of horses, those of the Mule, the Ass, the Zebra, and the Quagga, and he never could find a character sufficiently fixed to enable him to pronounce on a species from an isolated bone. Size, he remarks, furnishes but incomplete means of distinction: horses and asses vary much in this particular, from their state of domestication; and he adds, that though he had not yet procured the skeleton of a Dshikketei, he doubted not its resemblance to that of the other species as much as they resembled each other in the same particular. He therefore seems to be borne out in his opinion that comparative anatomy cannot solve the question whether the horse whose remains are found in a fossil state resembled the horses of the present day. The fossil species recorded by authors are *Equus fossilis* (*Equus Adamiticus* of Schlotheim); *Equus* (*Caballus*) *primigenius; Equus* (*Mulus*) *primigenius; Equus* (*Asinus*) *primigenius.*

HORSE-CHESNUT, the Æsculus Hippocastanum of botanists; it is said to derive its name from the practice among the Turks of feeding their horses on the seeds of this tree.

HORSE-RADISH, the pungent root of the Cochlearia Armoracia of botanists.

HORSE-TAIL, a name given to weeds common in stiff ill-drained soil, belonging to the genus Equisetum.

HORSHAM. [Sussex.]

HORSLEY, SAMUEL (born 1733, died 1806), a distinguished prelate of the English church, successively bishop of St. David's, Rochester, and St. Asaph. He was the son of John Horsley (whose father was originally a non-conformist), who was for many years the clerk in orders at St. Martin's-in-the-Fields, and who held two rectories, Thorley in Hertfordshire, and Newington Butts in Surrey. The bishop was educated at Westminster School, from whence he passed to Trinity Hall, Cambridge, and had the rectory of Newington, which his father resigned to him soon after he had taken orders in 1759.

His more public career he may be said to have commenced in 1767, when he was elected a Fellow of the Royal Society, to which body he became the secretary in 1773. His earliest publications were certain small tracts on scientific subjects; but in 1776 he projected a complete and uniform edition of the philosophical works of Sir Isaac Newton. This design was not accomplished till 1784, when the fifth and last of the five quarto volumes made its appearance.

In the earlier years of his public life he found patrons in the earl of Aylesford, and in Lowth, bishop of London; but we pass over, as uninteresting and unimportant, the presentations to his various livings, and the dispensations which the number of his minor preferments rendered necessary. In 1781 he was appointed archdeacon of St. Alban's.

It was a little before the date last named that he first appeared in the field of theological controversy, in which he soon showed himself a very powerful combatant, powerful from the great extent of his knowledge and from the vigour of his intellect. The person against whom he chiefly directed his attack was Dr. Joseph Priestley, a minister among the Presbyterian dissenters, who in a series of publications defended with great subtilty and skill the doctrines of philosophical necessity, materialism, and Unitarianism. Dr. Horsley began his attack in 1778 on the question of Man's Free Agency; it was continued in a Charge delivered in 1783 to the Clergy of his Archdeaconry, in which he animadverts on many parts of Dr. Priestley's 'History of the Corruptions of Christianity.' This charge produced a reply from Dr. Priestley, which led to a rejoinder from Dr. Horsley in 'Seventeen Letters to Dr. Priestley,' a work which was regarded by the friends of the church as a most masterly defence of the orthodox faith, and as the secure foundation of a high and lasting theological reputation.

The tide of preferment now began to flow in upon him. Thurlow, who was then chancellor, presented him with a prebendal stall in the church of Gloucester, observing, as it is said, that 'those who defended the church, ought to be supported by the church;' and in 1788 he was made bishop of St. David's.

In parliament he distinguished himself by the very hearty support which he gave to the measures of Mr. Pitt's administration, and some of his declarations of political sentiment were thought by many persons to be as little in accordance with the true spirit of the English constitution as with the spirit of Christianity itself. But in judging on such a point as this, the circumstances of the times are to be considered; opinions as strong in another direction being by many persons promulgated, and a disposition manifested by some to act according to them. His political conduct however gained him the favour of the court; in 1793 he was translated to Rochester, and in 1802 to St. Asaph.

We have mentioned but a few of his published writings, which are very numerous. But a list, it is believed, complete, may be found in a work which is an immense storehouse of information respecting many of the distinguished persons of the last century,—'Literary Anecdotes of the Eighteenth Century,' by John Nichols, F.S.A., in six large volumes, published in 1812, with several volumes of supplementary matter.

HORTE'NSIUS, QUINTUS, born B.C. 114, of an equestrian Roman family, began to plead at a very early age, and he had already attained a great reputation in his profession when Cicero made his appearance in the Forum. From that time Cicero and Hortensius were considered as professional rivals, but they lived on friendly and even intimate terms with each other, as Cicero acknowledges in several of his writings. At the beginning of his book 'De Claris Oratoribus,' Cicero pays an eloquent and apparently sincere tribute of praise to the memory of Hortensius, who was then lately dead. He styles him his friend and adviser, who often assisted him in their common career, 'being not, as many imagined, a rival or detractor of his fame, but a fellow-labourer in a glorious vocation.' And yet in some of his letters (Epist. iii. of the 1st book *Ad Quintum Fratrem*) Cicero had bitterly complained of the duplicity and ungenerous conduct of Hortensius towards him when he was obliged to quit Rome in the Clodian business. Hortensius went through the regular career of public offices and honours; he was made in succession quæstor, ædile, prætor, and lastly consul, with Q. Cæcilius Metellus Creticus, B.C. 69. He appears to have acquired great wealth, which he spent liberally, and yet bequeathed an ample inheritance to his children. His villas at Tusculum, at Bauli, at Laurentum, and other places, are mentioned as splendid. He is charged by Cicero with having used bribery and other means to gain his causes, and to have received presents from his clients. Hortensius died B.C. 50, while Cicero was returning from his government of Cilicia (Epist. vi. of the 6th book *Ad Atticum; Brutus*, c. 64, 94); and Cicero considers it a continuation of the good fortune which had attended him through life, that he died just before the breaking out of the civil war, and was thus spared the grief of seeing the fall of the republic. The Orations of Hortensius which are mentioned by Cicero and Quintilian are lost, as well as his Annals, and some erotic poems which he is said to have written. Cicero (*Brutus*, c. 92, 95) has given his opinion of the character of Hortensius as an orator.

HORTICULTURE. [Gardening.]

HOSEA (הושע; 'Ωσηέ, LXX.), one of the twelve minor Hebrew prophets. We possess no particulars respecting the place of his birth, or his history; but it appears probable that he was a native of Samaria, since his prophecies relate principally to the ten tribes. We learn from the inscription of the book that he was the son of Beeri, and that he lived 'in the days of Uzziah, Jotham, Ahaz, and Hezekiah, kings of Judah, and in the days of Jeroboam the son of Joash, king of Israel.' The reign of Jeroboam II. lasted from B.C. 823 to 783; and that of Hezekiah began B.C. 726. It is therefore evident, if this inscription is correct, that Hosea could only have entered upon his prophetical duties in the latter part of the reign of Jeroboam; which supposition is also rendered probable by the tenor of his prophecies, which describe the kingdom of Israel as in a weak and divided state, and obliged to seek assistance from foreign powers; whereas in the book of Kings (xiv. 25—28) the affairs of tho kingdom of Israel are represented as in a very prosperous condition during the reign of Jeroboam II. But the prophecies of Hosea are quite in accordance with tho period of anarchy and foreign invasion which followed the death of Jeroboam II. (2 *Kings*, xv., xvi.) It is therefore probable that the prophecies of Hosea extended over a period of about 60 years (B.C. 784—724); and that he was contemporary with Isaiah, Micah, and Amos.

The principal object of the prophecies of Hosca is to reprove the people of Israel on account of their sins, and to denounce the divine judgments which awaited them if they continued disobedient. The book may be divided into two parts; in the first of which, the prophet, under the supposed infidelity of his wife, represents the spiritual infidelity of the children of Israel, and foretells the judgment of God against them, and at the same time promises that God would at some future period receive them again into his favour. (c. i.—iii.) In the second part, this symbolical representation is dropped; and the prophet foretells in express language that the country would be devastated by the Egyptiaus and Assyrians, and that the people would be carried away into captivity; and he concludes with an exhortation to repentance, and a promise that God 'would heal their backslidings, would love them freely, and would turn his anger away from them.' (c. iv.—xiv.)

'Tho style of Hosea,' Bishop Lowth remarks, 'exhibits the appearanco of very remote antiquity: it is pointed, energetic, and concise. It bears a distinguished mark of poetical composition, in that pristine brevity and condensation which is observable in the sentences, and which later writers have in some measure neglected. This peculiarity has not escaped the observation of Jerome, who remarks that this prophet is altogether laconic and sententious. (*Præf.* in xii. *Proph.*) But this very circumstance, which antiently was supposed to impart uncommon force and elegance, in the present state of Hebrew literature is productive of so much obscurity, that although the general subject of this writer is sufficiently obvious, he is the most difficult and perplexed of all the prophets.' (*Prælect.* xxi.) Compare also Bishop Horsley's remarks on tho style of Hosea, in the preface to his translation of this prophet. (p. xxix.—xliv.)

The canonical authority of the prophecies of Hosea has never been disputed. They are frequently quoted in the New Testament; compare Hos. vi. 6, with Matt. ix. 13, xii. 7; Hos. x. 8, with Luke xxiii. 30; Hos. xi. 1, with Matt. ii. 15; Hos. i. 10, ii. 23, with Rom. ix. 25, 26, and 1 Peter ii. 10; Hos. xiv. 2, with Hebr. xiii. 15. (The *Introductions* of Eichhorn, Jahn, De Wette, Augusti, and Horne; Pococke's *Commentary on the Prophecy of Hosea*, Oxf., 1685; Kuinoel's *Hoseæ Oracula, Hebraice et Latine*, Leip., 1792; Horsley's *Hosea, translated from the Hebrew, with notes explanatory and critical*, Lond., 1801, 1804; Stuck's *Hoseas Propheta*, Leip., 1828, a useful work.)

HOSIERY. The principal seat of the hosiery manufacture in England is in the three midland counties of Leicester, Nottingham, and Derby. In the first of these woollen hosiery forms the principal branch of the manufacture, while in Nottinghamshire the material chiefly used is cotton, and in Derbyshire silk goods are mostly made. It is computed that the number of persons engaged in the manufacture of hosiery in the three counties amounts to 35,000.

The stocking-frame, by means of which this manufacture is carried on, is, next to the common warp and weft loom, the oldest machine in existence applicable to textile fabrics. It was invented about the close of the sixteenth century by the Reverend William Lea, of St. John's College, Cambridge, but a considerable time elapsed before the produce of this frame took the place of the trunk-hose then worn by all who could afford such an article of dress. For this reason Mr. Lea settled at Rouen, in Normandy, where his manufacture was carried on under the patronage of Henri IV., but the assassination of the king and the political troubles brought on by that event caused the abandonment of Mr. Lea's establishment, and that gentleman shortly after died in a state of poverty at Paris.

From the time of its first invention the stocking-frame has not received any considerable improvement, but at this moment (July, 1838) stocking-frames with a rotatory action, and worked by steam-power, have been successfully brought into use at Nottingham, and bid fair to supersede altogether the use of the old reciprocating engine. The economy in the process of manufacture that will be thus effected is very great, and may be the means of securing to our manufacturers for some time longer the supply of foreign countries, a branch of trade which was fast leaving us.

The working of a rotatory machine impelled by steam-power, in which twelve fashioned stockings are made at the same time, will require the superintendence of only one man and a boy, whereas in the old frame but one stocking can be made at once by a single workman. The principal seat of the cotton hosiery manufacture abroad is at Chemnitz, in Saxony, where, owing to the low rate of wages as compared with the earnings of the weavers of Nottingham, goods are made, with yarns imported from Lancashire, at prices which have excluded English goods from third markets, and have even brought them into consumption in this country after paying a duty of 20 per cent. Notwithstanding this fact, the hosiery trade in England has been and continues in a fair state of prosperity, owing to the extension of the home market. More stockings are worn now than at any former period, their use having increased with the progress of general improvement.

The substitution of steam-power frames for the old hand frames may at first be productive of some distress to the present race of cotton stocking makers, only a part of whom will, for a time at least, be able to find employment in the rotatory frames; but it may be hoped that the great extension of demand which is always found to accompany a considerable cheapening of any manufacture will speedily remove this evil by causing employment for at least as many hands as may at first be disengaged. The cotton branch of the hosiery manufacture differs from the woollen and silk branches of that manufacture in the relative proportions of the cost of labour as compared with the cost of the material, and it therefore does not appear probable that the manufacturers of Leicestershire and Derbyshire have so much to apprehend from foreign rivalry as the Nottinghamshire stocking-weavers have encountered. In cotton hosiery the cost of labour constitutes from two-thirds to five-sixths of the value of the goods, while in woollen hosiery the labour does not exceed two-fifths of the value, and in silk goods the proportionate cost of labour is still much smaller.

It is not possible to furnish any statement of the quantity or value of the shipments of hosiery from this country, because the custom-house returns include with hosiery many articles of haberdashery, under the name of 'small wares.' The value of the shipments of cotton and woollen hosiery and small wares, in each of the ten years from 1828 to 1837, was as follows:—

	Cotton.	Woollen.
1828	£1,165,763	£201,216
1829	1,041,885	178,483
1830	1,175,153	242,505
1831	1,118,672	150,155
1832	1,175,003	136,655
1833	1,331,317	192,048
1834	1,175,219	168,128
1835	1,240,284	205,135
1836	1,328,525	237,598
1837	912,192	167,564

HOSPITAL (sometimes called simply *spital*, from the French *hôpital*), a place endowed for the reception of the sick or support of infirm persons. Hospitals intended merely for the relief of poor and indigent persons in England are peculiarly called *Alms-houses*. At an earlier date hospital signified a place of shelter or entertainment for travellers upon the road, more especially for pilgrims. Spensor, in the 'Fairy Queen,' uses the word in this sense:—

> 'They spy'd a goodly castle, placed
> Foreby a river in a pleasant dale,
> Which, chusing for that evening's *hospital*,
> They thither march'd.'

The Maison de Dieu at Dover, St. John's Hospital at Warwick, and some others, were expressly founded for the reception and entertainment of pilgrims and travellers.

Many of the charitable endowments in England are called hospitals, and are incorporated bodies, consisting of a master, brethren, and occasionally other members. Some of these foundations have also schools attached to them. As to the management of their revenues and their general superintendence, hospitals are on the same legal footing as other charities. [COLLEGE.]

HOSPITALLERS. Hospitaller, in its literal acceptation, means one residing in an hospital, in order to receive the poor or stranger; from the Latin *hospitalarius*, a word found only in the language of the lower age. The *Knights-Hospitallers* were an order of religious formerly settled in England, who took their name and origin from an hospital built at Jerusalem for the use of pilgrims going to the Holy Land, dedicated to St. John Baptist. The first business of these knights was to provide for such pilgrims at that hospital, and to protect them from injuries and insults upon the road. They were instituted about A.D. 1092, and were very much favoured by Godfrey of Bouillon and his successor Baldwin king of Jerusalem. They followed chiefly St. Austin's rule, and wore a black habit with a white cross upon it. They soon came into England, and had a house built for them in London A.D. 1100; and from a poor and mean beginning obtained so great wealth, honours, and exemptions, that their Superior here in England was the first lay-baron, and had a seat among the lords in parliament; and some of their privileges were extended even to their tenants.

There were also sisters of this order, of which one house only existed in England, at Buckland in Somersetshire.

Upon many of their manors and estates in the country the Knights Hospitallers placed small societies of their brethren, under the government of a commander. These were allowed proper maintenance out of the revenues under their care, and accounted for the remainder to the grand prior at London. Such societies were in consequence called Commanderies. What were commanderies with the Hospitallers were called Preceptories by the Templars, though the latter term was in use with both orders.

The Knights Hospitallers had several other designations. They were at first called Knights of St. John of Jerusalem; afterwards, from their fresh place of settlement, Knights of Rhodes; and after the loss of that island, A.D. 1522, Knights of Malta, from the island which had been bestowed upon them by the emperor Charles V. (Tanner, *Notit. Monast.*, edit. Nasmith, præf. p. xv.; Newcourt, *Repert. Eccles.*, vol. i., p. 530; ii., p. 199; Dugdale, *Monasticon Anglicanum*, new. edit., vol. vi., p. 786.)

HOSPODAR is the title of the persons sent by the Turkish sultan to govern Moldavia and Wallachia, the two provinces north of the Danube. These governors for a century past have been taken from the principal Greek families of the Fanar, such as Maurocordato, Soutzo, Caradja, Morousi, Callimachi, Ypsilanti, &c. These Hospodars or governors assumed the title of princes, and were addressed as 'Most Serene Highness.' They held in their respective capitals, Bucharest and Jassy, a numerous court, consisting chiefly of Fanariote Greeks, and were in fact almost absolute sovereigns during the time of their administration, which however might be shortened at the pleasure of the Porte, which often recalled them, and put them to death. At the time of the Greek revolution in 1821 the Hospodar of Moldavia, Prince Michael Soutzo, escaped into the Russian territory, and his relative the Hospodar or Prince of Wallachia was poisoned. For the present government of those two principalities, as agreed upon between Russia and Turkey, see MOLDAVIA and WALLACHIA.

HOTBED, a name given by gardeners to a heap of fresh stable litter in a state of formentation, upon which a glazed box is placed for the cultivation of certain plants requiring heat and moisture in greater quantity than those agents exist in the external air. Formerly hotbeds were more exclusively used for various purposes in horticulture than they now are. This is owing to the perfection to which other means of producing and applying artificial heat have now attained; but still, for the growth of cucumbers and melons, raising seeds of tender annuals, and of other plants, either culinary or ornamental, hotbeds continue to be advantageously employed, as they likewise are for the striking of cuttings.

Hotbeds may be formed of various substances, such as unrotten dung, tan, leaves, or a mixture of these with moist litter; in short, any substance capable of producing and retaining fermentation, and which will admit of being built up so as to support a frame with sashes. The substance however that is most generally used is fresh stable-dung; the preparation which it requires consists in its being thrown in a heap, and also watered, if it contain much dry litter; and as fermentation proceeds it should be turned two or three times, and mixed thoroughly in the process.

The situation in which hotbeds ought to be formed should be dry, open to the south, and well sheltered in every other direction, either by walls backed by high and close-growing trees, or by very close and lofty hedges. Such extensive shelter, though desirable, cannot always be obtained; but some mode should be employed to break the force of sweeping winds. The basis on which the bed is to be formed should be marked out from 4 to 6 inches each way beyond the dimensions of the frame intended to be placed upon it; and if faggots or a layer of brushwood be laid as a foundation, it will admit heat completely under when the bed requires the application of a *lining*, which is a quantity of fresh materials added to the outside, should a diminution of heat require a new supply. The bed is then built of successive layers of the prepared materials, each layer being beaten tolerably compact with the fork as it is laid on, to the height of 4 feet in front, and 4 feet 9 inches at the back: the sides and ends should be quite perpendicular. The top layer should be as free from litter as possible. When thus finished, the frame and lights are placed upon it, and as soon as the violence of the fermentation has diminished, mould is put in; and when the latter has acquired a proper temperature the plants are introduced. Instead of mould, rotten tan, or leaf mould, or sand, is spread over the surface of the bed, when pots containing seeds or cuttings are to be plunged.

As soon as the heat of the bed begins to decline, a *lining* of fresh materials must be applied. This however may be composed of substances that have not undergone any previous fermentation, and may consist of fresh stable-dung, merely shaken up as it is placed against the sides of the bed, or of grass mowings, or of leaves, or of a mixture of such substances.

A bed formed of well-prepared materials, and raised to the height above mentioned, will be sufficient for any purpose for which a strong bottom-heat is required; but a very mild bottom-heat is frequently all that is wanted. In this case the bed is made lower and more compactly beaten or trodden. Substances that ferment violently are likewise excluded from its composition.

It sometimes happens that, notwithstanding every precaution with regard to its formation, a hotbed will become too hot for plants or seeds that may have been placed above it. In this case the only remedy is to remove the plants until the hotbed has been remade, with the addition of some materials the fermentation of which is slower and less violent. Gardeners sometimes attempt to avoid the trouble of doing this by piercing the sides of the hotbed with holes for the egress of heat; but this is seldom an effectual remedy for the evil.

HOTCHPOT. (Law.) The word has been thus quaintly explained by Littleton:—'It seemeth that this word hotchpot is in English a pudding, for in a pudding is not commonly put one thing alone, but one thing with other things together.' The common law prescribed the rule, that where a daughter to whom lands had been given in frank marriage claimed a portion of the lands descending upon her together with her sisters from the father in fee simple, she should not take any share unless she mixed and blended the lands given to her in frank marriage with the descended estate, so that they might be equally divided among all the daughters. The rule is founded upon the same grounds as the Collatio bonorum of the civil law. (*Dig.* xxxvii. 6; *De Collationibus*.) The statute 22 and 23 Chas. II., c. 10, § 5 (the Statute of Distribution) provides, that in making distribution of the personal estate of intestates, advancements made by them in their lives to their children shall be brought into hotchpot. The like rule prevails by the custom of London, where the children of a deceased freeman are entitled to a third of his personal estate. (Co.-Litt., 176-177; 2 Bl. *Com.*)

HOTHOUSE, in horticulture, is a structure in which exotic plants are cultivated under circumstances approximating as closely as possible to those under which they naturally exist; or it is used for accelerating the production of flowers and fruits of either indigenous or exotic plants Hothouses appropriated to the latter purposes are very frequently termed *forcing-houses*.

In the beginning of the seventeenth century that description of hothouse generally termed the *greenhouse* began to be constructed in Germany; and one in the Apothecaries' Garden at Chelsea is mentioned by Ray in 1684. These, like many others of later construction, had glass only in the front, which was perpendicular; and the mode of applying artificial heat exhibited little more knowledge of means for the end than the remains of flues found in the ruins of the dwelling-houses and baths of the Romans.

In 1724, when Switzer published his treatise entitled 'The Practical Fruit Gardener,' the principles of managing hothouses were still very imperfectly understood; for he observes, p. 305, that 'Peaches, nectarines, and apricots don't love to be forc'd; at least the fruit is very seldom good: there being much occasion to keep the glasses close, the fruit is always rendered flat and insipid. This is not pure speculation, but the result of the practice that I have observed in the glass houses at Brompton Park.'

Considerable alterations, particularly in houses for grapes, were made towards the end of the last century. The most material improvement was the substitution of a slanting glass roof for a perpendicular glass front; but the advantages of this were much diminished by the heaviness of the sashes, and the large quantity of opaque matter which it was thought necessary to employ in order to ensure the durability of such structures.

In the present century great advances have been made in hothouse building, and more particularly since 1815. The application of heat by steam or hot water, and the admission of a greater quantity of light by glazing on metallic bars instead of wooden sashes, are the principal features of these improvements.

The principles by which the construction of hothouses must be governed have reference to the three great agents in vegetation—*heat*, *moisture*, and *light*.

With regard to *heat*, the building must provide for a sufficient amount to raise the internal temperature of the house, from that of the lowest degree of external air that occurs in this climate, to that of the highest which prevails for any length of time in the countries of which the plants intended to be introduced are natives. This rule is unexceptionable as far as plants strictly tropical are concerned; a slight relaxation may be allowed in some cases with regard to plants of temperate climates, such as, for instance, the vine when it is only intended to be forced late in the season, after the severity of the winter is over. With regard however to vineries intended for early forcing, the extremes of temperature should always be made the data for calculating the extent of the requisite heating power. The consequences of too limited a heating power will, in many instances, be exhibited for several years. Vines in a forcing state were so affected by the extreme cold of one night in January, 1838, that the crop was not only lost, but the vines themselves so much injured as not to be worth preservation. This shows the necessity of always providing for extreme cases, since a deficiency of heat for only a few hours may occasion an injury that cannot be remedied in as many years.

Moisture is of very great importance, and a due proportion of it is frequently more difficult to maintain in the atmosphere of the house than heat, and more so by some modes of heating than by others. It therefore follows, that as all applications of fire-heat have a tendency to produce too great a degree of dryness, that mode is the best for the growth of plants which allows the greatest quantity of vapour to remain uncondensed in the atmosphere of the house.

Some tribes of exotic plants, natives of the torrid zone, are adapted for existing under a very dry atmosphere. Instead of developing a thin expanded foliage, they form thick succulent masses, which no degree of atmospheric dryness seems to injure. Plants of such a nature of course require a *dry stove;* and a period of extreme dryness is perhaps as necessary for their future vigorous development as the cold of winter is to the deciduous trees of the north. But with regard to the generality of plants from tropical regions, a very different atmosphere is necessary. Within the tropics, the dryness of the air seldom exceeds 10° of Daniell's hygrometer; whereas, in the neighbourhood of London, between 20° and 30° are frequently indicated during the day. In tropical countries the air is saturated with moisture during the night, or at least it is but very rarely otherwise in the open air. But if due precautions be not taken, and temperature only is attended to, without regard to moisture, a degree of dryness will prevail at *night* in hothouses, which is double that of the tropic during the *day*. Artificial heat having therefore this excessive desiccating tendency, the necessity becomes obvious of adopting such modes of construction and heating as will afford the best means not only of supplying but of maintaining moisture; for vapour may be raised till the air of the house is at the point of saturation, and yet causes may operate so as to occasion a speedy condensation and a consequent dryness.

Light cannot be admitted too freely into hothouses. This will appear evident from the circumstance of the most transparent medium that can be used reflecting a great proportion of the sun's rays when they impinge obliquely on its surface. According to Bouguer's *Table of Rays reflected from Glass*, when the angle of incidence is 85° as much as 54 per cent. of the sun's rays are reflected; and at angles of incidence of

80°,	70°,	60°,	50°,	40°,	30°,	20°,	10°,	1°
41,	22,	11,	5,	3,	2,	2,	2,	2

per cent. are reflected, omitting fractions.

Besides this, in wooden roofs, even although of good construction, 22 per cent. of the rays of light are obstructed by the rafters, &c. In iron roofs the obstruction is reduced to 7 or 8 per cent. In the case of a house fronting due south, the rays of the sun at 6 A.M. will run parallel with the roof; at 7 A.M. 30 per cent. of the rays will be reflected from the glass alone, independent of the quantity from other causes. At 8 A.M. 10, and at 9 A.M. about 4 per cent. will be reflected. From this time till 3 P.M. the proportion reflected will be only from 2 to 4 per cent. If we therefore take from 6 A.M. to 6 P.M., a length of time from which the tropical days never differ much, we may calculate the loss of rays to be from

Reflection of glass, say on an average	10 per cent.
Obstruction from rafters (iron) .	8 „
Ditto from glazing laps . .	5 „
	23 per cent.

But if wooden rafters are employed, 15 per cent. additional must be added, making in this case a loss of 38 per cent. In old and heavily constructed houses, it certainly would not be too much to state the loss of rays at 50 per cent.; and under this privation of light it is not surprising if the plants are found to exhibit a yellow sickly foliage.

The above calculation of the reflection of rays is made on the supposition that the *pitch* or elevation of the roof forms an angle with the horizon corresponding with the latitude of the place, say for London 51½°, or forming an angle with the back wall equal to the complement of the latitude, or 38½°. The period of the season is that of the spring or autumn equinox. A plane elevated to the above angle would have the sun's meridian rays more nearly perpendicular throughout the year than could be the case with any other elevation. This however is not the most eligible angle of elevation, except perhaps in the case of a very early forcing vinery or peach-house, where the direct rays of the sun are more especially required at an early period of the season. The principal objection to this elevation is, that it occasions the house to be built too high in proportion to its width; and the heat accumulates in the upper angle where it is least wanted; in short, the higher the back wall, the colder is the air of the house at its base, and the warmer at the top, compared with the mean temperature throughout the house. It will therefore be proper to inquire how far the above elevation may be deviated from without greatly affecting the transmission of light. If the slope of the roof were lowered so as to form an angle of 20° with the horizon, the loss from reflected rays at noon would average about 3 per cent.; but in the morning and afternoon the loss would be considerably greater, more especially in the winter season; and it is of course proportionally less in summer So far therefore as light is concerned, any angle may be chosen that is found in other respects the most convenient between 20° and 50°. Pine pits and frames are even lower than 20°; but with reference to the supply of light, as well as the descent of the rain, it is not advisable to have the roof flatter than 20°.

Although the necessity of admitting as much light as possible is now generally acknowledged, and although in cloudy weather great advantage will be derived from a roof rendered as transparent as possible, yet the generality of tropical plants do not thrive in bright sunny weather when placed near the glass of a hothouse in this climate; and the necessity of a screen of netting will appear obvious from the effects of solar radiation observed in the tropics as compared with, what is rather surprising, the still greater energy of the same in this country. In the tropics, a thermometer covered with black wool, and consequently prepared to receive the full effects of the sun's rays, does not rise higher than one so exposed in this climate frequently does, notwithstanding the greater general coldness of the air. It is not uncommon in the neighbourhood of London for a thermometer placed in the sun to rise 50° Fah. above one in the shade. At Cumana, Humboldt never found the sun's rays to have the effect of raising the thermometer more than 6° or 7°. Nearer the pole, the energy of the solar rays appears to be still greater than in this climate. Between lat. 80° and 81°, Captain Scoresby states that the thermometer was 18° below freezing on one side of the ship, whilst on the other the pitch was heated to a temperature of 90° or 100°. This is a greater radiating effect than has perhaps ever been observed in this climate, and certainly unequalled in the tropics. The body of the atmosphere surrounding the earth is supposed to have the form of an oblate spheroid, flattened at the poles and elevated at the equator. Indeed if this were not the case, as it is found to be considerably denser at the poles than at the equator, a different barometrical indication would be the consequence; but at the level of the sea this is everywhere the same. This difference in density may have some effect in weakening the sun's rays, but probably not so much as the circumstance of the atmosphere having a much greater capacity for moisture at the equator than at the poles. At the equator more moisture is required to produce saturation, and at the same time the process of evaporation is so powerful that the atmosphere is maintained on an average much nearer the point of saturation than it is at the poles. These circumstances doubtless contribute greatly to temper the solar rays.

Plants from a great elevation, from within the tropics as well as elsewhere, appear to require less shade than those from the level of the sea. The rays of the sun have been ascertained to be more powerful at 4000 feet above the level of the sea on the mountains of Jamaica than at Port Royal. Hence the potatoe, a native of the high table-land of South America, will not thrive under glass unless placed very near it; and if placed at a distance from it at which the pine-apple, a native of the same country, but near the shore, will grow robust, the potatoe will become pale and languid.

These facts are too important to be omitted in explaining the principles by which the construction of hothouses ought to be regulated, and it will be found that those houses are the most perfectly suited to the cultivation of plants in which such principles have been most considered.

With regard to the means of supplying artificial heat, the old system of using brick flues is now rapidly being superseded by that of hot water. Brick flues occupy a large space; and are also liable to crack and emit sulphureous effluvia to such an extent that the crops of early forcing fruits have often been entirely destroyed. These objections do not spply to hot-water pipes. When once fitted up they require no repairs for many years; whereas the brick flues must be frequently broken up in order to clear out the soot. By hot water the distribution of heat can also be better regulated, and the uniformity of temperature better maintained than by any other known means. The methods of heating by hot water are various. The oldest and perhaps the best for small houses is extremely simple, consisting of a boiler, and, at the further end of the house, a cistern on a level with the boiler. A pipe proceeding from near the top of the boiler, and communicating with the cistern at the same level, conveys the heated water slowly from the former to the latter. Another pipe, situated lower than the preceding, conducts the colder and consequently denser portion of the water from the cistern to the boiler. This is frequently called the return-pipe. A circulation is thus established in consequence of the hottest and therefore the lightest portion of the water ascending, and displacing the colder in the upper pipe, which from its greater density tends to subside at the lowest level, which is in the lower or return pipe. Here it would remain stationary, but the pipe communicating with the water in the boiler, a few inches above the bottom of the latter, and the rarefied water in the boiler being unequal to the balancing of the colder and consequently denser portion in the return-pipe, a continual ingress from the latter takes place into the boiler

This extremely simple form of the hot-water system has received various modifications. Circulation has been obtained on the siphon principle, the pipes being elevated above the level of the boiler, and a vacuum being formed in them by pumping out or otherwise displacing the air, which is replaced by the water, so that a greater descent is afforded for the water in the return-pipe. Instead of large pipes, of about four inches in diameter, a number of small pipes hermetically closed have also been employed, and coils of such pipes have been enclosed in a furnace instead of a boiler; a large extent of radiating surface is thus made to enclose a comparatively small quantity of water. As the water becomes heated, a degree of pressure corresponding with its expansion takes place; this however requires to be regulated by an expansion tube to prevent explosion. Steam forced through pipes has also been extensively used as a heating agent. Such modes undoubtedly afford the means of raising the temperature more rapidly, and their application in some cases may be attended with advantage; but as the cooling, if the fuel is not supplied regularly, takes place in the same ratio of rapidity, it becomes a question whether a mode that produces a slow and lasting heat, or one that is rapid in its production and decline, is to be preferred. In order to solve this, it becomes necessary to take into consideration the progressive amount of heat which is required in hothouses relative to time. At noon, or soon after, the natural temperature of this climate is generally at the highest, and the temperature of the hothouse should also then be higher than at any other time of the day or night. The external temperature declines gradually till three or four A.M., when it reaches its minimum, of perhaps 50° below the noon temperature. The hothouse temperature should in like manner gradually decline, but only to the extent of between 5° and 10°. It is therefore evident that artificial heat must be increased, if well applied, so as exactly to make up the deficiency; and it should by no means be allowed to have any more than one rise and fall in the course of twenty-four hours. By a rapidly heating apparatus, this is next to impossible; and independently of all other inconveniences, sudden changes of temperature are sure to affect the hygrometrical state of the air in the house, causing condensation and consequent dryness. A slow but effective and lasting heating power is therefore preferable.

Only a very few modifications of the plan of heating by hot water require to be adverted to in this place. Instead of the pipes running quite horizontally from the boiler to the cistern, they may be slightly elevated towards the latter, which has the effect of conveying a greater proportion of the heat to the part of the house which is most remote from the boiler. The boiler must be so constructed and placed as to admit of the water contained in it being a little higher than the most elevated portion of the upper pipe. Flat pipes are sometimes employed as upper ones. As their transverse section is a parallelogram, and as a circle contains more space than any other figure of equal perimeter, these flat pipes contain less water in proportion to their surface, and consequently the water in them is sooner heated to its maximum; but this, as previously shown, is no advantage, if in fact it be not a disadvantage, since it cools so much sooner.

With regard to a supply of moisture, the above hot-water system, in which the pipes are level, or nearly so, presents several advantages over other methods of heating. Troughs can be arranged along the whole length of the pipe, which, when filled with water, will produce a gentle but constant evaporation. Besides the supply from this source a large quantity of steam may be safely introduced from the boiler, provided the violence of its ingress be a little broken by a perforated sheet of metal, or any similar contrivance. Another source of moisture is supplied by the reservoir, which, with moisture from the soil in which the plants are grown, and from the wetted floors, ought to keep the atmosphere of the house sufficiently moist during the night. The elasticity however of the vapour will be very great, particularly in cold nights when much fire-heat is required; and in such a state of the weather the condensation from the coldness of the glass will be increased. The atmosphere of the house is not only deprived of its moisture by this process, but a serious loss of heat by radiation from the glass takes place at the same time. This loss of heat and transmutation of moisture resulting from the radiation of the glass, although little attended to, demands the most serious care. It admits of no remedy but the interposition of some medium between the glass and cold sky; and such substances as are the worst conductors of caloric, and which will also keep the glass dry, are of course the best. A woollen net mounted on a roller with pulleys attached, would have a very beneficial effect if closely covered by light wooden shutters or a tarpaulin. And as it has been proved that the rays of the sun are frequently too powerful for hothouse vegetation, the netting would likewise be occasionally very useful as a shade; and with this provision the roof cannot be made too transparent, as previously stated.

It has been shown that iron roofs occasion an obstruction of light to the extent of only one-third of that which takes place when wood is employed. The iron roofs are therefore preferable, although, apart from the greater original expense, there are still some objections to them. Formerly the chief objection was the breakage of glass likely to result from the expansion of the metal; but the severity of the frost in 1838 has proved that this objection was groundless; for very little breakage occurred in the iron roofs compared with what took place in wooden ones; and it may be fairly asserted that none whatever was broken from contraction of the metal: nor can any breakage take place from its expansion if the glazing is performed in summer, or the glass cut so as to fit in with ease, or the panes made one-thousandth part of an inch less than the bed between the rebates of the bars in which they are placed. The principal remaining objection is that of the rapid abduction of heat. Plants never do thrive so well in the proximity of iron as in that of wood, and this is probably owing to the wood being a slower conductor of caloric. Supposing a bar of iron is heated to 100° by the sun's rays, and then syringed with water, it will instantly become very cold in consequence of evaporation; and if any plant be in contact with it, or nearly so, the juices will experience a chill. In many instances therefore where plants require to be close to the glass, such as in propagating houses and pits, wood is certainly preferable to iron. Again, when a wide and also lofty house is to be glazed iron is more proper; for besides the quantity of rays lost by reflection of glass and obstruction from rafters, those that do pass into the interior are so weakened, that when they reach vegetation remote from the glass they do not appear to be effective in performing the requisite functions in a perfect manner; but of course better when the roof is of iron than when wood is employed.

Various modes of ventilation are in use. One which was considered a great improvement has not been found to be so, namely, the having ventilators in front at the lower angle, and corresponding ones in the back wall near the top inside, communicating with the external air by means of openings in the south side of the parapet. Sometimes this mode appears to have little effect, and the temperature ascends too high, till the movement of a slight breeze outside causes instantly a rush of cold air. Ventilation should be so contrived as to be sufficiently effective in preventing excess of heat; but at the same time it should be perfectly at command, so that it may be employed when requisite in the most limited degree. No method should be finally adopted until it is put to the test by trying whether, under any agitation of the external air, a candle will burn steadily inside if placed near the apertures by which the air is admitted.

In all forcing-houses tanks should be placed for supplying water of a temperature more suitable to the nature of the vegetation than that from a pump out of doors. Nothing can be more injurious than cold water applied to the roots and tops of tropical plants, or others in a forcing state, under a high temperature. The rain and dews which supply the plants of warm climates cannot be much below the mean temperature of the climate; and if only equal to the minimum, still it would be between 20° and 30° above that of spring-water in Britain.

To these general remarks upon the principles of constructing hothouses, a few observations of detail require to be added. Greenhouses and conservatories are commonly included in the appellation of hothouse. The only difference between them is, that fires are seldom used in the greenhouse unless in very severe weather, while the hothouse is constantly kept at a high temperature; but so far as the building is concerned they may be considered as the same. A greenhouse is for keeping and growing the plants of temperate countries; while a hothouse is used for forcing fruits, or for growing plants which are indigenous to tropical regions. Hothouses may be classed under four different heads, namely, the *dry stove*, the *damp stove*, the *bark stove*, and the *forcing-house*.

The *dry stove*, as the name implies, is used for the cultivation of plants which do not require much water; such as the different species of Cacti, some Euphorbias, and other Succulents of like habits. The management of such a house is very simple. The temperature during the winter months should never exceed 55° of Fahr. No water should ever be given at that period, unless the plants show signs of suffering from want of it; indeed very little water should be given at any season, excepting when the plants are growing. In spring, or early in summer, most of the plants will show an inclination for growth, and then they may be watered about twice a week, but this must be done with great caution, otherwise they are very apt to rot. During summer fires may be discontinued, and plenty of air given in fine weather. The plants will probably get covered with dust and will be unsightly; in this case they may be syringed, but caution must be used in doing this, especially with melon-shaped Cacti, as the water lodges in their hollow tops, and eventually destroys them, if allowed to remain.

The *damp stove* requires treatment of an opposite description. Instead of being kept dry like the last, its atmosphere should be always excessively humid, except in the winter season, when the sky is generally cloudy, and the sun's rays weak. Various methods are adopted to keep the atmosphere in this saturated state. When the house is heated with common smoke flues, the most simple way is to throw water frequently upon them, and also upon the passages and other places, from which it will evaporate, and surround the plants with a moist atmosphere. Sometimes a channel is formed with cement, upon the upper surface of the flue, which keeps the water from running off. This is a very excellent plan, as it may be so made that it will hold a considerable quantity of water, which will be continually evaporating, and serve the same purpose as that of a person frequently throwing water upon it. When the house is heated with hot-water or steam-pipes, it is a good plan to get small ridges cast upon the sides of the pipes, if they are flat, or, if they are round, small cisterns made of lead or zinc will answer the purpose, which can be used in the same manner, and will have the same effect as the channel upon the smoke flue. With the exception of a few months in winter, the damp stove must be regularly syringed twice every day. This is indispensable to the health and vigorous growth of the plants, and also necessary in order to keep down insects. The quantity of water which the plants in this house will require depends entirely upon the state of the weather and their own growth; in winter they will need little, as spring advances they may be watered more freely, and in the summer season they will all require to be watered twice and some of them three times a-day; of course those which are growing vigorously will require the most. It is a very bad plan, although one which is too often practised, to water almost at random, giving all the plants almost an equal share, regardless of their different capacities. Some will require a very abundant and constant supply, others will almost live upon the atmospheric moisture that surrounds them. Another thing to be attended to in the treatment of this stove is the placing of the plants. Most of the kinds grow very freely, and if they have not plenty of room they will very soon get crowded, and instead of growing bushy and handsome, the result will be an unsightly specimen, with a long bare stem and a few leaves upon its top. To prevent this they must be regularly looked over, tied up, and kept clear of each other; elevating some, depressing others, and giving the whole not only enough of room but also a natural appearance. The temperature of this stove, like that of the dry-stove, should not be the same at all seasons; in winter, when the plants are in a torpid state, 55° or 60° of Fahr. is quite warm enough; when vegetation begins to take place, as spring advances, it may then be gradually raised to 70°; and during fine weather, in the middle of summer, fires may be discontinued for about three months; but this must depend entirely upon the weather. The thermometer should never be allowed to sink lower than 60°.

The *Bark-stove*, when it is of large dimensions, consists of a pit in the middle of the house, surrounded by a brick wall, leaving as much room round the sides as will form a passage to walk in. This pit is generally from four to six feet in depth, one-half below and the other half above the level of the floor of the house; but this depends chiefly upon the height of the roof and the object in view. In smaller houses no space is left for a passage, and the inside is entirely occupied by the pit. The pit is filled with bark (commonly called tan, from its having been used previously by the tanners), and after being allowed to sink a little and ferment, the pots containing the plants are plunged more or less deep as prudence may suggest. It is dangerous to plunge the pots too deep at first, before the heat of the bed is fully ascertained, because in that case the roots are very liable to be burned; the better way is to plunge the pots only about one-third at first, and deeper afterwards. Sometimes leaves are mixed with the tan; the reason being that they are in some parts of the country more easily procured. When the heat begins to decay, the bed must be turned over and a little fresh tan added; and whenever a new bed is made, a little of the old tan should always be mixed with the new. This stove is heated independently of the bark, of which the principal use is to warm the roots of the plants. A bark bed is found useful in the cultivation of all those kinds of plants which are grown in the damp stove; orchidaceous plants, for example, succeed admirably in this way. The treatment of it, so far as the temperature, watering, and syringing are concerned, is precisely the same as is recommended for the damp stove.

What are called *Palm-houses*, *Musa-houses*, *Orchidaceous-houses*, &c., are merely damp stoves of different dimensions, for the cultivation of those different subjects.

The only other hothouse distinct from those already noticed is the forcing-house. The treatment which this requires is essentially different from any which has been described, the object being not merely to grow the plants, or to make them produce flowers, but to obtain fruit, and that too at particular seasons. [FORCING.]

Hothouse plants are peculiarly liable to the attacks of insects, and unless carefully and constantly attended to, these little depredators do a vast deal of mischief. The most common kinds are the *Green-fly*, *Thrips*, *Red-spider*, *Brown-scale*, and *Mealy-bug*. The first of these is easily conquered by fumigating the house with tobacco, or syringing the plants with an infusion of the same substance. The best remedy for the thrips and red-spider is to syringe well, and keep the house very moist and warm, as those insects cannot live in excessive moisture; a little of the flowers of sulphur shaken upon the leaves will also destroy them. The brown-scale and mealy-bug are the worst of all that infest plants in hothouses. Bruised laurel leaves strewed upon the passages and other parts of the house are said to destroy them, but these must be used with great caution, as they may not only kill the insects, but the plants themselves. Various other substances are said to destroy them, but, after all, the best and surest remedy is to wash them off. This is perhaps rather difficult where these little intruders are numerous, but after the plants are once clean, it is an easy matter, with a little attention and diligence, to keep them so.

HOTMAN, FRANÇOIS, called also by his Latinized name HOTOMANUS, was born at Paris in 1524, of a family originally from Silesia. He studied law in the university of Orleans, and afterwards practised at the bar. About 1547 he embraced the Reformed religion, in consequence, it was said, of seeing the constancy with which Anne du Bourg, a counsellor to the parliament of Paris, supported the ignominious death to which he was condemned on account of his religion. [HÔPITAL, DE L'.] His father having, in consequence of his change of religion, refused him his support, Hotman repaired to Switzerland, where he taught humanities in the college of Lausanne. In 1550 he was appointed professor of law at Strasburg. He afterwards returned to France under the protection of the king of Navarre, and became professor of law first at Valence, and then at Bourges, from which last place he ran away after having concealed himself during the massacre of St. Barthélémi, and repaired to Geneva, and then to Basel, where he died in 1590. A collection of his works, in 3 vols. fol., was published at Geneva in 1599. His principal works are:—1. 'Commentarius de Verbis Juris, Antiquitatum Romanarum Elementis amplificatus; 2. 'Commentarius in Quatuor Institutionum Juris Civilis Libros;' 3. 'Commentatio Tripartita ad Libros Feudorum;' 4. 'De Jure Regni Galliæ Libri III.;' 5. 'Disputationum Juris Civilis Volumen unum;' 6. 'Antiquitatum Romanarum Libri Tres;' 7. 'Commentarius in Orationes M. T. Ciceronis, eas maxime quæ aliquam Juris Quæstionem continent;' 8. Commentarius in Epistolam Ciceronis ad Quintum Fratrem de Provincia bene administranda;' 9. 'Consolatio e Sacris Literis;' 10. 'Ad Remundum Rufum Defensorem Romanorum Pontificum contra Carolum Molinæum de Statu Primitivæ Ecclesiæ liber;' 11. 'Franco Gallia,' in which he contended that France was an elective and not an hereditary kingdom; 12. 'De Furoribus Gallicis and de Cædo Admiralis; 13. 'L'Anti-Tribonien, ou Discours sur l'Etude des Lois, which he wrote at the request of the Chancellor De l'Hôpital. A biography of Hotman is prefixed to the collection of his Latin Epistles, 4to., Amsterdam, 1700.

HOTTENTOTS. [CAPE OF GOOD HOPE.]

HOTTINGER, JOHN HENRY, born at Zürich in 1620, after studying in his native country repaired to Leyden in 1639, where Golius the Orientalist engaged him as his assistant. Hottinger learned the Arabic and Turkish languages under a native of Marocco, and gradually became a distinguished Oriental scholar. He made his Oriental studies subservient to his principal object, that of illustrating the Hebrew text of the Bible. He was appointed Professor of Scriptural Theology at Zürich, and in 1655 the Elector Palatine induced him to come to Heidelberg, to fill the chair of Oriental languages. He was afterwards made Rector of that University, which flourished greatly under his administration. Being recalled to Zürich in 1661, he was employed by the government of his country in several important affairs. In 1667 the university of Leyden offered him the chair of theology, which he accepted, but while on the point of repairing to his destination he was drowned by the upsetting of a boat in the river Limmat. Hottinger left numerous works, chiefly on Oriental learning, the principal of which are:—1, 'Historia Orientalis,' which contains dissertations on the religion of the Sabæi, Nabathæi, and other antient Arabic tribes; on the genealogy and history of Mohammed; on the various names of Saracens, Agareni, Ishmaelites, &c., given to his followers; on the condition of the Eastern Christians and Jews at the time of Mohammed; on the causes which have tended to maintain and to spread Mohammedanism; on the schisms and heresies among the Mussulmans, &c.; 2, 'Etymologicum Orientale,' being a Lexicon of seven languages, Hebrew, Chaldaic, Syriac, Samaritan, Arabic, Ethiopic, and Thalmudico-Rabbinic; 3, 'Promptuarium, sive Bibliotheca Orientalis,' being a catalogue of works in those languages. Hottinger had begun a work on the history of Mohammedanism on a large scale, which he styled 'Theatrum Mohammedicum,' of which however he only published a 'Compendium' to which he added a 'Topographia Ecclesiastica Orientalis,' and also a 'Compendium Theologiæ Christianæ Ecclesiarum Orientalium.' He also wrote 'Historia Ecclesiastica Novi Testamenti,' 9 vols. 8vo., 1667. His son John James Hottinger, professor of theology at Zürich, wrote an 'Ecclesiastical History of Switzerland.'

HOT-WALL. Hot or flued walls are constructed in cold countries, for the purpose of affording warmth to trees placed against them, so as to counteract the effects of frost in autumn, when the wood and buds are maturing, and in spring, when the blossoms and leaves are unfolding. If hot-walls are used for these purposes only, they are productive of great benefit to the plants which they shelter; but if, as often happens, in addition to this it is attempted by their aid to advance the ripening of fruit in any considerable degree, hot-walls are of very doubtful service. This uncertainty of success arises from the exposed condition of the surface of the wall, and the consequent liability of the heat to be dispersed as rapidly as it is generated, either in consequence of wet causing evaporation, by which the bricks themselves are cooled, or by cold sweeping winds, which prevent any accumulation of warm air from being formed. In mild weather, a hot-wall with a south aspect will forward vegetation very considerably; but in proportion to the extraordinary excitement, so will be the check from subsequent chilling blasts which this variable climate is so subject to in the early part of the season. Besides the dissipation of heat on the south side, an equal, if not a greater portion, is radiated from the north side of the wall, where it may be said to be entirely lost. It is therefore evident that where-ever coals are expensive, hot-walls are not to be recommended, except for the sole purpose of rendering a little assistance towards ripening the wood in autumn, and warding off the effects of frosty nights in spring.

One furnace is allowed for heating about 40 feet of wall, that is, 20 feet on each side of the place where the fire is situated. The flues on either side are made to take four courses, or two returns; the first course being a little above the surface of the ground, and the upper 1½ or 2 feet below the coping. An improvement consists in admitting, by means of a register, a portion of the heat directly from the furnace into the second course of flues. A thick double woollen netting ought to be provided for the protection of the plants on the wall, and so attached to rollers as to be easily rolled up in fine weather, and let down at night. This, with a close-fitting wooden coping, projecting at least 12 inches, will, in a great measure, obstruct the radiation of heat. By such means very excellent crops of cherries have been obtained at an early period of the season; and as this species of fruit is precarious to force in a hothouse, a portion of a hot-wall where the trees are planted permanently may be very properly set apart for such an object.

Instead of flues, hot-water pipes might be introduced into the cavity of a common hollow wall, a little above the level of the border. One range of 4-inch pipe would be sufficient for at least 200 feet of wall, the boiler being placed at the back of the wall, and having an upper and lower pipe extending 100 feet each way. If, as sometimes happens, a glass case is erected in front of a hot-wall, a hot-water pipe should be made to pass along in front of the trees, about two feet from the wall, and the return-pipe only might be placed in the cavity of the wall. A great saving of fuel would be the consequence of such an arrangement.

HOUBIGANT, CHARLES FRANCIS, a priest of the Oratory, and an eminent Biblical scholar, was born at Paris in 1686. He was distinguished in early life by his great attainments, and lectured successively on the belles-lettres at Juilly, on rhetoric at Marseille, and on philosophy at Soissons. He afterwards removed to Paris, where his devotion to study and the duties of his profession produced a serious illness, which terminated in total deafness. Being thus incapacitated for public duty, he devoted all his time to study, and directed his principal attention to the study of the Hebrew language, in which he followed the system of Masclef, who was a strenuous opponent of vowel points. In 1732 Houbigant published his 'Racines Hébraïques;' and in 1746, his 'Prolegomena' to a new edition of the Hebrew Bible, in which he attempted to show that numerous errors had been introduced into the text. His great work, entitled 'Biblia Hebraica cum Notis Criticis et Versione Latina ad Notas Criticas facta,' appeared at Paris in 1753, in 4 vols. fol.; each page is printed in two parallel columns, one of which contains the Hebrew text, and the other the Latin translation. The Hebrew text is that of Van der Hooght's without points; and in the margin of the Pentateuch the various readings of the Samaritan Pentateuch are given. The notes and emendations of the text are printed at the end of each volume. Those who wish for further information concerning the critical value of this work may consult Bishop Marsh's 'Divinity Lectures,' part ii., pp. 101-104. The critical notes and prolegomena were reprinted at Frankfort, 2 vols. 4to., 1777; and the Latin version, which is usually considered very elegant and correct, at Paris, 5 vols. 8vo., 1753. Houbigant learned the English language late in life, and translated into French Sherlock's 'Sermons,' Lesley's 'Short Method against the Deists,' and Forbes's 'Thoughts on Natural Religion.' Houbigant died on the 31st of October, 1783, in the 97th year of his age. An account of Houbigant's life, together with a list of his works, is given by Adry in the 'Magasin Encyclopédique,' May, 1806.

HOUND (from the German *Hund*), a name generally applied in the British Islands to those varieties of the dog which are employed in hunting the *Deer*, the *Fox*, the *Hare*, and the *Otter*, by scent. The hound employed for following depredators, and used so much in the old Border times, was called a Blood-hound. [BLOOD-HOUND.] The Greyhound, which follows its four-footed game by the eye [GREYHOUND], is not a hound in the proper acceptation of the term adopted by sportsmen; for that appellation is confined to those varieties of the dog which are trained to that species of chace called *hunting*, which implies that the dogs so employed follow their four-footed game by the scent principally.

In addition to the *Blood-hound*,—the *Stag-hound*, the old *Southern Hound*, the *Fox-hound*, the *Harrier* [HARRIER], and the *Beagle* [BEAGLE], were the hounds of greatest note. Some of these varieties, the old Southern Hound for instance, which was slow but very sure, and with a fine deep-toned voice when it gave tongue in earnest, are gradually disappearing; and indeed the pace required now in most kinds of hunting, except otter-hunting, but especially in fox-hunting, has brought into demand a breed of hounds whose fleetness requires the best and fastest horses. The old Fox-hunter of the early part of the last century would find himself nowhere on a good day in Leicestershire, could be now be present. His horses and hounds were bred with a view to endurance rather than speed; and, if he were to appear at a modern 'meet,' he would see that an entire revolution has taken place in the system. Whether this is an improvement is a question which will be answered differently, according as the respondent may prefer the old-fashioned slow hunting, where all the sagacities of the hound were minutely developed, not without a good deal of 'music,' or the rapidity which makes a good run now-a-days very like a race. The young, bold, and well-mounted rider will generally prefer the latter.

The *Southern-Hound*, which is supposed to have been of very high antiquity in Britain, is large in size, strong and of majestic aspect, long but round in the body, deep in the chest, and his ears are long and sweeping. The tone of his cry is deep, rich, and mellow. He will hunt the coldest scent, and persevere long after lighter hounds have given it up; but he is very slow. The author of 'Rural Sports' saw a pack of these hounds in Lancashire, where they were kept to hunt hares, and the least of them stood twenty-two inches. The huntsman went with a pole on foot.

As a contrast we may notice the celebrated match made between Mr. Barry and Mr. Meynell, to run a couple of each other's fox-hounds a drag, from the rubbing-house, at Newmarket town-end, to the rubbing-house at the starting-post of the Beacon-course, for five hundred guineas. The match came off on the last day of September, and was won by Mr. Barry's Bluecap and Wanton, which came in very close to each other; Mr. Meynell's nearest hound, Richmond, being beat by upwards of a hundred yards. The ground was crossed in eight minutes and a few seconds; and of sixty horses that started with the hounds only twelve were up. Cooper, Mr. Barry's huntsman, came in first, but it is asserted that the mare that carried him was completely blind at the conclusion of the run. The famous Will Crane, who rode Rib, a king's-plate horse, was only in the twelfth. Colonel Thornton's Merkin, which was sold in 1795 for four hogsheads of claret, the seller to have two couple of her whelps, ran a private trial of four miles in seven minutes and half a second.

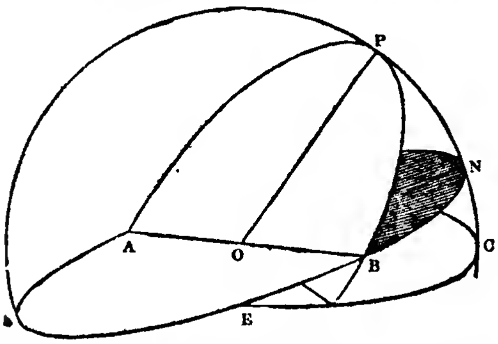
Our limits will not permit us to go into the details of this, to many, interesting subject; and we must refer the reader to Somerville's 'Chace;' Beckford's 'Thoughts upon Hunting;' 'The Sportsman's Cabinet;' Daniel's 'Rural Sports;' the Sporting Magazines; and, most especially, 'Nimrod,' for further information.

HOUR, HOUR-CIRCLE, HOUR-LINE. The first word always means the twenty-fourth part of a day, by what revolution soever the day may be measured. [TIME.] In angular measure [ANGLE] it signifies the twenty-fourth part of a complete revolution, or 15°.

Any great circle on the sphere which passes through the two poles is called an hour-circle, because the hour of the day is known when that circle of the kind mentioned is ascertained upon which the sun is for the time being. But the two semicircles into which the poles divide such a circle belong to different hours, and are twelve hours asunder. In fact, it is a *semi*circle which is spoken of under the term hour-circle. [SPHERE, DOCTRINE OF.]

The hour-lines of a dial are the lines on which the shadow falls at different hours, and are the intersections of the hour-circles with the plane of the dial. In the times preceding the common use of clocks, the science of dialling was of considerable importance, and many works were written on the subject, in which the forms of such instruments were varied without end, and also the methods of constructing them. One work even announces 'a new conceit of reflecting the sunne beames upon a diall, contrived on a plane which the direct beames can never shine upon.' In the rest of this article we propose to show how to construct any plane dial, or rather how to calculate the hour-lines for it by means of spherical trigonometry. A maker of dials should form a table for every species of dial which he wishes to construct, once for all.

Firstly, suppose the dial to be perpendicular to the meridian, which is the case in the horizontal dial and in the vertical south dial. In this case the line drawn through the dial, in a vertical east and west plane, must be horizontal. The style of the dial is of course to point towards one of the poles. Let O be the centre of the globe, and of SEN the circle on which the dial is to be drawn, and let SPN be the meridian, P being the north pole. Then at noon the shadow of the style (a portion of the line OP) is on ON. Let the position of the sun in the afternoon be in the plane of the hour-circle APB, and let the real solar time be h (hours or minutes), and turn h into degrees, &c., at the rate of 15° to an hour of time. Let H be the angle thus



obtained. Let a be the angle by which the plane of the dial is to dip below the horizontal plane, and l the latitude of the place. Then in the right angled spherical triangle PNB, the side PN or PC – NC is $l-a$, and the angle BPN (= SPA) is H. But NB (answering to the angle NOB) is the angle made by OB, the hour-line wanted, with ON, the noon hour-line: let it be called H′. And by the properties of right angled spherical triangles,

$$\tan. H' = \tan. H \times \sin. (l-a);$$

from which H′ may be calculated for as many values of H as may be necessary. If the dial be horizontal (the most common case), we have (a = 0)

$$\tan. H' = \tan. H. \sin. l;$$

and if the *north* side of the dial dip instead of the south, by an angle a, the formula is

$$\tan. H' = \tan. H \sin. (l + a).$$

In the case of a vertical south dial, in which the style must point towards the south pole, we have

$$\tan. H' = \tan. H \times \cos. l.$$

Secondly, suppose the dial to be not perpendicular to the meridian. In that case the circle SPN, perpendicular to the dial, is not the meridian, and it must be ascertained what angle it makes with the meridian, and thence, what hour-line is ON. This being found, the dial is constructed in the same manner as before, and the hour lines follow the same law, with this exception, that the preceding formula does not measure the angles from the twelve o'clock hour-line, but from some other. It is not worth while to pursue this case further.

HOUSE. The degree of comfort exhibited in the arrangement of their houses is one and a very important characteristic of a nation's degree of civilization; and we may mark the progress of this civilization in its successive stages from a rude condition to a high state of perfection by studying the architecture of a people as shown in their ordinary dwellings.

We have but little information about the houses of the Egyptians and Greeks; but as to the houses of the Romans, we have ample means of ascertaining the domestic arrangement, and even the minute details, from the numerous houses discovered and excavated in Pompeii.

There is a model in the British Museum representing most probably a part of an Egyptian house. It appears, to judge from the figures, to be about 10 or 12 feet square and 14 or 15 feet high. It is called a granary, which is not unlikely, as it is similar in character to a granary represented in Rossellini's work on Egypt. (*I Monumenti dell' Egitto e della Nubia.*) The steps of the stairs are of a different proportion.

In the lower part of this model, which has two stories, there is a court, the angles of the walls of which are raised a little higher in a sweep. The door into the court is low and roughly constructed, the hinges being merely wooden pins let into a socket above and below. The stairs leading to the upper part appear to be formed of a solid beam placed aslant and the steps notched out. The risers bear a proportion to the tread of six to one. The walls are plastered, and the door and doorcase are painted red. As much of the roof as is shown in the model is represented to be flat. There are three clamped and partly framed square-shaped doors to the mouths of the granaries. In the court a figure is represented kneeding bread, from which it might be inferred that the building was a bakehouse, and the doors those of ovens.

In No. 68 of Rossellini's work is a section representing an Egyptian house. The doorway is similar in form to the doorway of an antient Egytian temple; above are folding windows, not unlike the latticed windows of the houses of Cairo as described by Lane: a staircase leads up to the floor where the windows appear, and above them is an open gallery supported on columns; the garden, in a court, is shown attached to the house. The best description of a modern Egyptian house is given by Lane in his 'Manners and Customs of the Modern Egyptians.'

Vitruvius (vi. 10) gives a general description of a Greek house, which differed from the Roman in not having a vestibule and atrium; and the Greek practice of separating the apartments of the females from those of the males, led to an entirely different internal arrangement.

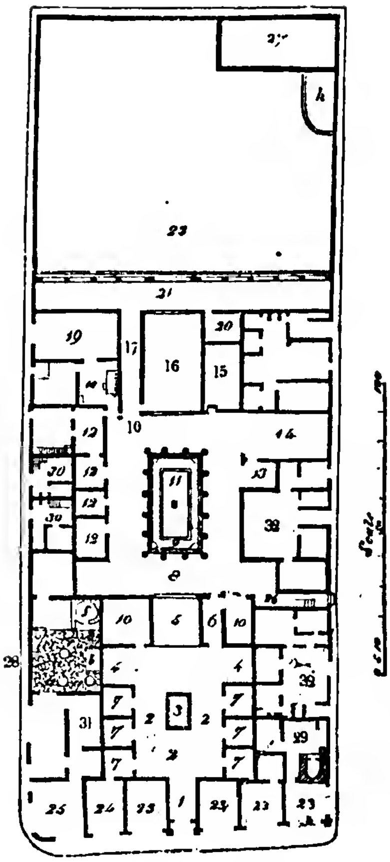
It appears from the oration of Demosthenes against Aristocrates (c. 53), that the houses of many of the Athenians were in his time very magnificent; while in the time of Themistocles and Miltiades they were comparatively mean; and indeed it may be inferred from various passages in the orators and other writers, that a great many of the Athenian houses continued to be very small and inconvenient. A Greek traveller who visited Athens about B.C. 300 says that most of the h uses were mean, and only a few good.

The modern Greek house is of a quadrangular form, with a court in the interior; the staircases are placed on the external part of the house, leading to a gallery round the first floor. The entrance is in the centre of the quadrangle; over the entrance is the sitting apartment of the women; a bow-window is placed in this apartment over the door: here, on a dais, the women sit and amuse themselves by watching the passers by. In the lower story the cattle are often placed. The women's apartments are separated from the men's, as was the custom among the antient Greeks. Many Greek houses are exceedingly mean and ill furnished.

The most perfect remains of Roman houses are at Pompeii. They exhibit the dwellings of both the rich and the poor; the latter are small and meanly finished; the former are in comparison extensive, and often richly decorated with columns, paintings, and mosaics. The principal features of a Roman house are the atrium, the tablinum, and the peristyle. The accompanying plans, with a description of the disposition of the various apartments of two of the principal Roman houses in Pompeii, will serve to convey some idea of their arrangement and uses.

The ground-plan of the house of Pansa is an entire insula, about 300 feet by 100, part of which however is occupied by shops, and part by a garden.

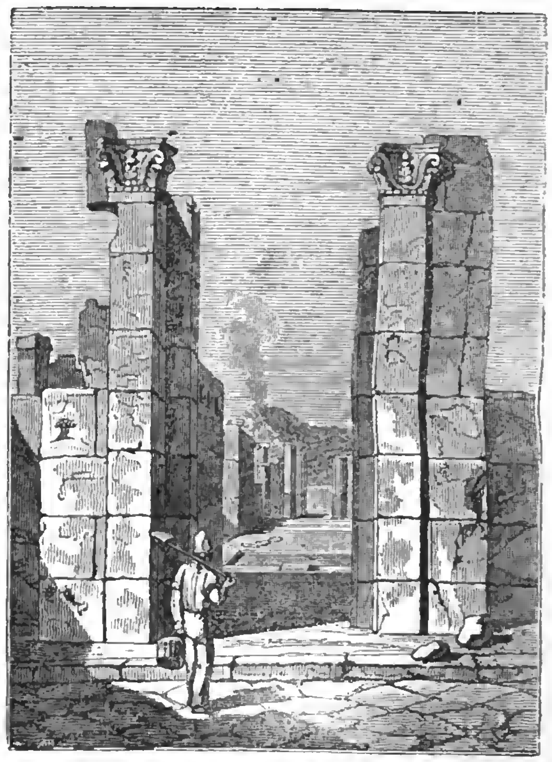
'1. Prothyrum paved with mosaic. 2. Tuscan atrium. 3. Impluvium. 4. Ala. 5. Open tablinum, paved with mosaic, serving as a passage to the peristyle, 8. There is also however a passage (fauces) 6, beside it; and though the tablinum was left open for the sake of the effect produced by thus making the whole length of the house visible at once, it was probably closed by a bronze or wooden railing, so as only to allow the master of the house or the family to pass through it. 7. The apartments on each side of the atrium probably were meant for the reception of guests entitled to claim hospitality, who came to the house of Pansa when pleasure or business brought them to Pompeii. The larger room beside the tablinum marked 10 might serve for a winter reception-room for clients, or for a winter triclinium. 9. Open court. 10. Private entrance to the peristyle. 11. Basin. 12. Bed-chambers. The centre one seems to have been a procœton, or anteroom, since it communicates with the one beyond it. 13 is called by Donaldson the library; by Mazois a pantry, or room to



Ground-plan of the House of Pansa.

arrange the dishes before they were introduced into 14, the triclinium. 15. Winter œcus, or triclinium; Donaldson calls this room the lararium. 16. Large summer œcus. We may call this a cyzicene œcus, or hall, so called by the Greeks. It is spacious, has a northern aspect, and a large opening towards the garden. 17. Fauces leading from the peristyle to the garden, to avoid making a passage-room of the œcus. 18. Kitchen. 19. Servants' hall, with a back door to the street. 20. Cabinet looking to the garden. 21. Portico of two stories, a clear indication that this house had at least one upper floor. The staircase however has so entirely perished that its site is unknown, although there is some indication of one in the passage (26). 22. Garden · in one corner, 27, is a reservoir supplying a tank *h*. 23. Four shops let out to tenants. 24. Shop belonging to the house, intended for the sale of the spare produce of the owner's estates. The produce of the farms of the Italian nobles is still vended in the same way, in a small room on the ground-floor of their palaces. 25, 29. Two baking establishments. 23. Baker's shop. 26. Entrance to the peristyle from the side street. On the pier, between the two doors, is a painting representing one of the guardian serpents, by the side of which is a projecting brick to receive a lamp lighted in honour of the Dii Custodes. In the centre of the large apartment 28 are three mills, *a a a*, and near them a large table *b*. Flanking the entrance to the oven are three large vases, *e*, and in the left-hand corner is a kneeding-trough, *c*, with two coppers placed over furnaces. The apartment 31, from its communication both with the shop and the bakery, was probably used as a store-room.

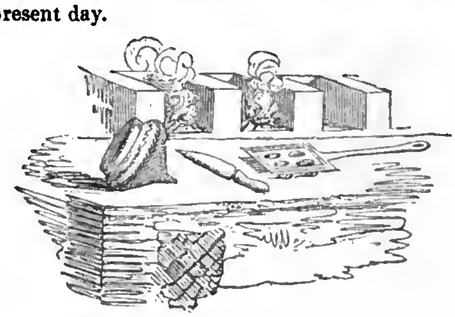
'The two compartments marked 30 are houses of a very mean class, having formerly an upper story. Behind the last of them is a court which gives light to one of the chambers of Pansa's house. On the other side of the island are two houses (32), small, but of much more respectable extent and accommodation, which probably were also meant to be let; or we might conjecture that one or both served as hospitia. The view above offers to the eye successively the doorway, the prothyrum, the atrium, with its impluvium, the Ionic peristyle, and the garden wall with Vesuvius in the distance. The entrance is decorated with two pilasters of the Corinthian order. Besides the outer door there was another at the end of the prothyrum, to secure the atrium against too early intrusion. The latter apartment was paved with marble, with a gentle in-



Entrance to the House of Pansa.

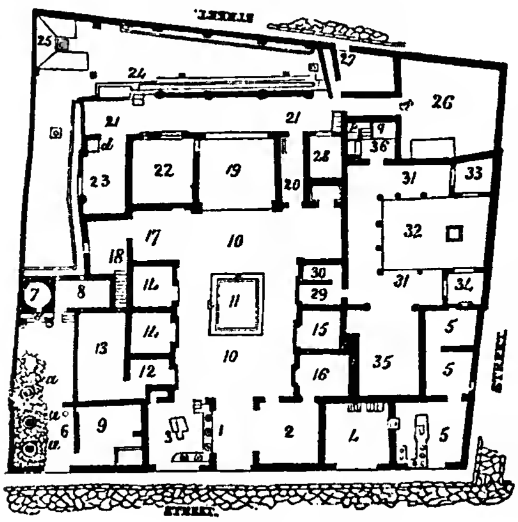
clination towards the impluvium. Through the tablinum the peristyle is seen with two of its Ionic capitals still remaining. The columns, a sort of pseudo-Corinthian, are sixteen in number, fluted, except for about one-third of their height from the bottom. The drippings of the roof were conducted by metal conduits into the central basin of the peristyle, which is about six feet in depth and was painted green. In the centre of the basin was a jet d'eau. This apartment, if such it may be called, was unusually spacious, measuring about 65 feet by 50. The height of the columns was equal to the width of the colonnade, about 16 feet. Their unfluted part is painted yellow, the rest is coated with white stucco.

'The floor is elevated two steps above the level of the tablinum. In the kitchen is a singular painting, representing the worship offered to the Lares, under whose protection and custody the provisions and all the cooking utensils were placed. Another object of interest in the kitchen is a stove for stews and similar preparations, very much like those charcoal stoves which are seen in extensive kitchens in the present day.



Stove in the Kitchen of the House of Pansa.

'Inferior to the house of Pansa, and to some others in size, but second to none in elegance of decoration and in the interest which it excites, is a house in the street leading from the gate of Herculaneum to the Forum, called by some the house of Actæon, from a painting found in it; by others the house of Caius Sallustius. It is remarkable that the architects of Pompeii seem to have been careless for the most part whether they built on a regular or irregular area. The practice of surrounding the owner's abode with shops enabled them to turn to advantage the sides and corners of any piece of ground however misshapen. Thus in the



Ground-plan of the House of Sallust.

plan before us the apartments of the dwelling-house are almost all well shaped and rectangular, though not one of the four angles of the area is a right angle.

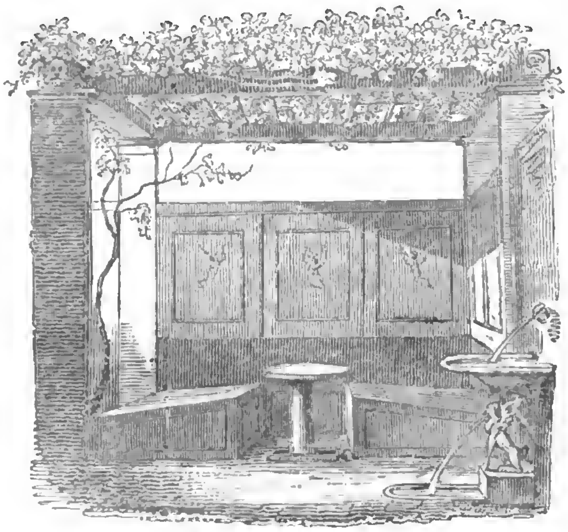
'1. Prothyrum. 2. Large hall serving as a vestibule, as is pretty obvious from its arrangement. In the comparatively humble edifices of Pompeii we cannot expect to find a splendid provision for the convenient reception of a crowd of importunate suitors, as in the spacious palaces of antient Rome; still it is interesting to trace the same disposition of apartments on a smaller scale, especially as this throws some light upon the contested question of the Greek or Roman origin of the private houses. There are four doors; one opening to the prothyrum, another to the street,—a large opening, closed, according to Mazois, with quadrivalve doors, or doors folding back upon themselves, like window-shutters. Of the other two, both communicate with the atrium, one directly, the other through an intermediate room, 16, probably the cella ostiarii, the porter's closet; so that at night, when the doors of the atrium were closed, no one could enter without his knowledge. 3. Shop communicating with the house for the sale of the produce of the proprietor's estates. Jars are set in the counter, probably to receive his oil or olives. 4. Shop. 5. Shop called a thermopolium, with two rooms backwards. Between 4 and 5, in the party wall, is the opening of a cistern, common to both. 6. Bakehouse. There were rooms over it, as is proved by a staircase. The four first steps, steep and inconvenient, were of stone, and still remain. The sites of three mills *a a a* are laid down. 7. Oven. 8, 9. Rooms belonging to the bakehouse. 10. Tuscan atrium. 11. Marble impluvium. 12. Antechamber of a large œcus, or hall, 13, which perhaps was the winter triclinium. This conjecture is founded partly on its neighbourhood to the oven, which would keep it warm and dry, and in a comfortable state for winter use; partly from its size and shape. The length is about 24 feet, the breadth 12, which exactly agrees with the descriptions of Vitruvius, that the length of a triclinium should be double its breadth. A further reason for thus appropriating it may be found in its central situation, which is such that it must have been very ill lighted, if lighted at all. It was probably therefore intended chiefly for evening use. 14, 15. Rooms, probably for the reception of strangers, which, where there was no hospitium, generally were placed round the atrium. The walls of 15 are preserved up to the cornice, and are stuccoed and painted. 17. Alæ. That on the right opens into a cabinet, probably that of the atriensis. To correspond with the doorway, there was in the other ala a false doorway, which served as a lararium, as the paintings which were found in it prove. 18. Open room and staircase leading to a winter apartment placed above the oven. 19. Tablinum. 20. Fauces. 21. Portico. 22. Summer triclinium. 23. Cabinet. 24. Garden, or xystus. 25. Triclinium in the open air, covered by a trellis. 26. Kitchen. 27. Back entrance. 28. Chamber. 29. Entrance to venerium. 30. Lodge for a slave whose duty was to keep the door and prevent intrusion. 31, 32. Portico and court of the venerium. 33, 34. Cabinets opening from the portico. 35. Triclinium. 36. Open space containing a stove, and staircase to the terrace above the portico.

View of the Entrance to the House of Sallust.

'The general view of this house is taken from the street in front, and runs completely through to the garden wall. One of the pilasters which flank the doorway has its capital still in good preservation. It is cut out of grey lava, and represents a Silenus and a Faun, side by side, each holding one end of an empty leather bottle thrown over their shoulders. Ornaments of this character are common to Pompeijan houses. On the right is the large opening into the vestibule. In the centre of the view is the atrium, easily recognised by the impluvium, and beyond it through the tablinum are seen the pillars of the portico. Beyond the impluvium is the place of a small altar for the worship of the Lares. A bronze hind, through the mouth of which a stream of water flowed, formerly stood in the centre of the basin. It bore a figure of Hercules upon its back. The walls of the atrium and tablinum are curiously stuccoed in large raised pannels, with deep channels between them; the pannels being painted of different colours, strongly contrasted with each other.

'The altar in the atrium, and the little oratory in the left hand ala, belong to the worship of the *lares domestici* or *familiares*, as is indicated by the paintings found in the false doorway. They consist of a serpent below, and a group of four figures above, employed in celebrating a sacrifice to these gods. In the centre is a tripod, into which a priest, his head covered, is pouring the contents of a patera. On each side are two young men, dressed alike, apparently in the pretexta. In one hand each holds a patera; in the other each holds aloft a cow's horn perforated at the small end, through which a stream is spouting into the patera at a considerable distance. In the back ground is a man playing on the double flute.

'Passing through the tablinum, we enter the portico of the xystus, or garden, a spot small in extent, elegantly decorated by the hand of art, and set apart as the favourite retreat of festive pleasure. The portico is composed of columns, fluted and corded, the lower portion of them painted blue, without pedestals, yet approaching to the Roman rather than the Grecian Doric. From the portico there is an ascent by three steps to the xystus. Its small extent, not exceeding in its greatest dimensions seventy feet by twenty, did not permit trees, hardly even shrubs, to be planted in it. The centre therefore was occupied by a pavement; and on each side boxes filled with earth were ranged for flowers, while, to make amends for the want of real verdure, the whole wall opposite the portico is painted with trellises and fountains, and birds drinking from them, and above with thickets enriched and ornamented with numerous tribes of their winged inhabitants. Exactly the same style of ornament is described by Pliny the Younger, as existing in his Tuscan villa. (Plin., *Ep.*, lib. v. 6.) At one end of the garden, which is shaped like an L, we see an interesting monument of the customs of private life. It is a summer triclinium, elegantly decorated. The couches are of masonry, intended to be covered with mattresses and rich tapestry when the feast was to be held there; the round table in the centre was of marble. Above it was a



Summer Triclinium in the small Garden of the House of Sallust.

trellis, as is shown by the square pillars in front, and the holes in the walls which enclose two sides of the triclinium. These walls are elegantly painted in pannels in the prevailing taste; but above the pannelling there is a whimsical frieze, appropriate to the purpose of this little pavilion, consisting of all sorts of eatables which can be introduced at a feast.

'In front a stream of water pours into a basin from the wall, on which, half painted, half raised in relief, is a mimic fountain, surmounted by a stag. Between the fountain and triclinium, in a line between the two pilasters which supported the trellis, was a small altar, on which the due libations might be poured by the festive party. In the other limb of the garden is a small furnace, probably intended to keep water constantly hot for the use of those who preferred warm potations. At the other end of the garden, opposite the triclinium, was a cistern which collected the rain-water, whence it was drawn for the use of the garden and of the house. There was also a cistern close to the triclinium.

'On the right of the atrium a suite of apartments existed, carefully detached from the remainder of the house, and communicating only with the atrium by a single passage. The disposition and the ornaments of this portion of the house prove that it was a private venerium. The strictest privacy has been studied in its arrangements; no building overlooks it; the only entrance is closed by two doors, both of which, we may conjecture, were never suffered to be open at once; and beside them was the apartment of a porter, whose duty was to prevent intrusion. Passing the second door, the visitor found himself under a portico supported by octagonal columns, with a court or open area in the centre, and in the middle of it a small basin: at each end of the portico is a small chamber, with appropriate paintings. These rooms were paved with marble, and the walls lined breast high with the same material. Among other things found in one of these chambers were eight small bronze columns, which appear to have formed part of a bed. Both chambers had glazed windows, and it is conjectured that they were provided with curtains. The ground of the walls is black, while its sombre aspect is redeemed by a profusion of gold-coloured ornaments, and bright green and red colours, composed in the most elegant taste.

'The columns were painted with a species of red ochre, of brilliant tint. Between the chambers is a large painting representing the story of Actæon, from which the house derives one of its names. The large apartment 35 was a triclinium for the use of this portion of the house: over the left-hand portico there was a terrace. The space marked 36 contained the staircase which gave access to it, a stove, connected probably with the service of the triclinium, and other conveniences.' It is not a little remarkable that in many Italian houses the convenience of the water-closet is close to the kitchen, and often in the kitchen itself.

The walls of Roman houses were decorated with arabesque paintings, which added an agreeable charm to the light and airy apartments of a hot climate.

The houses of which we are speaking are among the most extensive hitherto discovered in Pompeii: most of the dwellings are on a very small scale; but the principal feature, the atrium, is found in almost all of them. The decorations vary of course according to the wealth of the owner. Though the houses in the city resemble each other in the principle of their arrangement, there is one house without the walls of Pompeii very different in this respect. This dwelling is called the Suburban Villa of Diomedes, and is described at length in the volumes on Pompeii, published by the Society for the Diffusion of Useful Knowledge, from which, with a few verbal alterations, the account above given of the Roman house is taken.

Three centuries ago the English house was constructed in a very different manner from the houses of the present century. The chief materials were wood and plaster, and a common but peculiar feature was the projecting upper floors. The internal arrangement was adapted to the wants of that day, and the external architecture had often a picturesque appearance. The Butter-market at Ipswich contains a remarkable specimen of a house of this period. After the great fire of London the advantage of building in cities with brick or stone became so apparent, as well as the adoption of some regularity, that a great change took place in house-building in the metropolis, which extended by degrees to the houses which were from time to time rebuilt throughout the country. In this gradual change have almost entirely disappeared the projecting floors with large bow-windows, the wooden galleries round the quadrangular courts, the boldly-projected dripping eaves, and the high-pitched roofs with their large windows. In the latter part of the last century an act of parliament was passed for the improvement of house-building in the metropolis, as far as regarded strength, protection from fire, and the gradual removal of the old-fashioned projections. This system has no doubt gradually led to improvements in house-building all through England.

The modern English house, which is most commonly of brick, varies in its arrangement according to the wealth of the occupier, or the skill and taste of the architect. The houses of the middle class, especially in cities, are nearly the same in their chief features.

In cities, and particularly in London, for want of space, the basement story is for the most part built below the level of the ground, the earth being excavated for that purpose. This floor usually contains the kitchen and the rooms for the use of the domestics. The ground-floor, or the floor on a level with the ground, is laid out in the following manner:—the entrance is mostly at the side, leading into a passage, at the end of which is the staircase, which in double flights, with landings between each, ascends to the top story. On one side of the passage-way is usually placed the dining-room, and the drawing-room is placed on the first floor above the ground-floor. On the other floors are arranged the bed-rooms: the highest floor is called the attic. In the houses of the wealthy the drawing-room is formed of a suite of rooms, and the apartments are much more numerous. The servants' rooms are often placed in a contiguous wing of the house, near enough to be within immediate call, and yet so separated from the house as not to interfere with the privacy of the family. The best arranged English houses are the country mansions of the rich.

English houses are in general well provided with means for carrying off water and all impurities which require to be removed from the premises. The large towns of England which have sprung up or greatly increased within the present century, and particularly London, contain numerous capacious sewers, with which the private houses communicate, and thus are kept in a state of cleanliness and propriety which no other houses in any country enjoy in an equal degree. The convenient arrangement of bells is also one of the striking features in an English house, and is nowhere so general as in England.

The floors of English houses are constructed of wood, and hoarded; and the roofs, which are pitched, or at an angle, are covered with slates or tiles. The rooms are heated with open grates, with flues over them, the exit for which is above the roof.

The chimney-flue is a very important feature of an English house, as upon its construction depends the comfort of having the apartment free from smoke. According to Nicholson, 'In stone walls of ordinary buildings the most common dimensions for the sections of the flues of sitting-rooms are from 12 to 14 inches square, and for the brick-work 9 by 14 inches. The flue is gathered over, or contracted to this size, forming the throat of the flue, it being much wider immediately over the opening of the fireplace. To prevent smoke, the chimney ought to be so constructed that a current of air may pass immediately over the fire, so as to be rarefied in its passage, and not to pass entirely through the fire, as many have erroneously imagined. For this purpose the throat should he so near the fire as to prevent the cold air from passing over it, and its horizontal dimension in the thickness of the wall should not exceed 4½ inches or 5 inches at the most.'

The necessary construction 'is to he formed by facing up the back, and bevelling the covings, so that no cold air may be admitted by the ends of the fire: hy thus obliging the overplus above the quantity necessary to produce combustion to pass over the fire, it becomes so heated as to consume the smoke in part, and to drive the remaining portion before it with celerity and violence.

'The covings are generally placed at an angle of 135 degrees with the back and breast of the chimney, and should he made to form an abrupt plane on their top, so as to break the current of a sudden gust of wind.

'The greater the quantity of rarefied air that passes up the flue, and in general the higher the chimney, the more celerity and force will it ascend with. The flue ought therefore to be carried as high as convenienoy will admit.

'The tops of flues should not have such wide apertures as to permit a greater quantity of air to rush down the chimney and counteract the force of the ascending rarefied stream.

'Smoky chimneys are frequently occasioned by the situation of doors in a room, the grate being placed too low or the mantel too high.'

'Flues with circular sections are, with some reason, supposed to he more favourable for the venting of smoke than those whose sections are square or rectangular.' (Nicholson's *Dict.*, art. 'Chimney.')

The staircase of an English house is usually constructed of wood; the stairs are technically called steps and risers; they are both parallel and radiating or winding at the turns. The staircase has a protecting baluster, with a handrail on the top to assist a person in ascending and descending: the handrail is considered to be a nice piece of workmanship, and requires a skilful workman to execute it. (Nicholson's *Dict.*, art. 'Handrail.')

Every convenience which ingenuity can contrive is now found in the numerous minute arrangements and details of English houses, even of those which do not belong to the wealthy class. Those luxuries which the richest nobles could not formerly procure at any price, are now at the command of every man of a moderate income. The windows are hung with pulleys and weights, so that they are opened and shut with the greatest ease. The shutters which close them at night are made to fold and to fall into the smallest possible compass. The ceilings and walls are beautifully plastered, and the latter, if not painted, are carefully papered with paper printed of various colours; and the wood-work is often painted in imitation of the most costly materials.

The houses of the poorer classes are generally called cottages. In their construction, economy, convenience, and a wholesome ventilation should he mainly kept in view, and these may be united with as much picturesque beauty as the nature of the materials will admit of without increasing the expense. In cottages of two stories the upper should be warmed by a flue from the fire in the lower; in order to effect this the vent ought to be carried up the middle with its sides as thin as possible. In a single cottage of twelve or fourteen feet square the conveniences should consist of a common dwelling-room on the ground floor, and a sleeping apartment on the upper floor, which should be partitioned off to separate the sexes.

When cottages are built in rows they may be arranged with a living-room on the ground floor, about sixteen feet square, with a door and window in the front, and a door leading into a lean-to at the back. The fireplace should be on the side away from the door, with an oven opening into it by means of a flue; under the stairs a pantry with shelves may be formed. The object of the lean-to is for fuel, the tools of the labourer, and for the shelter of a pig. The English and Scotch cottages differ in their external appearance and arrangement. The walls of the old English cottage were formed of clay, mud, or turf, kept together and strengthened with upright pieces of wood and with wooden braces; the roof was steeply pitched, that is, with an acute angle at the top, which was done to remove any great pressure from the walls, and to throw the rain off rapidly. In order to keep the walls dry, the eaves of the roof were continued downwards beyond the top of the wall and projected from it. This method preserved the building in some measure from damp. The chimneys, which formed the main strength of the huilding, were generally carried up singly in one or both ends of the building, and for the most part they projected on the outside of the wall. The roof was covered with straw, reeds, or slate. An upper chamber was sometimes formed in the roof, lighted by a dormer window in the side of the roof, or a window was formed in the gable wall. The front walls being low, the windows were made much longer than high, and the long lintel, or head part of the window, was supported by one or more upright pieces called *munnions*, or *mullions*.

The frames for the glass revolved on hinges with an upright axis, and were glazed in borders of lead stiffened by cross pieces of wood or iron, called saddle-bars. These squares are sometimes of an oblong form, but most commonly diamond-shaped, and the leaden bands are fixed to an iron frame. A small shed for a cow was frequently added, with occasionally a lean-to at the end or hack, for the convenience of the cottager. It is most prohahle that cottages were constructed originally of but one story, and in such cases the projecting roof would well protect the walls from wet, but when a second story was raised the windows and doors were more exposed to the rain; to protect the heads of the doors and windows, a projecting piece of wood or slate was placed over them, and in some cottages the second floor was projected over the lower or ground floor. The best English cottages of recent construction are huilt of hrick and covered with slate. The use of these materials has changed the character of this class of dwellings. In many cottages the chimney-stack forms the principal hearing for the floors and roof. The Scotch cottage has not only a different appearance when compared with the English, but from its being so much wider it admits of two apartments heing formed on the ground floor; this is also a matter of necessity, as they are seldom raised more than one story. The material for the walls is most commonly stone; the roof is large and heavy in appearance, and has but a small projection beyond the walls; the gable walls also run up frequently above the roof, forming a parapet, which is sometimes notched so as to resemble steps or has a battlement appearance.

The windows and doors, being without the projecting label, are not so well protected from the rain; the walls however are thick, and the window openings, on account of the size of the stones, are narrow; the windows slide vertically, being placed in a frame. The squares of glass employed are larger than those used in English cottages, in order to obtain more light; the sides of the windows are also splayed.

Mr. Nicholson, in his account of Scotch cottages (*Arch. Dict.*), says—'The chimneys are either carried up in one or both gables, or in a partition wall, which separates the two apartments in the length; when they are carried up in the ends, as the walls are always made sufficiently thick to receive the flues, the materials, which are of crude stone cemented with mortar, not being of sufficient value, the walls are not recessed upon the flanks of the stack of chimneys in order to save them.' The chimney shafts are finished with a coping of hewn stone.

'In many old constructions of Scottish cottages the chimney is placed in the front wall, with a large recess all round the fire, which gave great advantage, in admitting more than double the number which the modern construction admits of.' The old roofs of thatch, turf, or heath, have given place to slate and tile. 'The common kind of the present cottages in the north are made very wide, either to receive a framed bedstead and press, or to form recesses, by means of a partition, for the reception of the bed and cupboard on the side of the apartment opposed to the window.'

Some valuable information on cottage-building is contained in Loudon's 'Architectural Magazine,' and in the 'Encyclopædia' of the same author.

As it is not our object to enter into a description of the construction of a house, but rather to point out those general arrangements of houses which mark, in some degree, the national character, and the adaptation of a building to the wants of the inhabitants and the circumstances of the climate, we proceed to mention some of the most striking features of foreign domestic architecture.

As the French and Italians of the middle classes do not generally live in separate houses like the English, but on floors containing a series of rooms, it follows that the arrangement of their houses differs from that of the English. The staircase, as in public chambers, is common to each floor. The rooms communicate with each other, and generally with a passage or balcony on one side: chimneys are rare, stoves being most commonly used to heat the rooms. The windows are not hung with pulleys and weights, but are formed of two folding glass doors on hinges. The Mezzanino (Mezzanine) is common in French and Italian houses. The houses have generally projecting roofs with often broad overhanging eaves, while in England the gutter is usually concealed within a parapet wall. French and Italian houses are mostly built of rough stone and stuccoed: the floors are seldom boarded, being paved with glazed tiles or unglazed bricks. So rare are bricks in Paris that it is not unusual to see the chimney shafts painted in imitation of red bricks; bricks are however employed in the construction of their flues.

The Spanish houses are very spacious: they have large courts in the interior, and are formed with galleries round the inside of the quadrangular courts: families occupy the separate floors, as in France and Italy. The chief door, which is large, has a small wicket, from which any one applying for admission is first scrutinized. It is a peculiarity of the Spanish house, at least in the south of Spain, that it is without chimneys.

The houses in Switzerland are smaller than those in Italy, France, and Spain; and the people are accustomed, as in England, to live in separate dwellings. The most remarkable of the Swiss houses are those which are built in the neighbourhood of the great pine forests; these are really log-houses, though they are generally finished very carefully and constructed with great accuracy. The walls are formed of whole trees neatly squared and notched into each other at the ends where the walls cross. The roof is of wood: short pieces of pine split into thin layers are used as tiles, and held together by small spars laid across them, which are again weighed down by stones. This kind of tiling is much used in the United States of North America. Many of the cottages have wooden chimneys, the whole of the flue being formed of and lined with wood: the smoke and turpentine together produce a varnish, which preserves it from taking fire. The beams supporting the roof are formed into bold cantilevers, and the principal front is often carved, sometimes with elaborate ornaments, and inscriptions in German text are painted in several colours. These houses have altogether a picturesque appearance, and are much warmer than houses of stone or brick. The houses in many parts of Germany approach nearer to the English in their arrangement than the French and Italian houses. In many places the houses are a framework of wood, and the interstices are filled with unbaked bricks, and are plastered with clay. The mode of heating houses in Germany and Switzerland is principally by stoves (öfen), which, in the better houses, are so arranged that the domestic feeds the fire without entering the apartment which is heated by it.

In North Prussia the peculiar feature of the houses is that they are framed of wood with bricks between. In the same country the upper stories project over the lower, and are supported on columns, generally of wood.

The city architecture of Russian houses, both in its effect and arrangement, resembles the architecture of Italian and French houses, except that the roofs are covered with sheet-iron painted with vivid colours, mostly green and red. The windows are double. The village houses are all log-houses (mostly of rounded logs), and very similar to the Swiss log-house, with the exception that the staircase is for the most part in the interior of the house; the roof is high-pitched, and covered with sawed boards projecting six feet from the walls; while the Swiss roofs are flat, and generally covered with wooden shingles. The chimney of the Russian house is of brick. On the less frequented roads the village houses are of much ruder construction; the rafters project above the ridge, and form by their closeness the entire covering; the projections above the ridge are sometimes cut off, and the ridge-piece is introduced, on which is rudely carved the representation of the head of some animal.

The Russian village generally consists of one street, presenting on each side a range of bold projecting gables. The houses are of two stories; some of the better village houses have a third story in the roof, and a colonnade with a balcony on the ground floor, and occasionally a second balcony from the attic; these balconies are always in the gable front. In the villages there is a side entrance, with a penthouse roof over it, leading into the court where the sheds for the cattle are placed.

The Russian stoves are well adapted for economizing heat. The flue is carried up and down, so as to fill a space of about four feet square, and to the height of about ten feet; it is then carried off; these stoves stand in the corner of the room, so that they can warm four rooms. The flues are built of hollow porous brick, which of course contains the heat. The external surface is of white glazed and ornamented tiles. The fuel is usually birch, and when the flame is entirely spent, a damper is placed on the flue, and the heated air thus enclosed diffuses itself through the rooms. The stove requires to be heated at most for an hour in the morning, and another at night, to maintain a high temperature (50° Fahrenheit for instance) during the twenty-four hours.

For the external design of modern house architecture the English are principally indebted to the Italians. This style, which was invented by the great Italian architects and executed in many of the Italian cities, is mainly characterized by the judicious arrangement, proportion, and decoration of the openings in the elevations, the windows and the doors, and by the bold cornices which surmount the whole front. These masterpieces are deservedly studied by modern architects, and their principal features sometimes judiciously introduced into their designs. The cities of Rome, Genoa, Verona, Venice, and Bologna, with many others, contain magnificent examples of palatial architecture, a style which might be advantageously employed in this country to a greater extent than it has been.

Houses are generally ventilated by means of the openings, the doors and windows, and the chimneys. The system of ventilation adopted in some large covered markets, as at Liverpool, and some large hospitals, might be adopted with advantage in certain classes of dwellings, as in workhouses and other buildings of that class. This system consists in the adoption of fine air-holes on the line of the floors, which keep up a gradual fresh current of air, without a rapid draft.

The houses of all countries are, in some degree at least, adapted to the climate. The houses of hot climates are large, with lofty and well ventilated apartments; while those of cold climates are more particularly arranged with a view to protect the inhabitants from cold.

HOUSE OF CORRECTION. [PRISON.]

HOUSSA. [SOODAN.]

HOVEDEN, ROGER DE, an English historian, who seems to have been the same person whom Robert of Gloucester calls 'Hew of Howdane,' and who is supposed to have received his name from Hoveden, or Howden, in Yorkshire, the place of his birth. Walter of Coventry says he was in the household of Henry II.; probably as a chaplain, as that monarch is stated to have employed him in the service of visiting monasteries at the time when their abbots or priors died, and when the revenues of the respective foundations fell into the king's hands. The exact time of Hoveden's birth and death is unknown, but it was not till after the reign of Henry II. that he wrote his History, which commences in 731, where Bede ends, and continues to 1202, the third year of King John. Hoveden's History was published by Sir Henry Savile, in the 'Scriptores post Bedam,' fol., Lond., 1595, and again at Frankfort in 1601. Nicolson, upon the authority of Pits, says that in 1291 Edward I. caused diligent search to be made in all the libraries in England for Hoveden's History, to adjust the dispute about the homage due from the crown of Scotland. Leland, Selden, Sir Henry Savile, and Nicolson, all bear testimony to the fidelity of Hoveden as an historian. (Tanner, *Bibl. Brit. Hib.*, pp. 415, 416; Nicolson, *Engl. Hist. Libr.*, 4to., Lond., 1776, p. 49.)

HOWARD, HENRY, EARL OF SURREY, son of Thomas Howard, third duke of Norfolk, by his second duchess Elizabeth Stafford, daughter of Edward duke of Buckingham, was born about the year 1516, but the exact time and place of his birth are uncertain. Nothing particular is known of his life until his marriage in 1532, at which time he could not have been more than sixteen. In that year he visited France in company with the duke of Richmond, Henry the Eighth's natural son, and was present at the interview between Henry and the king of France. At Anne Boleyn's coronation (1533) he bore one of the swords in the procession, and soon after paid that visit to Windsor which he notices in one of his sweetest poems; this at least is the opinion of the author of his life prefixed to Pickering's edition of his poems, while Dr. Nott, his more learned but less judicious biographer, supposes the visit to have been made in his childhood. In 1536 his eldest son was born. We find him soon after assisting at Anne Boleyn's trial, and in the same year he lost by death his friend the duke of Richmond. In 1540 he served his first campaign in France, and two years afterwards was elected a knight of the garter. The short remainder of his life appears to have been clouded by misfortunes, the first of which was his quarrel with John à Leigh, and consequent imprisonment in the Fleet. This was soon followed by a summons from the Privy Council for eating flesh in Lent, and for walking about the streets at night in a 'lewd and unseemly manner,' and breaking windows with a cross-bow. On the first charge he excused himself; the second he confessed, and on it he was again confined. Dr. Nott, with singular obtuseness, appears utterly to misunderstand a poem in which Surrey defends himself in a half jocose manner, and assumes the whole proceeding to have been one of sober purpose, not a mere freak of youthful folly. In the next October he made another campaign in France, and after his return took Hadrian Junius into his family as physician. In 1547 he was again imprisoned for using bitter language against the earl of Hertford, after which nothing further is worth note until his last imprisonment, the real grounds of which are doubtful; the king's suspicious temper and Surrey's haughty spirit would however supply ample means of accusation to an unprincipled enemy. The charge was that of having quartered the royal arms with his own, which it appears he had a right to do, although the point is not quite clear. This however was taken as a proof of treasonable intentions, and by the joint testimony of his sister the duchess of Richmond and of his father's mistress he was condemned and executed, January 21, 1547. His father, who was involved in the same charge, had the better fortune of a reprieve, which, by the king's death in the same week with Surrey's execution, was converted into a release.

Surrey seems to have been on bad terms with his mother, and as he was betrayed by his sister, he could not have been fortunate in family matters. The controversy respecting the existence of Geraldine, his supposed mistress, has not terminated, and probably never will, until there are greater opportunities than exist at present for examining public records. It appears that there was an Irish lady to whom the famous sonnet might refer; and it also appears that Dr. Nott has understood some other of Surrey's poems to refer to Geraldine, when they do not; but the case is not clear on either side.

Surrey's works are principally remarkable as forming an important æra in English literature. He was the first whose ear taught him to substitute the present method of poetical accent for that which we find in the writings of Chaucer and his followers. He is also the earliest writer of English blank verse [BLANK VERSE], of which his translation of some parts of the 'Æneid' is a beautiful example. In addition to both these characteristics he is the leader of the second school of English poets who admired and followed the Italian models. As such, Spenser directly, and Milton indirectly, are indebted to Surrey, who, if for no other reason, for this at least deserves remembrance. His works went through four editions in two months, and through seven more in the thirty years after their appearance in 1557, besides appearing in garlands, broad-sheets, and miscellanies. Many people who could not afford to buy printed copies multiplied them in manuscript, which sufficiently proves their popularity. It is a curious fact however that the literary tyranny of Pope was so absolute, and the national taste so much altered, in the beginning of the eighteenth century, that the booksellers, who reprinted Surrey's poems about the year 1714, apologized for their audacity in thus restoring to notice a forgotten and antiquated poet by a reference to the authority of Mr. Pope.

(Nott's *Life of Surrey*, 2 vols. 4to.; *Surrey's Life*, prefixed to Pickering's edition of his poems.)

HOWARD, CHARLES, LORD HOWARD OF EFFINGHAM, second of that title, grandson of Thomas, second duke of Norfolk, was born in 1536. After seeing much service by land and sea, he was appointed in 1585 lord-high-admiral of England, and in that capacity had the chief management of the preparations made in defence of England against the Spanish Armada in 1588. [ARMADA.] He acquitted himself of this most weighty charge with signal prudence, as well as bravery. In 1596 he was joined with Essex in the expedition against Cadiz, having command of the fleet, while Essex had command of the troops. A natural jealousy existed between the old soldier and the young favourite; nor did they quite agree as to the measures to be pursued. However the town was taken, and the ships in the harbour destroyed. [ESSEX, EARL OF.] For this service Lord Howard was created earl of Nottingham, as declared in his patent, much to the annoyance of Essex, who would willingly have engrossed the glory himself, and sought to prejudice the queen against his late collegue. In 1599, in the anticipation of another Spanish invasion, coupled with suspicion of the earl of Essex's intentions in Ireland, the queen reposed in the earl of Nottingham the sole command of the army and navy, with the title of lieutenant general of England, which he held during six weeks—an extraordinary mark of confidence. He commanded the troops which put down Essex's rash attempt at rebellion, and treated him in his downfal, as he had during his prosperity, with respect and kindness. Under the reign of James I. he retained his high consideration at court, and was employed in several distinguished capacities. He died at the advanced age of eighty-seven, December 14, 1624, some years before which he had resigned the office of lord-high-admiral in behalf of the favourite, Villiers, then earl of Buckingham, receiving in exchange a pension of 1000*l.* and the acquittal of a debt of 1800*l.* due to the crown. During half a century he possessed the favour, and for great part of that time the highest confidence, of his sovereigns, without earning or retaining it by unworthy compliances or selfish and interested intrigues. His temper appears to have been no less upright, honourable, and generous, than his services were distinguished. (*Biog. Britann.*)

HOWARD, JOHN, one of the most disinterested, laborious, and useful philanthropists that have done honour to any age or nation, was born about 1727. His father was a London tradesman, who, dying early, left him in possession of a handsome future. Having always been fond of travel, he conceived a desire to visit Lisbon immediately after the great earthquake in 1756, and embarked accordingly, but was captured by a French privateer. The sufferings which he endured and witnessed during his confinement struck deep into his mind. The impression was renewed in 1773, when, as sheriff of Bedfordshire, he had charge of the prisons of the county. Shocked by the misery and abuses which prevailed, he set diligently to work to inquire into the nature and remedy of the evil. In that year he visited, in two journeys, most of the town and county gaols of England, and accumulated a large mass of information, which, in March, 1774, he laid before the House of Commons. This was the commencement of prison reform in England; for in the same session two acts were passed, one for relieving acquitted prisoners from payment of fees, the other for preserving the health of prisoners. Once actively engaged, he became more and more devoted to this benevolent pursuit; insomuch that the history of his remaining years is little more than the diary of his journeys. He travelled repeatedly over the United Kingdom, and at different periods to almost every part of Europe, visiting the most noisome places, relieving personally the wants of the most wretched objects, and noting all that seemed to him important either for warning or example. The first fruit of these labours was a 4to. volume, entitled 'The State of the Prisons in England and Wales, with some preliminary observations, and an account of some Foreign Prisons,' 1777. 'As soon as it appeared the world was astonished at the mass of valuable materials accumulated by a private unaided individual, through a course of prodigious labour, and at the constant hazard of life, in consequence of the infectious diseases prevalent in the scenes of his inquiries. The cool good sense and moderation of his narrative, contrasted with that enthusiastic ardour which must have impelled him to his undertaking, were not less admired; and he was immediately regarded as one of the extraordinary characters of the age, and as the leader in all plans of meliorating the condition of that wretched part of the community for whom he interested himself.' (Aikin.)

The House of Commons having seconded his views by the introduction of a bill for the establishment of houses of correction, Mr. Howard, in 1778, undertook a fresh tour, principally to revisit the celebrated Rasp-houses of Holland; but he continued his route through Belgium and Germany into Italy, whence he returned through Switzerland and France in 1779. In the same year he made another survey of Great Britain and Ireland. In these tours he extended his views to the investigation of hospitals. The results were published in 1780, in an 'Appendix to the State of the Prisons in England and Wales,' &c. In 1781, having now travelled over all the south of Europe, except Spain and Portugal, through which he went in 1783, he visited Denmark, Sweden, Russia, and Poland; and continuing at intervals his home inquiries, published in 1784 a second appendix, together with a new edition of the original work, in which the additional matter was comprised.

The importance, both in prisons and hospitals, of preventing the occurrence or spread of infectious diseases, produced in Mr. Howard a desire to witness the working and success of the Lazaretto system in the south of Europe, more especially as a safeguard against the plague. Danger or disgust never turned him from his path; but on this occasion he went without even a servant, not thinking it right, for convenience sake, to expose another person to such a risk. Quitting England in 1785, he travelled through the south of France and Italy to Malta, Zante, and Constantinople; whence he returned to Smyrna, while the plague was raging, for the purpose of sailing from an infected port to Venice, where he might undergo the utmost rigour of the quarantine system. He returned to England in 1787, resumed his home tours, and in 1789 published the result of his late inquiries in another important volume, entitled 'An Account of the principal Lazarettos in Europe, &c., with additional Remarks on the Present State of the Prisons in Great Britain and Ireland.' The same summer he renewed his course of foreign travels, meaning to go into Turkey and the East through Russia. He had however proceeded no farther than the Crimea when a rapid illness, which he himself believed to be an infectious fever, caught in prescribing for a lady, put an end to his life, January 20, 1790. He was buried at Cherson, and the utmost respect was paid to his memory by the Russian government.

Mr. Howard's piety was deep and fervent, and his moral character most pure and simple. His education had been neglected, so that his literary acquirements were small; neither were his talents brilliant. But he was fearless single-minded, untiring, and did great things by devoting his whole energies to one good object. The influence of disinterestedness and integrity is remarkably displayed in the ready access granted to him even by the most absolute and most suspicious governments, in the respect invariably paid to his person, and the weight attached to his opinion and authority. His character is well portrayed by Bentham in a striking passage already quoted. [BENTHAM, p. 248.] He was strictly economical in his personal expenses, abstemious in his habits, and capable of going through great fatigue; both his fortune and his constitution were freely spent in the cause to which his life was devoted. His property, and home, when he had one, were at Cardington, near Bedford. He was twice married: his second wife, to whom he was devotedly attached, died in 1765, after giving birth to an only son, who unfortunately became insane. Mr. Howard was a strict, and has not escaped the charge of being a severe parent; an imputation to which increased circulation has recently been given. In Lockhart's 'Life of Scott' (vol. vii., p. 115), Sir Walter speaks of Howard's harshness to his son. We are enabled to contradict this statement through the kindness of a correspondent, who derived his information from Dr. R. W. Darwin of Shrewsbury, who lived on terms of intimacy with Mr. Howard's son at Dr. Blacklock's in Edinburgh during the winter of 1783-4. According to Dr. Darwin, Howard's son always spoke with the greatest affection and veneration of his father; and on one occasion, being asked by Dr. Darwin whether his father would be angry at his want of compliance with a certain wish, he answered 'not angry, but unhappy.' (Aikin's *Life of Howard*.)

HOWDEN. [YORKSHIRE.]

HOWE, RICHARD, afterwards Viscount Howe, the second son of Emanuel Scrope Howe, governor of Barbadoes, and Mary Sophia Charlotte, daughter of Baron Kielmansegge, master of the horse to George I. when elector of Hanover, was born in 1725. At the age of fourteen he left Eton, and joined the Severn, one of the squadron which, under the command of Commodore Anson, was sent to make war upon the western coasts of Spanish America. On his return he received an appointment in the Burford, one of the fleet destined to the West Indies; where his behaviour in an action was such as to hasten his promotion, and he was made lieutenant of the Comet in 1745. His name is first publicly mentioned in the account of the siege of Fort William, when he was in command of the Baltimore. Shortly after he joined the Greyhound frigate (Captain Noel), and, with her assistance, engaged two French ships at Loch Nouy, but did not succeed in capturing them: Commander Howe was wounded in the head. On his arrival in England he was raised to the rank of Captain, and, at the request of Rear-Admiral Knowles, was sent to join his squadron on the Jamaica station, where he arrived too late for the action off the Havanna, 2nd October, 1748: the Cornwall, which had severely suffered in the action, was sent home under his orders. In 1751 Captain Howe obtained a commission for the Glory, of 44 guns, destined for Africa, and, on his return from thence, was successively appointed to the Mary yacht, and the Dolphin frigate, in which he acquired much valuable knowledge of the navigation on the Barbary shores. In 1755 the command of the Dunkirk, 60 guns, was given to him, and he sailed with Admiral Boscawen. The fleet took up a position off Cape Race, Newfoundland, in order to intercept the French fleet. The fogs enabled the main body of the enemy to escape; but two ships, the Llys and the Alcide, struck to Captain Howe. Thus commenced the Seven Years' War.

In 1756 Howe was employed in the Channel service; during the following year he commanded the Magnanime, under Sir Edward Hawke, but the expedition proved unsuccessful, except in taking a fort on the island of Aix. On the 1st of June, 1758, he hoisted his flag in the Essex, as commodore of the fleet destined to blockade Brest. Contrary winds forced them to put back, a month after their departure from St. Helen's; but sailing a second time, with the duke of York on board the Essex, he reached Cherbourg, and instantly reduced it: after this he landed the troops in St. Lunaire bay to attack St. Malo, an object which they abandoned in order to engage with the French at Martignon, where many English were killed while endeavouring to embark. On this occasion Howe distinguished himself by his coolness and intrepidity. In 1758 he married Mary, daughter of Chiverton Hartop of Welby; and soon after, losing his brother Viscount Howe, he succeeded to his title and estate. In 1759 Lord Howe was re-appointed to the Magnanime, and on the 20th of June engaged with the squadron under M. de Conflans, in which Howe took the Thésée and the Formidahle. His reputation was now so high that George II. complimented him hy saying that 'his life had been one continued series of services to his country.'

After he had heen again afloat in the Princess Amelia, he returned home; and peace being proclaimed, Howe occupied a seat at the Board of Admiralty for two years, and then filled the important office of Treasurer of the Navy, and was returned to parliament for Dartmouth. Except in questions that regarded naval administration, he took little part in the husiness of the house. In October, 1770, he was promoted to he Rear-Admiral of the Blue, and commander-in-chief in the Mediterranean. In 1776 he sailed on board the Eagle for North America. He was successful in a brilliant action with D'Estaing's squadron off Rhode Island, which he quitted September, 1778, and on the 30th October landed at St. Helen's. On a change of ministers, his friends, who came into power, appointed him Admiral of the Blue, and to the command of the Victory; hut failing in his attempt to intercept the West Indian traders, he soou returned to Spithead. He was then sent to relieve Gihraltar, which he accomplished, and arrived in England on the 14th November. Lord Keppel having resigned his office, Lord Howe succeeded him as First Lord of the Admiralty. He quelled, in his own person, a mutiny on hoard the Janus. In three months he was obliged to resign, on another change of the ministry, which restored Lord Keppel. At this time he was created Earl Howe, in acknowledgement of his services, with remainder of the harony of Langar to his eldest daughter. On the 22nd of June, 1790, he was appointed to the command of the Channel fleet, with the additional and peculiar distinction of being ordered by his majesty to hoist the union at the main, on board the Queen Charlotte of 100 guns; hut after cruising about in a fruitless search for the Spanish fleet, he anchored at Spithead, 14th September, and enjoyed repose on shore for a considerable time. In 1794 he again advanced with the several convoys to the Lizard, and the same day discovered three frigates outside of Brest harbour. On the 25th May two French corvettes were taken; on the 28th May several French vessels were seen far to the south-east, and the Bellerophon engaged with the Révolutionnaire. The enemy's motions having been watched during the night, the two fleets continued in the same relative position on the morning of the 29th: on the 30th and 31st the state of the weather prevented an engagement, but on the 1st of Juue the action commenced at 9 A.M. The Marlborough, Defence, Queen Charlotte, &c. hroke the enemy's line: ten of the enemy's ships were dismasted, seven were taken, three only rejoined the French admiral, and Howe had the glory of towing into Portsmouth six ships of the line.

Lord Howe's health now began to fail; but notwithstanding his infirmitics, he consented to go in person to quell the mutinies that had arisen at Portsmouth, Spithead, &c.; he ascertained the causes of complaint, and endeavoured to remove them hy causing the ohnoxious officers to be superseded: his concessions were judicious, hut they did not escape censure.

This was the last public act of his life. With his wife and daughter he spent the rest of his life in retirement at his house at Porter's Lodge, in the enjoyment of a fortune of ahout 1800*l*. a year He had declined a pension, which was offered him after the action of the 1st of June. On the death of Dr. Warren, and in the ahsence of his other medical adviser, Dr. Pitcairn, at Lisbon, he tried electricity as a remedy for his complaint; the disease, which was the gout, was hy these means driven to his head, and after sinking rapidly, he expired 5th August, 1799. He was huried in the family vault in Nottinghamshire, and a monument by Flaxman was erected to his memory at the puhlic expense. In person Lord Howe was tall and well proportioned; his features strongly marked and dark—their expression generally harsh. His mind was strong, and his judgment usually correct. His reserve gave rise to the saying, that 'Howe never made a friendship but at the mouth of a cannon.' Bravery, patient endurance under adverse events, and coolness in danger, were his chief characteristics. He was the first sea officer of his time. (Barrow's *Life of Howe*.)

HOWITZER, a piece of ordnance which differs from what is denominated a gun only in its proportions; the ratio of the length of the piece to its diameter being considerably less than in the latter kind of arm.. It is also similarly mounted, and is employed to project shells, carcasses, round or solid shot and case-shot, either in the point-blank direction or at angles of elevation, which hitherto have not exceeded fifteen degrecs.

Le Blond considers it as a species of mortar, and ascribes its invention to the English or Dutch. By the latter people it is said to have heen used at the end of the sixteenth century; and its name is derived from the German word *häufen*, to fill. It is prohahle, however, that tho name did not at first indicate a distinct species of ordnance, but was applied to any gun filled, or charged, with slugs or case-shot. Short guns for the discharge of shells were used in Italy, in 1618; but they do not appear to have been introduced into France till 1683, about which time they were also adopted in the British service.

The howitzer may he said to hold a middle place between the gun and the mortar: with equal calihre, being lighter, it is more manageable than the former; and, being greater in length than the latter, the path of the projectile tends with superior accuracy to the point of aim. It is used against troops in the field; in the attack of redoubts or villages, and both in the attack and defence of regular fortresses. By shells the palisades and other obstacles which might impede the assault of a redoubt are destroyed; and by these, or carcasses, huildings are demolished or set on fire. In the attack of fortresses, a fire of shells from howitzers is directed so as to enfilade the covered-ways for the purpose of destroying the traverses: the demolition of the ramparts and parapets is also accelerated by the explosion of sholls when fired directly into them. In the defence of places howitzers are sometimes disposed along the covered-ways and on the terrepleins of ramparts, from whence the missiles are discharged over the parapets, in order to annoy the hesiegers in their lodgments on the glacis.

A few years since Colonel Paixhans, in France, and the late General Millar, in this country, made some importsnt improvements on this arm. Both these officers increased the length of the pieces for the sake of gaining superior directive power; and, in order that the force of the powder might act in the most efficacious manner, they diminished the windage, and adopted chambers which, at the part joining the cylindrical bore, have the form of truncated cones; the former however made the lower extremity of the chamber cylindrical, aud the latter terminated the conical part hy a hemispherical concavity. In the British service hoth iron and brass howitzers are employed, and the former are denominated from their calibres, which are 10 inches and 8 inches. The latter are of four kinds, which are designated 24 pounders, 12 pounders, $5\frac{1}{2}$ inch and $4\frac{2}{5}$ inch, from the weight of the round shot and the diameters of the shells discharged from them. The lengths of the above natures of howitzer are, respectively,—

Iron, 5 feet and 4 feet.

Brass, 4 ft. 9 in., 3 ft. 9 in., 2 ft. 8 in., and 1 ft. 11 in.

The French officer above mentioned has proposed to his government the employment of iron howitzers on hoard of ships of war, for the purpose of firing loaded shells in naval actions; recommending at the same time to use such charges of powder as will suffice to give the shell only the momentum necessary to allow it to enter into, without penetrating through, the side of an enemy's ship. Its explosion in that situation would prohahly produce an effect equal to thst which would result from the concentrated fire of a whole hroadside of solid shot; and should the shell strike near the surface of the water, it might even immedistely sink the ship. Experiments made both in France and in this country havo sufficiently proved that destructive consequences would ensue on the hursting of a shell when so lodged; and, notwithstanding the danger supposed to exist in keeping loaded shells on hoard a ship, on account of the risk of their fuses being accidentally ignited, it is probahle that, in a future war, one or hoth of the helligerents will have recourse to this formidable means of ohtaining victory on the occan.

HOWTH. [DUBLIN.]

HOYA. [HANOVER.]

HUDDERSFIELD, a market-town, parish, and township in the upper division of the wapentake of Agbrigg, and in the West Riding of Yorkshire. It was created a parliamentary borough by the Reform Act, with the right of sending one member to parliament. The borough extends over the entire township, and includes a population of 19,035, and 1140 houses of 10*l.* and upwards. The township of Huddersfield comprises about 3700 acres of land, which are divided into five hamlets for the maintenance of the highways, viz. Huddersfield, Fartown, Bradley, Deighton with Sheepridge, and Marsh with Paddock. The parish of Huddersfield consists of seven townships and parishes, which, with their population, are as follow:—Golcar 3143, Huddersfield 19,035, Lindley 2306, Longwood 2111, part of Marsden 642, Scammonden with Deanhead 912, and Slaithwaite 2892; total population 31,041. Huddersfield is 189 miles north-north-west of London, 7 miles south-south-east of Halifax, and 26 miles north-west of Sheffield.

Huddersfield is said to have derived its name from Oder, or Hudder, the first Saxon who settled on the river Colne, which rises above Holmfirth, and falls into the Calder near Nunbrook. It is one of the chief seats of the woollen manufactures. Its population has more than doubled since 1811. Its situation on the high road from Manchester to Leeds, and its supply of water-power, together with the immediate proximity of coal and building-stone, have contributed to its increased wealth and population. The soil is naturally unproductive; oats were the chief grain formerly grown here, and within the present century oaten-cake was the principal food of the district. The soil now produces fine wheat and barley, and wheaten bread is much more common than oaten-cake, even in the dwellings of the poorest. The greater part of the houses of Huddersfield are built of a light-coloured stone. Within the last few years the commissioners, under an act for improving, lighting, and cleansing the town, have effected some beneficial changes in widening the streets, and making the approaches and principal thoroughfares worthy of the increased wealth and trade of the town. Sir John Ramsden, Bart., is lord of the manor, and proprietor of all the land in and near the town, with the exception of a very small portion belonging to another individual. The market-place is a large area, surrounded with good houses and shops. The manufactures of Huddersfield and the adjacent villages are principally woollens, consisting of broad and narrow cloths, serges, kerseymeres, cords, and a great variety of fancy goods, as shawls and waistcoatings, whose fabrics are generally composed of worsted, silk, and cotton; some wholly of the first, others of certain admixtures of woollen and the other two materials. Many of these articles are delicate in their texture and elegant in their patterns. The cotton manufactures are also carried on, though not to a very great extent. In 1765 a commodious cloth-hall was erected for the buyers and sellers of the Huddersfield manufactures by Sir John Ramsden; it was enlarged by his son in 1780. This edifice is circular; it is two stories high, and 880 yards in circumference. It has a diametrical avenue of stalls one story high, which divides the interior into two semicircles. The main building is divided on the one side into separate compartments or shops, and on the other into open stalls. The light is wholly admitted from within; protection is thus afforded against fire and depredation. Upwards of six hundred manufacturers, chiefly from country parts, attend this hall each market-day (Tuesday), and the sales are conducted under certain regulations prescribed by a governing body. The doors are opened in the morning, and closed at half-past twelve; they are again opened at three in the afternoon for the removal of cloth. In addition to this public mart a great number of the traders, chiefly in fancy goods, have warerooms in various parts of the town. This neighbourhood was one of the centres of the system of *Luddism* in 1812. [Bradford.]

The trade of Huddersfield derives great advantages from its inland navigation both eastward and westward. The Ramsden canal commences close to the town, unites with the Calder, and opens a communication with Halifax, Wakefield, Leeds, York, and Hull. The Huddersfield canal joins the Ramsden canal, and conveys goods westward, forming part of the direct canal communication which connects the Mersey and the Humber. There is a tunnel to this canal 5451 yards long (above three miles), which is carried under Stanedge Hill: in one place it is 222 yards below the surface, and 656½ feet above the level of the sea; it emerges at Dobcross, leaves Yorkshire near Lydgate, and unites with the Ashton and Oldham canal, thus completing the line of communication with Manchester and Liverpool.

The parish church of Huddersfield was a small antient structure, which was taken down in 1835, when a new one was erected in the perpendicular Gothic style, and opened in October, 1836. The cost was about 9000*l.*, including 300*l.* for a new clock, and 460*l.* for the east window. The expense was defrayed by subscription, the sale of pews, and a grant of 600*l.* from the Church Building Society. Trinity church was built by Benjamin Haigh Allen, Esq., of Greenhead, on his own land; its cost was 12,000*l.*; it is in the pointed Gothic style. St. Paul's church was built by the parliamentary commissioners on a site given by Sir John Ramsden. Christ church, which was built and endowed by John Whitacre, Esq., is on an eminence at Woodhouse, on the north of Huddersfield. The other places of worship are: one for Catholics, two (very large) for Wesleyans, one for Primitive Methodists, one for Independents, and one Friends' meeting-house (at Paddock). There is no endowed grammar-school at Huddersfield, nor in the immediate neighbourhood, but there is an intention to establish a Church of England collegiate school on an enlarged and comprehensive system of education. There is also a college for the education of persons of all sects. There is a national school for boys and girls, an infants' school, and a day-school (at Woodhouse), which together educate about 500 children. The Sunday-schools and religious and educational societies connected with the town and county are liberally sustained. The Philosophical Hall is a Grecian building, which was completed in 1837. The society sprung out of a Mechanics' Institute formed in 1825. This edifice cost about 3000*l.*; the members have a library, a small museum, and laboratory, and there is a good lecture-room in the building. There are also subscription and law libraries, and a commercial news-room. The waterworks are admirably constructed; they are situated in the townships of Longwood and Golcar, about four miles west of the town, from whence the water is brought to the houses of the consumers. The supply is calculated for any increase in the population which may be looked for during the ensuing century. The town is lighted with gas. The Huddersfield and Upper Aghrigg Infirmary is a large and elegant stone building in the Grecian Doric style. It was erected in 1830 by voluntary donations amounting to 10,000*l.*; out of this sum a partial endowment was also effected towards its future support, though it is chiefly sustained by annual subscriptions. Nearly the whole of this large amount was obtained by the personal exertions of Samuel Clay, an humble tradesman of the town, since deceased. In the year 1836 this institution relieved 3234 out-patients and 206 in-patients. The savings' bank, established in 1818, had in 1836 deposits amounting to 53,000*l.*, belonging to 1511 individuals and 44 societies. Lockwood Spa baths are about half a mile from the town. The buildings are elegant, and the water strongly sulphureous; the baths comprise cold, tepid, warm, vapour, and shower-baths. The income from the Dole Land (25 acres) is distributed by the vicar annually on St. Thomas's day; the other charities of this nature are very inconsiderable. The introduction of the New Poor Law into this district was met by much opposition in 1837; but the obstacles which were thrown in the way of its operation are now removed.

HUDSON, HENRY, is eminent among these early navigators who sought a shorter passage to China than the circuitous route round the Cape of Good Hope. Nothing is known of him before 1607, when he was employed by some London merchants to command a ship fitted out to prosecute that object. In that year he advanced along the eastern coasts of Greenland beyond the 80th degree of latitude, before he was stopped by the ice. In 1608 he kept more to the east, and in a lower latitude; but was unable to get to the eastward of Nova Zembla. In 1609 he tried again the north-eastern route; and being again unsuccessful, bore away for America, along the coast of which he ran down as far as Chesapeak Bay, whence he returned to England. Not yet discouraged, and still finding persons willing to adventure their money in the lottery of maritime discovery, he undertook a fourth voyage, in hopes of discovering a north-western passage, in April, 1610. In the course of June and July he sailed through the Strait, and discovered the Bay, both of which have since been called after his name; and hoped for a time that the much coveted object was attained. But finding that great inland sea to be but a bay, he resolved to winter in the southern part of it, hoping to pursue his discoveries in the spring. The insufficiency of provisions however exposed him and his companions to great hardship, and at last proved fatal to his scheme. The men became discontented and insubordinate; Hudson on the other hand seems to have lost his temper, and at last, while they were in the Strait on the voyage home, some of the boldest of the mutineers seized the captain and eight of his staunchest followers, and sent them adrift in an open boat; and they were never afterwards heard of. It may give a juster notion of the hardihood of these old sailors, to know that in his first voyage Hudson's crew consisted of ten men and a boy; his last and largest ship's complement was only twenty-three men. For an account of his adventures, see Purchas's *Pilgrims;* Harris's *Voyages*. He has a full article in the 'Biog. Britann.

HUDSON, JOHN, D.D., was born at Wedehop in Cumberland, about the year 1662. He entered the University of Oxford in 1676; took the degree of M.A. in 1684; and was soon afterwards elected a Fellow of University College, of which he was tutor for many years.. In 1701 he was appointed principal librarian of the Bodleian Library; and in 1712, principal of St. Mary's Hall. He died on the 27th of November, 1719.

Hudson published editions, with critical notes, of several of the classical authors: namely, 'Velleius Paterculus,' 1693, 1711; 'Thucydides,' 1696; 'Geographiæ Veteris Scriptores Græci Minores,' with notes and dissertations by Dodwell, 4 vols. 8vo., 1698—1712; 'Dionysius of Halicarnassus,' 2 vols. fol., 1704; 'Longinus,' 1710, 1718; 'Mœris Atticista,' 1712; Æsop's 'Fables,' 1718; 'Josephus,' 2 vols. fol., 1720, which was printed as far as the fourth index under the author's own superintendence; the last few pages were edited by his friend Hall, who has prefixed to the work a short account of the life and writings of Hudson.

HUDSON, RIVER. [NEW YORK.]

HUDSON'S BAY is an extensive mediterranean sea on the eastern side of North America, and connected with the Atlantic Ocean by Hudson's Strait. Its surface is greater than that of any of the inland seas of the Old Continent, the Mediterranean only excepted. Its southern part is called James's Bay. From the most southern corner of James's Bay to Repulse Bay, which may be considered as the most northern point of Hudson's Bay, is upwards of 1000 miles (between 51° and 66° N. lat.). It is more than 500 miles across in its widest part. James's Bay itself extends nearly 240 miles south and north, and at its mouth (near 55° N. lat.), between Cape Jones on the east and Cape Henrietta Maria on the west, it is 140 miles wide. The coasts are generally high, rocky, and rugged, and in many places precipitous, except along the south-western shores between Cape Henrietta Maria and Cape Churchill, where they are generally low and swampy, and frequently exhibit extensive strands. The depth of water in the middle of the bay has been taken at 150 fathoms, but it is probably greater. The northern part of Hudson's Bay is occupied by Southampton Island, which is formed of high rocky masses, and seems to consist of numerous smaller islands, separated from one another by straits, which however are always closed by ice. It does not appear to be inhabited. Between it and the East Main is Mansfield Island, likewise a mass of rock, but not of great elevation. About 100 miles from the shores of East Main, and nearly in the meridian of Mansfield Island, there is a dangerous chain of rocks, extending as far as the innermost portion of James's Bay: to the northward they are called the Sleepers; and, near James's Bay, the Belchers; at other places they have other names.

The countries which enclose Hudson's Bay on all sides constitute by far the greatest portion of the British dominions in North America; but they are not known under any one general denomination, and may therefore be described here under the name of the 'Hudson's Bay Country.' We shall not include the islands lying east of Fox's Channel and north of Fury and Hecla Strait, which will be noticed under NORTH-WEST PASSAGE, but we shall include the large peninsula of Labrador and East Main, which lies between the Gulf of St. Lawrence and the Atlantic on one side and Hudson's Bay on the other. These countries extend between 49° and 70° N. lat., and from Cape Charles in Labrador (near 55° W. long.) to the Rocky Mountains and the mouth of the Mackenzie river (135° W. long.). The area cannot be given, as considerable tracts of the coast are still unknown, but it certainly exceeds 2,000,000 square miles, and probably does not fall much short of 3,000,000 square miles.

This immense country may be divided into four natural regions. The most eastern is the *sterile region*, which lies along the shores of the sea, and extends far inland. Its southern and western boundary may be marked by a line beginning on the south on the St. Lawrence River at Cape Torment, about 30 miles below Quebec, and running across the peninsula of Labrador to Cape Jones, at the mouth of James Bay (55° N. lat.). Hence it crosses Hudson's Bay to Cape Churchill (59° N. lat.); it then runs west to the eastern extremity of Lake Athabasca, and hence northward to the eastern corner of the Great Slave Lake, from which point it passes through the Great Bear Lake, and terminates near the eastern mouth of the Mackenzie River. That portion of it which lies west of Hudson's Bay is called the *Barren Grounds*. The whole region to the north and east of the above line is characterized by extreme barrenness of soil and great severity of cold in winter. It seems in its whole extent to be considerably elevated above the sea-level, though there rarely occur any heights which can be called mountains. Its surface is very uneven, broken, and universally composed of bare rocks, on which only lichens and mosses grow. It is only here and there furrowed by narrow valleys, whose soil consists either of an imperfect peat-earth, which gives nourishment to dwarf birch trees, stunted willows, larches, and black spruce-trees, or of dry coarse sand, covered with no other vegetation than lichens. In the depressions of its surface there are numerous lakes, frequently completely land-locked; others however communicate with one another by narrow ravines traversed by streams, which rush down with great violence. Nearly all the rivers of this country consist of a succession of lakes communicating by such rapid streams. The want of high forest-trees probably accounts for its being nearly destitute of fur-bearing animals, and hence the Hudson's Bay Company has no establishments within its limits. Only the reindeer and the musk-ox are abundant. It is solely inhabited by Esquimaux and a few forlorn families of Indians. The winters are longer and more severe than in Greenland in the same latitude, a fact well established as to the coast of Labrador.

The second region occupies the country between the two portions of the sterile region, and extends on both shores of James's Bay, and along the southern shores of Hudson's Bay, as far westward as Cape Churchill. It also extends inland to the ridge which forms the northern boundary of Canada, and to the lakes Superior, Winnipeg, Deer, and Wollaston. Along the shores and several miles inland it is mostly occupied by swampy tracts, which are separated from one another by comparatively narrow and dry but low ridges. These tracts have little wood on them. Farther inland it is generally well wooded, and produces the fur-bearing animals in great abundance. Many parts of it could certainly be cultivated, though the winters are more severe than in Europe in the same latitude. This country may be called the *wooded region*. Its surface is generally undulating, and the hills not numerous.

To the west of the wooded region is the *Savannah region*, which extends to the foot of the Rocky Mountains, and northward to the Lake of Athabasca and the Peace river. Its surface stretches out in extensive plains, intersected only by the beds of several rivers, which are considerably below the plains. In these bottoms, along the rivers, trees grow abundantly, and the soil seems adapted to agriculture. But the soil of the plains themselves is rather sandy and dry, and entirely destitute of wood; yet it supports a thick grassy sward, on which numerous herds of buffaloes and several kinds of deer find abundant pasture. In a few places the plains are intersected by ridges of low hills. North of the river Saskatchevan the country is more broken, and wooded hills occur more frequently, and on the banks of the Peace river the plains are of comparatively small extent, and separated from one another by richly wooded tracts.

The fourth region we shall call the *Valley of the Mackenzie River*. It comprehends the country between the sterile region and the Rocky Mountains north of Lake Athabasca. The river generally runs through a bottom, rarely more than a few miles wide, whose alluvial soil is in many places covered with trees of moderate height. The highe grounds which enclose the bottom are usually from 100 to 150 feet above it, and exhibit towards the Rocky Mountains in some places an undulating, but in others, especially towards the south, a broken surface. But towards the Barren Grounds their surface rises rapidly into high hills, which in many places attain from 800 to 1000 and even 1500 feet of elevation, and frequently run parallel to the course of the river. White spruce-trees grow at the base of these hills as far as 68½° N. lat., north of which they become very stunted and straggling, and very soon disappear: none are found as far as 69° N. lat. The delta of the Mackenzie, which is 90 miles in length (from 67° 40′ to 69° 10′ N. lat.), and from 15 to 40 miles in width, is formed by flat alluvial islands, which divide the various branches of the river. Most of the islands are partly or entirely flooded in the spring, and have their centres depressed and marsby or occupied by a lake, whilst their borders are higher, and well clothed with white spruce-trees. The trees terminate suddenly in 68° 40′ N. lat.

The Rocky Mountains, which separate the countries now under survey from the North-western Territory, seem to attain the greatest elevation where the sources of the Athabasca river approach the upper course of the Columbia river. Mount Hooker is stated to rise to 15,700 feet, and Mount Browne even to 16,000 feet above the sea. Their elevation farther north seems to be considerable, as the range which runs parallel to the upper course of the Peace river is always covered with snow: farther north however they decrease in elevation; and where the Mackenzie river approaches them, they are less than 4000 feet high. They decrease in height still more towards the Arctic Ocean, where they are free from snow in summer. As far as our information goes, they seem to consist of a number of parallel ridges, with longitudinal valleys of moderate depression lying between them. The most eastern ranges seem to be the highest, but they do not constitute the watershed, as several rivers originate in the ridges farther west, and break through the more elevated ridge which forms the boundary-line of the countries of which we are taking a general survey.

Numerous large rivers traverse this extensive country. One of the most important, not on account of the country which it drains but of its situation, is the Moose river and its affluent the Abbitibbe. Both rise in lakes situated on the high ground which separates Canada from the territories of the Hudson's Bay Company, and at no great distance from the upper branches of the Ottawa river; and they are accordingly used as the most convenient means of communication between both countries, and are the most frequented road from Hudson's Bay to the great commercial town of Montreal. The Abbitibbe lake, which may be considered as the source of the river of that name, is about 60 miles long, and somewhat less than one-third of that amount in breadth, and is diversified by numerous islands. The river, which issues from it, runs west, but afterwards declines to the north, falling into the Moose river after a course of about 200 miles. The Moose river itself rises about 60 miles from the shores of Lake Superior, and falls into James's Bay after a course of about 230 miles.

Between the mouth of the Moose river and Cape Churchill are the embouchures of the Albany, Severn, Hayes, and Nelson rivers. The first three rise in the hilly country which extends from the western extremity of Lake Superior to Lake Winnipeg, and skirts the eastern side of the latter lake. The Albany river has a course of perhaps not less than 500 miles, if its windings are taken into account, its course being about 320 miles from its mouth in a straight line. The Severn runs 250 miles in a straight line. Hayes or Hill river runs about 220 miles; about 5 miles from its mouth, on its west bank, stands York Factory, the principal settlement of the Hudson's Bay Company in these countries.

The Nelson river is only inferior to the Mackenzie; its remoter branches rise in the Rocky Mountains. All the waters which descend from the eastern declivity of that range between 47° and 53° N. lat. unite in two large rivers, the southern and the northern branch of the Saskatchevan. Both branches unite, about 420 miles from their source, below Carlton House, and the united river falls into Lake Winnipeg after a straight course of above 200 miles more. Lake Winnipeg extends from north-north-west to south-south-east, between 50° 30′ and 53° 50′ N. lat., and 96° and 99° 25′ W. long. It is about 240 miles long, but its breadth varies from 5 to 50 miles. West of it are the two lakes Winnipigoos and Manitoba, which, taken together, occupy in length nearly the same extent as Winnipeg itself. They are united by the Waterhen river, which does not exceed 20 miles in length, and they discharge their waters into Winnipeg Lake by St. Martin's Lake and Dauphin River. The waters of all these lakes are carried off by Nelson River, which issues from the northern extremity of Lake Winnipeg, expands several times into lakes, and empties itself into Hudson's Bay, near the mouth of Hayes River, after a course of 350 miles in a straight line. The whole course of this river, including the Saskatchevan, and measured along its windings, is stated to be 1600 miles, or only about 250 miles less than that of the St. Lawrence.

The mouth of the Churchill river is west of Cape Churchill. This stream, which is also called the Missinnippi and English River, rises in Methye Lake, which is nearly 500 miles from its mouth in a direct line. Its winding course probably exceeds 700 miles. It expands several times into lakes, among which the largest is the Southern Indian, or Big Lake, which is upwards of 60 miles long, with an average breadth of 25 miles. It receives from the north the Deer River, or outlet of the Deer Lake, which from north to south is 90 miles long, with an average width of 25 miles. This lake receives a supply of water from Wollaston Lake by another short river; and as the Stone River, which issues from the last-mentioned lake, likewise carries a supply of water to the Athabasca lake, we find in this part of America a natural communication between two river systems, which discharge their waters in two different directions, like the Cassiquiare in South America. Wollaston Lake has a circular form, and its diameter is about 45 miles.

The largest river of this country is the Mackenzie. Its most southern branch is the Athabasca river, which rises on the eastern declivity of Mount Browne, and flows first in a general north-eastern direction, and then north until it falls into the western portion of Athabasca Lake. Lake Athabasca, called also the Lake of the Hills, is nearly 200 miles in length from east to west, and 14 to 15 miles in its general width. The river which issues from its north-western extremity is called Stone River, but at its confluence with Peace River it takes the name of Slave River. The Peace River rises on the western side of the eastern range of the Rocky Mountains, within 300 yards of the Tacootchtesse or Frazer River, which falls into the Pacific. Within the mountains it is a large stream navigable for boats, where it makes its way through a narrow gorge bounded by lofty mountains covered with eternal snow. (Richardson, *Fauna Boreali-Americana*.) It flows through the plains more than 300 miles in a direct line until it joins the Stone river. The united stream, called the Slave river, flows mostly in a northern direction to Great Slave Lake. Great Slave Lake is the largest of the numerous lakes of this country. It extends between 109° and 117° 30′ W. long., or about 250 miles from east to west, with an average breadth of 50 miles. It covers a surface of more than 12,000 square miles, or half the extent of Ireland, and is probably larger than Lake Ontario.

From the north-western corner of this lake issues the Mackenzie River, which varies in breadth from one to three miles, except in a few places, where it is narrowed by rocky hills. It flows first nearly west, declining by degrees to the west-north-west until it meets the Mountain River, or, as it is now commonly called, the southern branch of the Mackenzie. The remainder of its course lies to the north of north-west, until it reaches the Arctic Ocean, in 69° 10′ N. lat. At 67° 40′ N. lat. it begins to divide into several branches, which at their months occupy a space of more than 40 miles along the shores of the Arctic Ocean. The southern branch of the Mackenzie originates, like the Peace River, within the mountain-ranges of the Rocky Mountains, and probably less than 150 miles from the shores of the Pacific. Its upper course is little known, but it seems to make a great circuit before it leaves the mountains. East of the mountains it still runs about 200 miles. Near 60° N. lat. the Great-Bear-Lake River falls into the Mackenzie; it is the channel by which the Great Bear Lake discharges its water. This lake lies between 65° and 67° N. lat., and 117° 30′ and 123° W. long., and has a very irregular form, it probably covers an area of 8000 square miles. The Mackenzie River, including the Athabasca branch, traverses 15 degrees of latitude, and it is supposed that its whole course does not fall short of 2000 miles, which is more than that of the St. Lawrence.

East of the mouth of the Mackenzie and close to the shores of the Arctic Ocean is a great lake, called Esquimaux Lake, which communicates with the sea, and whose water is said to be brackish. It has not been visited by Europeans.

Besides the Mackenzie, the Coppermine River traverses the northern part of the countries, and falls into the Arctic Ocean. [COPPERMINE RIVER.] The last river which we shall mention is the Thleweechodezeth, or Back River, which obtained the latter name from Captain Back, who in 1834 discovered and descended it from 108° to its mouth (95° W. long.). In its course, which extends to more than 300 miles, it traverses the northern portion of the Barren Grounds, and forms several lakes. In the present state of our knowledge of these countries it is impossible to say whether the sea into which it falls is to be considered as a part of the Atlantic or of the Arctic sea. Its mouth is in 67° 15′ N. lat., and between 94° and 95° W. long.

We observed above, that the climate of the sterile region is much colder than Greenland under the same latitude. At Winter Island (66° 11′ N. lat. and 83° 30′ W. long.) the mean annual temperature does not exceed 6° 84′ of Fahrenheit; the maximum of heat observed is 54°, and the minimum −42°. At Fort Franklin, which is about 230 feet above the sea, and only one degree farther south (65° 12′ N. lat. and 132° 13′ W. long.), but situated in the Vale of the Mackenzie, the mean annual temperature is 17° 50′, the maximum of heat 80°, and the minimum −58°. But though the other parts are much less cold, the mean annual temperature even at Fort Chippewyan on the banks of Lake Athabasca (58° 43′ N. lat.) does not rise above the freezing-point, being 30°, whilst the maximum of heat is 97°, and the minimum −31°. At Cumberland House on the Saskatchevan (53° 57′ N. lat.) the mean annual temperature in only 32° 11″; the maximum heat 87°, and the minimum −44°. But at the last-mentioned place grain may be cultivated, as is proved by experience. Judging from the slight difference of temperature between Cumberland House and Fort Chippewyan we should conjecture that agriculture might be extended to the southern banks of Lake Athabasca, when the variations of the seasons with respect to agriculture are understood. In winter the country is, of course, covered with snow, but it is stated to be rarely more than 18 inches deep, which is considerably less than falls in the northern countries of Europe. The aurora borealis is a very common phenomenon in the northern parts of these countries, but it does not occur frequently about Lake Winnipeg.

Though a great portion of the country is covered with woods, and at several places iron, copper, lead, and coal, as well as salt and bitumen, have been discovered, the present wealth of the country consists in its animals, especially rein-deer, musk-ox, moose-deer or elk, different kinds of deer, bears, wolves, wolverines, foxes, beavers, otters, raccoons, and several smaller animals, which are killed either on account of their flesh or for their skins. The number of water-fowl is also very great, and fish is abundant in the numerous lakes which are dispersed over nearly all these countries.

The native tribes consist of Esquimaux and Indians. The Esquimaux occupy nearly the whole of the sterile region, on both sides of Hudson's Bay [ESQUIMAUX], and the latter wander about in the other regions. The southern tribes of the Indians belong to the Crees [CREES]; but the northern seem to have sprung from another stock. They all are divided into small tribes, rarely consisting of a hundred families, and yet each tribe occupies an immense tract of country. As they mainly rely for their subsistence on the produce of the chase, they are frequently exposed to starvation, which diminishes their numbers, or at least prevents their increase. The number of Europeans among them is considerable, and may amount to some thousands. They are either settled in the establishments of the Hudson's Bay Company, for the purpose of receiving the furs and forwarding them to the places of embarkation, or they travel through these countries for the purpose of collecting them. These travellers are commonly French Canadians, and are called *voyageurs*. Among the Europeans there is also a considerable number of half-breeds. The settlements of the Hudson's Bay Company are divided into two districts. The southern district comprehends the settlements on the East Main, or western coast of Labrador, together with the more numerous establishments in the countries enclosing James's Bay, and as far as the banks of the Albany River. The principal depôt is at Moose Fort, near the mouth of Moose River. The northern district comprehends all the others as far north as Fort Good Hope on the Mackenzie River, north of the Polar Circle. Its chief settlement is York, on the Hayes River.

Labrador was discovered by John Cabot in 1497, and it is probable that his son Sebastian entered and partly surveyed Hudson's Bay in 1512. It was re-discovered by Hudson in 1610. Meanwhile the French had colonized Canada, and from thence carried on an active fur-trade with the Indians inhabiting the countries west of Hudson's Bay. But in 1668 Prince Rupert sent a vessel to Hudson's Bay, which erected Fort Charles on the bank of Rupert's River in James's Bay. In 1670 the Hudson's Bay Company was incorporated, and it soon rose to prosperity. [FURS.]

(Hoarne's *Travel to the Coppermine River*; Mackenzie's *Voyages from Montreal to the Frozen and Pacific Ocean*; Franklin's *First and Second Journey to the Polar Sea*; Richardson's *Fauna Boreali-Americana*; Capt. Back, in the *London Geographical Journal*.)

HUDSON'S STRAIT connects Hudson's Bay with the Atlantic Ocean. It extends between 65° and 78° W. long., and 58° 30′ and 64° 36′ N. lat., and its general direction is nearly south-east and north-west. Its length is about 360 miles, and its mean width between 90 and 100, though it narrows at some places to less than 80 miles. Near the eastern entrance it widens to about 150 miles, the Bay of Ungava stretching far into the peninsula of Labrador. At the eastern entrance are Cape Cudleigh, in Labrador, and Hatton's Headland, on the island of Resolution, which is an extensive mass of high rocks, and uninhabited. The western entrance is formed by Cape Wolstenholme on the East Main, and King's Cape on the large island of Cumberland. The navigation of this strait is always difficult and dangerous, on account of the high and rocky coast which lines its shores, and still more so on account of the large masses of ice which are always met with there, and by which vessels are frequently beset for many days. It can only be attempted during the months of July and August. There are several islands in the Strait, which are mostly inhabited by Esquimaux.

HUDSON'S BAY COMPANY. [FURS AND FUR TRADE.]

HUE AND CRY was the old common-law process of pursuing with horn and voice all felons and such as had dangerously wounded another.

Though the term has in a great measure fallen into disuse, the process is still recognised by the law of England as a means of arresting felons without the warrant of a justice of the peace. [ARREST.] Hue and Cry may be raised either by the precept of a justice of the peace, or by a private person who knows of the felony; who should acquaint the constable of the vill with the circumstances and the person of the felon; though, if the constable is absent, hue and cry may be made without licence. When hue and cry is raised, all persons, as well constables as others, are bound to join in the pursuit and assist in the capture of the felon. A constable also who has a warrant against a felon may follow him by hue and cry into a different county from that in which the warrant was granted, without having the warrant backed. The pursuers are justified in breaking the outer door of the house where the offender actually is, and are not liable to any punishment or suit if it should appear that the hue and cry was improperly raised, but the person raising the hue and cry wantonly and maliciously may be severely punished as a disturber of the public peace. (Bl. *Com.*; Stephen's *Criminal Law*.)

HUERTA, VICENTE GARCIA, DE LA, was born in 1729, at Zafra in Estremadura. Actuated both by national and academic pride, he became, through his numerous poetical effusions, the successful leader of that reaction which in the middle of the last century took place in Spain against the exotic Gallic school, which had been imported with its new dynasty and was headed by his able adversary Luzan. The reputation of his fine tragedy, 'La Raquel,' which is a far superior composition to the short poem of the preceding century, with the same title, by Ulloa Pereyra, soon extended even to Italy, into which language it was translated, and where it was performed in 1780 at the theatre Zannoni of Bologna. It has however undergone the severest criticism of Bouterwek and others, who in other respects highly commend tne author. Huerta died at Madrid in 1797. Besides another inferior tragedy, partly taken from the 'Electra' of Sophocles, 'Agamemnon vengado,' he published 'Vocahulario Militar Español,' which portrays the great Spanish captains; 'Obras Poeticas,' 2 vols. 8vo., and a classical selection out of the amazing store of Spanish dramas, which he entitled 'Tbeatro Hespañol,' 16 vols. 8vo.

Huerta must not be confounded with his brother Pedro, the laborious author of the 'Commentarios de la Pintura Encáustica del Pincel,' and of 'De las Lineas de Apeles y Protogenes;' nor with another academician, Francisco Manuel de Huerta, one of the three editors of the 'Diario de los Literatos de España;' nor with Lopez de la Huerta, who wrote the 'Exameu de la Posihilidad de Fijar los Sinónimos de la Lengua Castellana.'

HUESCA. [ARAGON.]

HUET, PETER DANIEL, hishop of Avranches, was born at Caen on the 8th of February, 1630. He was originally intended for the profession of the law; but he is said to have been induced to devote his attention to subjects of general literature by the perusal of the 'Principles' of Des Cartes, and Bochart's 'Sacred Geography.' In 1652 he accompanied Bochart to Sweden, and was solicited hy the queen to settle in ber dominions. This offer however he refused, and returned to France, where he acquired so great a reputation that he was appointed in 1670 subtutor to the Dauphin. During the next 20 years he was principally engaged in superinteuding the publication of the edition of the classics which is usually known hy the name of 'In usum Delphini.' The first idea of this edition was started by the duke of Montausier; hut we are indehted to Huet for the plan and arrangement of the work. In 1674 he was elected a member of the French academy; and having taken orders in the Catholic church in 1676, at the age of 46 years, he was appointed to the ahbey of Aunay near Caen, where he composed the greater part of his works. In 1685 he was made bishop of Avranches, hut was not consecrated till 1692, in consequence of some disputes between the pope and the French government. He resigned his hishopric in 1699, in order to enjoy more time for study; and he obtained in exchange the ahbey of Fontenay near the gates of Caen. During the latter years of his life he lived principally at Paris in the Maison Professe of the Jesuits. He died on the 26th of January, 1721, at the age of 91.

The best known of Huet's works is his 'Demonstratio Evangelica,' which was published originally at Paris in 1679, and has since been frequently reprinted. This book, like most of Huet's other works, is written with more learning than judgment. The most important of Huet's other works are: 'De Interpretatione libri duo,' Paris, 1661; 'Origenis Commentarii in Sacram Scripturam,' Rouen, 1668, 2 vols. fol., reprinted at Cologne, 1685, 3 vols. fol.; 'Censura Philosophiæ Cartesianæ,' Paris, 1689, 1694, 12mo.; 'Quæstiones Alnetanæ de Concordia Rationis et Fidei,' Caen, 1690; 'De la Situation du Paradis Terrestre,' Paris, 1691, 12mo.; 'Huetii Commentarius de Rebus ad eum pertinentibus,' Amst. 1718, 12mo., of which tbe title page contains a curious instance of bad Latinity; 'Traité Philosophique do la Faiblesse de l'Esprit Humain,' published after the author's death, hy his friend the Abbé d'Olivet, Amst., 1723, 8vo.

HUGUENOTS was the name given to the early followers of the Reformed or Calvinist religion in France. The origin of the name has heen variously accounted for. It is said to be derived from the German word 'Eidgenossen' ('bound together by oath'), which was the uame assumed hy the confederate cantons of Switzerland, and which was afterwards adopted by those citizens of Geneva who promoted the alliance of that republic with the cantons of Fribourg and Bern, in opposition to the partisans of the duke of Savoy, who were called Mamelucs, *i.e.* slaves. The word Eidgenossen, heing transferred into the French language, was corrupted first into Eguenots, and lastly Huguenots. (Bérenger, *Histoire de Genève.*) When the Reformation began at Geneva, the party which favoured it, being in great measure the same which had supported the Swiss alliance, retained the appellation of Eguenots, or Huguenots, and as several of the early French reformers came from or were connected with Switzerland, and especially with Geneva, the name spread into France, and was applied to the partisans of religious reform during the times of religious war and persecution. The Catholics used the name of Huguenots as a word of reproach against heretics. The word is now obsolete, and has been replaced by that of 'Réformés,' which is given to the disciples of Calvin, or of the church of Geneva, in contradistinction to that of Lutherans, or Protestants, properly so called. The wars and persecutions of tho Huguenots are mentioned in the articles BARTHOLOMEW, ST.; CHARLES IX.; COLIGNY; and HÔPITAL, DE L'.

HULL, or KINGSTON-UPON-HULL, is a horough and county of itself, and one of the principal seaports of the United Kingdom. It is tbe chief town in the East Riding of Yorkshire, and is situated on the north side of the æstuary of the Humhor, where it is joined hy the river Hull. It is distant from London 174 miles north, from Beverley 9 miles south, from York 38 miles south-east. Hull returns two members to parliament. It has its old constituency of freemen, and it contains 3133 ten-pound bouses. The borough comprises the parishes of St. Mary, Holy Trinity, Sculcoates, Drypool, and Garrison-side, as well as other extra-parochial places within these parishes. The population may be thus stated:—

The town part of the town and county .	32,958
Sculcoates parish	13,468
	46,426
The county part	3,335
	49,761

For municipal purposes Hull is divided into seven wards, with fourteen aldermen and forty-two councillors.

History.—This place took its name of Kingstown from its purchase hy Edward I., who saw the great natural advantages of its position, and determined on the foundation of a fortified town and port. The researches however of a recent historian of Hull satisfactorily estahlish the fact that it was a place of considerable mercantile importance for more than a century prior to 1296, the date to which its foundation is usually referred. (See notices relative to the 'Early History of tbe Town and Port of Hull,' by Charles Frost, Esq., F.S.A.) The following circumstances indicate its early importance. From the fifteenth to the eighteenth years of Edward I. the duties on exports received at Hull amounted to nearly one-seventh of the aggregate sum received throughout the whole kingdom; and in tbe twenty-eighth of Edward I. it was appointed, hy a royal ordinance for establishing mints, one of the places for the erection of furnaces. Other proofs of its early mercantile importance might easily be offered. Several visitations of the plague, at intervals during the fifteenth, sixteentb, and seventeenth centuries, caused much suffering to the inhabitants. The visitation of 1635 was accompanied by famine, as tbe country people were afraid of bringing in supplies of provisions. At the hreaking out of the dissensions between Charles and the parliament Hull was a great depôt of arms. The authorities of the town refused to receive the earl of Northumberland, whom the king sent to take possession of the town in his name, and after some hesitation they admitted Sir John Hotham as governor, who was sent by the parliament. At this time the magazines of Hull contained more warlike stores than the Tower of London, and it was tbe policy of tbe parliament to have them conveyed to London. On the 23rd of April, 1642, Charles I., accompanied by his son, afterwards Charles II., with a train of from two to three hundred servants, and attended by many gentlemen of the county, set out from York to Hull, and wben within a few miles of the town sent an officer to inform the governor that be intended to dine with him that day. Sir John Hotham was not disposed to accept this honour, and he sent a message to the king humbly beseeching him to forego his intended visit, as the governor could not without betraying the trust committed to him open the gates to so great a train as his majesty was attended hy. The king then demanded entrance for himself and twenty of his followers. The governor pleaded the trust confided to him, at the same time declaring himself to he a faithful and loyal subject of his majesty. The king, finding that threats and entreaties were alike unavailing, retired to Beverley, where he lodged that night. The next morning he sent a herald to Sir John, summoning him once more to open the gates on pain of being proclaimed a traitor, and with a promise of forgiveness for the past if he complied. The herald proved unsuccessful, and the king returned to York grievously disappointed. This was the first act of hostility between the king and the parliament. A short time after this the king laid siege to the town, which was defended by Sir John Hotham and Sir John Moldrum, who was sent by the Parliament to his assistance. Sir John Hotham received overtures by means of Lord Digby for delivering up Hull to the king. His treachery was suspected by the Parliament, and they were induced to watch his movements. The appointment soon after of Lord Fairfax to the office of general of the parliamentary army in the north gave great umbrage to Sir John Hotham, and he was induced to seek opportunities to deliver up Hull to the Royalists. His son Captain Hotham joined him in this purpose. Sir John found means, when his designs became known, to escape to Beverley, where he was taken, and sent with his son to London; they were both charged with having traitorously betrayed the trust reposed in them by parliament, and were executed on Tower Hill. After these events Hull was again laid under siege by the marquis of Newcastle, and was successfully defended by Lord Fairfax and Sir John Meldrum. During the short period of excitement which terminated the Stuart dynasty and placed William III. on the throne of England, Hull was again a scene of warlike activity. The town, fort, and citadel were in the hands of the Catholic party. But measures were concerted and acted upon with such decision and promptitude that the governor was taken in his quarters before he had even heard of such a design. The anniversary of this event is still celebrated by the name of *the town-taking day*.

Commerce.—The exports of Hull formerly were chiefly wool, woolfels, and leather; its imports wine and timber. At present the coasting-trade, of which Hull has a greater share than any other port in the kingdom, except London, is one of its chief branches of profit. It has also an extensive commerce with the Baltic, with the north of Germany, Holland, and Denmark. The Greenland fishery owed its revival, about 1766, and its subsequent importance, to the mercantile enterprise of Hull. The facilities of communication between Hull and the interior of the kingdom are numerous; the Ouse, Trent, Aire, and Calder, all communicate with the Humber, and these means of internal communication are extended by the Leeds and Selby railway, and will be again augmented by the continuance of the line from Selby to Hull, a work which is at present in progress. It is computed that the manufactured goods, coal, stone, &c., yearly introduced into Hull from the West Riding of Yorkshire alone, amount in value to at least five millions sterling. In some years within the present century more than sixty ships left Hull for the whale fisheries of Greenland and Davis's Straits. Since 1819 this number has been gradually diminishing; in 1834 twenty-seven ships were sent out, and the number has continued to decrease since that time, though Hull may still be regarded as the principal seat of the northern whale-fishery. The establishment of Goole as a port, about twenty miles up the Humber, has caused the general commerce of Hull to decline in a slight degree since the year 1828. Within the last few years Hull has become a principal steam-packet station. These packets may be classed as sea-packets and river-packets. Of the former eight are constantly employed between Hull and London; seven between Hull and Hamburg; three between Hull and Rotterdam; and four between Hull and Newcastle. Ocean-steamers to Berwick, Aberdeen, and Yarmouth also pass between these places and Hull at regular intervals. The river-packets and steam-tugs are more than twenty in number. They go to Gainsborough, Selby, Goole, York, Barton, New Holland, Thorne, and Grimsby. The prosperity of Hull has been greatly increased by the progress of steam-navigation, and it may be considered as the second great centre of this mode of transit on the eastern coast.

The Docks.—The Old Dock was formed in 1775; its length is 1703 feet, breadth 254 feet, and depth 24 feet; its wharfs and quays occupy an area of 13 acres; the entrance to it is from the river Hull, a little higher than that part of it called the Old Harbour. The Humber Dock, at the west part of the town, was commenced in 1807; its length is 914 feet, breadth 342 feet, and depth 31 feet: the wharfs cover a space of more than 10 acres. The Junction Dock was commenced in 1826, and completed in 1829; as its name imports, it connects the Old Dock and the Humber Dock. Its dimensions are as follow: length 645 feet, breadth 407 feet, area 29,191 square yards; it will contain 60 square-rigged vessels. The area of the quays is 15,643 square yards; the locks are 120 feet long, 36 feet broad, and 25 feet deep; the two bridges are each 24 feet wide. It may here be remarked, that the Hull docks occupy the site of the antient fortifications, and encircle the part which was the old town with water in place of its former walls. Attached to the Humber Dock is a capacious basin, with its piers. This spot is the focus of the extensive traffic occasioned by the steam-packet trade. Hundreds of passengers land here daily, for whose accommodation the extension of the piers to low-water mark would be an improvement so obvious, that its accomplishment may be looked for at no very distant time.

Manufactures.—The manufactures of Hull are neither numerous nor extensive. The expressing and refining of oil from linseed is effected by wind-mills and steam-mills; the residue of the seed is prepared as food for cattle· rape-oil is also refined by similar means. There is a large sugar-house, a soap manufactory, several white-lead works, ship-builders' yards, turpentine and sail-cloth manufactories, extensive ropewalks, and several breweries. A flax and cotton mill has recently been erected on a large scale, which at present employs 200 persons; when completed it will employ 500. New lines of houses for the workpeople have risen up in the neighbourhood of this factory.

Public Buildings.—The public buildings connected with the trade and commerce of Hull are the custom-house, the dock-office, the pilot-office, the excise-office, the exchange, the post-office, the stamp-office, the corn-exchange, and several banks. The establishments connected with the internal economy of the town are the waterworks, the gas-works, the public baths, the shambles, the savings' bank, and the fire-engine establishment. The mansion-house is a plain brick edifice, at the rear of which is a court-house, and a building for the court of requests: the other law-courts are the county court, and the court of venire for determining civil causes, which has a jurisdiction extending to the town and county of Hull. The quarter-sessions are held in the Guildhall. The new gaol and house of correction is in Kingston Street on the Humber bank; it cost 22,000*l.* The prisoners are classed according to their age, sex, and degrees of delinquency, and they are kept employed. Crime and mendicity have been much checked by the establishment of a new police on the system of the metropolis. The citadel, which is on the east bank of the river Hull, at its junction with the Humber, is surrounded by a wall, with ramparts and ditches, and is occupied by a regular garrison. The magazines are capable of containing 20,000 stand of arms, and ordnance stores for twelve or fifteen sail of the line. There is a handsome equestrian statue of William III. in the Market-place, which is covered with leaf gold. The Wilberforce Memorial is a fine fluted Greek Doric column, which stands on a square pedestal, on each side of which is a wreath and an inscription: the inscriptions state that the first stone of this memorial was laid on the 1st of August, 1834, the day on which negro slavery was abolished, and that it was erected by voluntary subscription. Above the capital of the column is a small circular pedestal, on which stands a statue of Wilberforce in his senatorial robes. The column with the figure is 80 feet high. This monument was executed by Messrs. Myers and Wilson of Hull.

Education.—The educational charities are—the Trinity House school for 36 boys, who receive a nautical education; the Vicar's school for 50 boys; Cogan's charity-school for 40 girls; the national school, which is open to children of all denominations, and which contains 400 children of the two sexes; the Sculcoates and Drypool national schools, each of which contains upwards of 300 children; the Catholic free-school, which is attended by nearly 100 children; the British and Foreign school, which will accommodate nearly 500 children; the Savings' Bank school, which is mainly supported by the managers of that institution, and which contains about 250 children; and the Sunday-schools which are attached to the various denominations of Christians, and which have under their charge several thousands of children. The free grammar-school was founded by Bishop Alcock, a native of Beverley, in 1486. [BEVERLEY.] Originally the sons of freemen received a classical education at this school on the payment of 14*s.* per annum; at present there are no classical scholars, and the more common branches of learning are taught. Many men who have risen to eminence received some part of their education here, among whom may be named Andrew Marvell, Dr.

Watson, bishop of Llandaff, and William Wilberforce. The educational wants of the town have given birth to two new proprietory institutions, one of which is denominated the Hull College, and the other the Kingston College. The latter is exclusively for education on the principles of the Established Church; the other is open to all. Both are in full operation; Hull College has 109 pupils, and Kingston College 129. Both have preparatory schools attached to them, where it is intended that the better parts of the infant system shall be carried out. The other educational institutions of Hull are the Literary and Philosophical Society, which possesses an excellent museum; the Mechanics' Institute, which has a good library of nearly 2000 volumes; the Hull Subscription Library of 15,000 volumes, and of which there is an admirably-classified catalogue published; and the Lyceum Library, containing 5000 volumes. The Hull Philosophical Society occupies a part of a splendid pile of buildings in Kingston Square. These rooms were erected for public meetings, concerts, and lectures. Hull has several musical societies, and a convenient theatre.

Medical Institutions.—The General Infirmary of Hull was commenced in 1782. The present building is of brick with stone dressings; it has accommodations for 70 in-patients. On the lawn in front of the building is a neat monument in memory of the late Dr. Alderson, by William Westmacott, jun. The other medical institutions are the Dispensary, established in 1814, the Refuge for the Insane, the Dispensary for Diseases of the Eye and Ear, and the Hull and East-Riding School of Medicine and Anatomy. The Botanic Garden, established in 18tt, is about a mile from the town, comprises five statute acres, and is the property of 800 shareholders.

Places of Worship.—The Holy Trinity church is the most antient in Hull, and is said to be one of the largest parochial edifices in the kingdom. It is 272 feet long from east to west; the length of the nave being 144 feet; the breadth of the nave of the transept under the tower is 28 feet; and the length of the chancel is 100 feet; the breadth of the nave of the church is 172 feet; the length of the transept 96 feet; and the breadth of the chancel 70 feet. The transept is of brick, covered with composition, and is said to be the oldest brick building, not Roman, in England.* This church is thus mentioned by Rickman, in his 'Gothic Architecture:'—'The east end to the street is decorated. It is a cross church, and in the centre has a very lofty and beautiful tower. The western part is perpendicular, of good character, remarkably light, and with very small piers. The transepts are of very early decorated work, and the great window of the south transept is curious from its tracery and mouldings. Only a part of the nave is pewed; the chancel is open and has a very fine effect; there is in it a decorated monument, with rich canopy and buttresses, and some niches and stalls; there is also some wood screen-work. The font is large, and much enriched.' The other churches are those of St. Mary's, St. John's, the Mariners' church, the parish churches of Drypool and Sculcoates, St. James's church, and Christ church. Of dissenting chapels, the Unitarians, Swedenborgians, Primitive Methodists, New Connexion Methodists, Church Methodists, Catholics, Friends, and Jews, have each one; the Baptists have three, the Wesleyans four, and the Independents six; there is also a floating-chapel, at which service is gratuitously performed by the Methodist, Independent, and Baptist ministers.

The endowed charities which have not yet been enumerated are the Charter-house, which has fifty-seven apartments for as many poor persons; and the following hospitals or almshouses—Gregg's, Harrison's, Ratcliff's, Weaver's, Crookhay's, Gee's, Lister's, Crowle's, and Watson's. Each of these establishments receives a certain number of poor and aged persons, from six to fourteen, and provides them with a residence, a small weekly sum of money, and other advantages. The other charities are the Lying-in Charity, the Poor and Strangers' Friend Society, the Benevolent, and the Clothing Societies.

The persons of eminence connected with Hull are: the De la Poles, afterwards dukes of Suffolk; Luke Foxe, who revived the attempt to discover a north-west passage in 1631; Andrew Marvell, admiral Sir John Lawson, commodore Edward Thompson, John Mason, the poet, Benjamin Thompson, the translator of the 'Stranger' and many other German dramas, Daniel Sykes, and William Wilberforce. (This article is drawn chiefly from Tickell's *History*; Frost's *Notices*; and Greenwood's *Picture of Hull*; and assisted by original communications.)

* The revival of the art of brick-making has generally been attributed to Hull. In 1321 William de la Pole had, without the north gate of the town, a tilery or brick-yard.

HUMÂIÛN, NESIR-EDDIN MOHAMMED, the son of Baber, and the second emperor of the Tartar, or as it is more usually called, the Mogul dynasty in Hindustan, was born at Cabul, A.H. 913 (A.D. 1508). He accompanied his father Baber in his invasion of Hindustan, A.H. 932 (A.D. 1525), and commanded the right wing of the army in the decisive battle of Panipat, in which the Afghan Sultan Ibrahim Lodi was entirely defeated. After this battle, Humâiûn was sent against two Afghan chiefs, who had assembled an army of forty or fifty thousand men east of the Ganges; and after having defeated them he rejoined the army of Baber, and was present at the battle fought with the native Hindu princes at Biana near Agra, in which he greatly distinguished himself.

Humâiûn ascended the throne on the death of Baber, A.H. 937 (A.D. 1530). Humâiûn does not appear to have possessed that energy and decision which characterized his father; in consequence of which the native princes of Hindustan quickly renounced their allegiance to the Mogul dynasty. Humâiûn was however at first successful in reducing them to subjection; Bahadur, the powerful monarch of Gujerat, was conquered; and the Hindu princes were defeated in Bengal. But while he was employed in reducing these provinces, Shir Khan, the Afghan governor of Bahar, revolted against him. A battle was fought between them on the banks of the Ganges A.H. 947 (A.D. 1540); in which Humâiûn was entirely defeated, and obliged to retreat to Lahore. Soon after this he was deserted by his brothers Kamrân and Hindal; and after wandering for a year in the neighbourhood of the Indus, exposed to many hardships and dangers, he at length took refuge in the territories of Tahmâsp Mirzâ, king of Persia; who received him most hospitably, and assisted him with troops to enable him to recover his dominions. In A.H. 952 (A.D 1545) he again entered Cabul; and was engaged for several years in a contest with Kamrân, who, though repeatedly conquered and as often pardoned by Humâiûn, did not cease making war against his brother till he was deprived of his eyes. In A.H. 962 (A.D. 1554-5) Humâiûn marched against Sekunder, the Afghan emperor of Delhi; and after defeating his forces near the river Sutlej, and at Sirhind (28th of June, 1555), he again obtained possession of that part of Hindustan, which had been conquered by Baber. Humâiûn died on the 11th of the month Rubby al Avul, A.H. 963 (21st of January, 1556), in his 48th year, in consequence of a fall from the terrace of his palace. He was succeeded by his son Akbar.

Humâiûn was distinguished by a greater love of justice and humanity than we usually meet with in Oriental sovereigns. He frequently pardoned his brothers who rebelled against him, and was with great difficulty persuaded to consent to the punishment of Kamrân. We are informed by Ferishta, that 'he devoted himself to the sciences of astronomy and geography, and not only wrote dissertations on the nature of the elements, but had terrestrial and celestial globes constructed for his use.' He also wrote several poems, which were extant in the time of Ferishta.

An interesting account of the life of Humâiûn is given in the 'Tezkereh al Vakiât, or Private Memoirs of the Mogul Emperor Humâyûn, written in the Persian language, by Jouher, a confidential domestic of His Majesty;' of which an English translation has been published by Major C. Stewart, Lond., 1832. See also Ferishta's 'History,' translated by Lt.-Colonel Briggs, vol. ii., pp. 70-97; 154-180.

HUMBER. [YORKSHIRE.]

HUMBLE-BEE. The technical characters of the insects called humble-bees are given under the head BOMBUS; in the present article the habits and economy of the species are all that remain to be noticed.

In the autumnal months, when the cold weather begins to be felt, and the various honey-yielding flowers disappear, the male and neuter humble-bees die, having performed their allotted task, which, as far as we can discover, appears to be that of fecundating certain plants, by conveying the pollen from the male to the female flowers; a task which is unavoidably accomplished by their visiting different flowers for the purpose of collecting honey and pollen to rear their young. Some female humble-bees also die, whereas others (probably those only which had been reared in the previous summer) seek a convenient spot in which they may pass the winter as little exposed to the cold as possible; sometimes in rotten wood of old pollard trees, and sometimes in moss, or among dead leaves, or in fact in almost any situation which will afford the desired protection. Here they remain in a torpid state and without food. The warmth of the spring causes these females again to make their appearance, and having been impregnated the previous autumn, they seek a convenient spot wherein they may construct their nests. Grassy banks are the localities most frequently chosen for this purpose, but various situations, and even a difference of soil apparently, are selected by the different species of humble-bees; for we observe certain species abounding more in one situation than another, and that in places distant from each other but similar in character. The nests are sometimes built upon the ground, but most generally they are in a hole excavated by the bee. These excavations vary in depth and form, even though made by the same species of bee. In their construction the animal uses its jaws to dislodge the particles of earth, which are then, by means of the anterior pair of legs, passed backwards to the hinder pair, which perform the same office: but as the burrow becomes deeper, the whole body of the bee is used to eject the grains of soil. In saying that the humble-bees form the burrows in the ground in which we find them, we speak upon the authority of Réaumur, for although we have frequently observed the female bee commence removing particles of earth, apparently with intent to make such an excavation, upon returning to the same spots after a sufficient interval of time, the work was always abandoned. Huber, who paid much attention to these insects, says, 'I have not discovered in what manner they excavate the holes which lead to their nests, nor do I know how they form the vaults in which they are placed, neither am I aware whether they always construct these vaults themselves, or whether they do not sometimes avail themselves of the holes made by moles or other animals.' Upon consulting some other authors, these points appear to be treated of in too vague a manner. When a small cylindrical but generally tortuous gallery is formed, it is terminated by an arched chamber of considerable extent, and it is in this chamber that the nest is constructed. Those species which do not burrow in the ground choose a situation in which the herbage is sufficiently thick to afford shelter, and there form on the surface of the ground an arched chamber of moss thickly matted together. In what manner the female first commences the interior arrangement of her nest, and how she brings up her young whilst in her solitary state, Huber and some of the earlier authors did not ascertain; we are indebted to M. le Comte Saint-Fargeau* for this portion of the present history. This author informs us that having collected a quantity of pollen and honey, these substances are formed by the female humble-bee into a ball, in which the eggs are deposited, so that when the eggs are hatched, the larvæ are surrounded by the substance, which serves them both for food and protection. The balls generally contain numerous eggs, and consequently, when these are hatched, numerous larvæ. Réaumur found them to vary from three to thirty. Each larva feeding upon the food nearest to it, the original crust of their enclosure becomes thin, and the parent insect then takes care to add fresh alimentary paste to the weakest parts. When the larvæ are full grown each one encloses itself in a silken cocoon of an oval form and placed always in a perpendicular position. A certain number of neuters, or workers, having undergone their final transformation, the nest is enlarged, and an inner coating of wax is attached to it, and in those nests which are constructed with moss the particles of wax are so amalgamated with it, that a portion of the moss cannot be removed without injuring the interior more or less. Wax is also used by the workers in the construction of little cells for the reception of honey. Each species of humble-bee makes these cells, as Huber informs us, in a different manner; some construct them on the top of the cocoons and of a half oval form, others build them of an egg-shape with the apex truncated. In some again they resemble the first, but have a ring of wax within the top. The next variety is almost a perfect oval, having but a small opening at the apex. Lastly these humble-bees show, says Huber, 'that they are not inferior to the hive-bee in the art of economy. Between four honey-pots there would necessarily be a vacant space; but this is occupied by a fifth reservoir, which is not of the same form as those by which it is surrounded, but sometimes approaches to a square,' &c.*

The male humble-bees are not reared till late in the season, and do not appear in any abundance till the autumn. As in the case of the hive-bee therefore, they take no part in the duties of rearing the young, which it appears are almost entirely under the protection of the neuters as soon as they are hatched.

When the nest is tolerably well peopled, it presents a mass of oval cocoons, spun by the larvæ as before described interspersed with which there are numerous masses of an irregular but generally somewhat rounded form, and of a brown colour: some of the largest are about the size of a small walnut. Each of these masses encloses either egg or larvæ, and is composed of pollen mixed with honey. To these must be added the little honey-pots which are irregularly interspersed with the cocoons.

HUMBOLDTINE, mineral oxalate of iron. This substance occurs crystalline and massive; the crystalline form is undetermined. Fracture uneven, earthy; colour brightish yellow; devoid of lustre; opaque. Specific gravity variously stated from 1·3 to 2·13. Hardness sufficient to scratch gypsum, but is scratched by mica.

It is insoluble in water, but dissolves in nitric acid without effervescence, and imparts a yellow colour to it.

The massive variety occurs in small, flattish, reniform pieces, of a fine earthy structure; colour greenish yellow.

Analysis by Rivero:—

Oxalic acid . .	46·14
Protoxide of iron.	53·86
	100

HUMBOLDTITE. This mineral is a *boro-silicate of lime*, and is therefore a variety of *datholite*, unless indeed it be identical with it, which has been supposed to be the case. It occurs crystallized. Primary form an oblique rhombic prism; cleavage parallel to the oblique diagonal of the prism; fracture conchoidal; hardness 4·5, 5·0; colour white and yellowish white; streak white; lustre vitreous, transparent, translucent; opaque. Specific gravity 2·99.

Found in the Tyrol, in the Harz, in North America, and near Edinburgh.

HUME, DAVID, was born at Edinburgh on the 26th of April, 1711. His father's family was a branch of that of the earl of Home, or Hume; but it was not a wealthy family, and Hume, being besides a younger brother, inherited but a slender patrimony. He was destined by his mother (his father had died when he was very young) for the profession of the law; but for this he showed no inclination, and it was eventually given up. The following is his own account of the matter. 'I passed through the ordinary course of education with success, and was seized very early with a passion for literature, which has been the ruling passion of my life, and the great source of my enjoyments. My studious disposition, my sobriety, and my industry, gave my family a notion that the law was a proper profession for me; but I found an insurmountable aversion to everything but the pursuits of philosophy and general learning; and while they fancied I was poring upon Voet and Vinnius, Cicero and Virgil were the authors which I was secretly devouring.'

We proceed with quotations from his autobiography. 'My very slender fortune however being unsuitable to this plan of life, and my health being a little broken by my ardent application, I was tempted, or rather forced, to make a very feeble trial for entering into a more active scene of life. In 1734 I went to Bristol, with some recommen-

* 'Histoire Naturelle des Insectes—Hymenoptères,' tom. i.

* The above is the meaning of the paragraph of the author quoted, but is not a close translation. The original will be found in the 6th vol. of the Linnean Society's 'Transactions,' page 275. The paragraph is of importance, since it shows that when one cell is placed in contact with others, and the space is confined, it assumes an angular form, the number of sides depending on the number of cells with which it is in contact, and so far helps to confirm the new theory of the construction of the honey-comb detailed in the article BEE. Since that article was written, the author has examined numerous specimens of honey-comb, and has observed an instance in which a cell, larger than usual, had assumed a seven-sided figure; others again which were pentagonal, and one which was four-sided: in all instances consistent with the number of cells surrounding, and with the theory that the angular form arises from the circumstance that the typical form of the cell is oval or nearly so, but that the natural diameter intersecting those of surrounding cells, a straight partition is produced. In the case of the hive-bee there is reason to believe that if all the cells were constructed separately, they would resemble those of the queen-bee. This idea is not suggested in the article before-mentioned, but has occurred upon examining the mode of constructing a cell in a species of bee allied to the hive-bee. It is generally the case that when an insect constructs a *free* cell, it approaches more or less to an oval form; but if the cell be *excavated* (as in the supposed case of bees excavating their cells in a solid mass of wax), it would be of a cylindrical form; the body of the animal being confined in its movements,

dations to eminent merchants, but in a few months found that scene totally unsuitable to me. I went over to France with a view of prosecuting my studies in a country retreat, and I then laid that plan of life which I have steadily and successfully pursued. I resolved to make a very rigid frugality supply my deficiency of fortune, to maintain unimpaired my independency, and to regard every object as contemptible except the improvement of my talents in literature.' He first went to Rheims, and thence to La Flèche in Anjou; and at these two places, but chiefly at the latter, he composed his 'Treatise of Human Nature.' He returned to London in 1737, and published his treatise the year after. 'Never,' he observes, 'was literary attempt more unfortunate than my "Treatise of Human Nature." It fell dead-born from the press, without reaching such distinction as even to excite a murmur among the zealots.' But the disappointment did not affect him much or long; and going to Scotland to his brother's house, he there prosecuted his studies with vigour. In 1742 he published at Edinburgh the first part of his Essays, which was on the whole favourably received, and the success of which consoled him in some measure for the failure of his first literary attempt.

In 1745 Hume went to live with the marquis of Annandale, whose state of mind and health was such as to require a companion. He lived with him a twelvemonth, and received, it appears, a handsome salary. He had immediately after an invitation from General St. Clair to attend him as secretary to his expedition, which was at first intended against Canada, but ended in an incursion on the coast of France. Hume took the appointment, and the next year, 1747, went as secretary to the same general in his military embassy to the courts of Vienna and Turin. 'These two years were almost the only interruptions which my studies have received during the course of my life; I passed them agreeably and in good company, and my appointments, with my frugality, had made me reach a fortune, which I called independent, though most of my friends were inclined to smile when I said so; in short, I was now master of near a thousand pounds.'

On his return to England he went again to his brother's house, and living there two years, composed his 'Political Discourses,' which formed the second part of his Essays, and his 'Enquiry concerning the Principles of Morals.' These two works were published in 1752, the first in Edinburgh, and the second in London.' Of the first he tells us that it was 'well received abroad and at home;' but the other 'came unnoticed and unobserved into the world.' In the same year he was appointed librarian to the Faculty of Advocates, an office which was unattended with emolument, but which, as he tells us, gave him the command of a large library. He now formed the plan of writing the History of England. 'Being frightened,' he says, 'with the notion of continuing a narrative through a period of 1700 years, I commenced with the accession of the House of Stuart, an epoch when, I thought, the misrepresentations of faction began chiefly to take place.' Priding himself much on his own impartiality, he was bitterly disappointed when, on the appearance of the first volume, he was accused on all hands of onesidedness. 'I was assailed by one cry of reproach, disapprobation, and even detestation; English, Scotch, and Irish, whig and tory, churchman and sectary, freethinker and religionist, patriot and courtier, united in their rage against the man who had presumed to shed a generous tear for the fate of Charles I. and the earl of Strafford; and after the first ebullitions of their fury were over, what was still more mortifying, the book seemed to sink into oblivion. Mr. Millar told me that in a twelvemonth he sold only forty-five copies of it.* * * I was, I confess, discouraged; and had not the war been at that time breaking out between France and England, I had certainly retired to some provincial town of the former kingdom, have changed my name, and never more have returned to my native country. But as this scheme was not now practicable, and the subsequent volume was considerably advanced, I resolved to pick up courage and persevere.'

In the interval between the appearance of the first and that of the second volume of his History, he published his 'Natural History of Religion,' against which a violent pamphlet was written by Dr. Hurd. The second volume of the 'History of England,' which embraced the period from the death of Charles I. to the Revolution, was published in 1756. 'This performance,' he says, 'happened to give less displeasure to the whigs, and was better received. It not only rose itself, but helped to buoy up its unfortunate brother.' 'The History of the House of Tudor' was published in 1759; and the two volumes, containing the earlier English history, which completed the work, in 1761.

At this point in his autobiography, he remarks: 'Notwithstanding the variety of winds and seasons to which my writings had been exposed, they had still been making such advances, that the copy-money given me by the booksellers much exceeded anything formerly known in England; I was become not only independent, but opulent. I retired to my native country of Scotland, determined never more to set my foot out of it; and retaining the satisfaction of never having preferred a request to one great man, or even making advances of friendship to any of them.' His determination was not long adhered to. He received in 1763 an invitation from the earl of Hertford to accompany him on his embassy to Paris, with a near prospect of being appointed secretary to the embassy, and, in the meanwhile, of performing the functions of that office. He at first declined the offer, but, on its being repeated, he availed himself of it. At Paris, as was to be expected, his literary fame brought him much attention; and he was greatly delighted with his residence there. When Lord Hertford was, in 1765, appointed Lord Lieutenant of Ireland, Hume remained at Paris as *chargé d'affaires* till the arrival of the duke of Richmond. He returned to England in the beginning of 1766, and the year after was appointed Under-Secretary of State. He held this appointment about two years, and then returned to Edinburgh. 'I returned to Edinburgh,' he says, 'in 1769, very opulent (for I possessed a revenue of 1000*l.* a year), healthy, and though somewhat stricken in years, with the prospect of enjoying long my ease, and of seeing the increase of my reputation.'

In the spring of 1775 he was attacked by a disorder in his bowels, which at first caused him no alarm, but which ultimately carried him off. In the spring of 1776 he was recommended to go to Bath, to try the effect of the waters; and just before making the journey he wrote this autobiography from which we have quoted so largely. The waters were of no avail, and he shortly returned to Edinburgh, thoroughly resigned to his fate. He died on the 25th of August, 1776, in his 66th year.

Together with Hume's autobiography was published, shortly after his decease, a letter from Dr. Adam Smith to Mr. Strachan, giving an account of his last days and of his death. He died composed, and as one without fear. Of Hume's personal character, Dr. Smith, who was one of his chief friends, speaks in that letter thus: 'His temper seemed to be more happily balanced, if I may be allowed such an expression, than that perhaps of any other man I have ever known. Even in the lowest state of his fortune, his great and necessary frugality never hindered him from exercising, upon proper occasions, acts both of charity and generosity. The extreme gentleness of his nature never weakened either the firmness of his mind or the steadiness of his resolutions. His constant pleasantry was the genuine effusion of good-nature and good-humour, tempered with delicacy and modesty, and without even the slightest tincture of malignity, so frequently the disagreeable source of what is called wit in other men. It never was the meaning of his raillery to mortify. . . . . And that gaiety of temper, so agreeable in society, but which is so often accompanied with frivolous and superficial qualities, was in him certainly attended with the most severe application, the most extensive learning, the greatest depth of thought, and a capacity in every respect the most comprehensive. Upon the whole, I have always considered him, both in his lifetime and since his death, as approaching as nearly to the idea of a perfectly wise and virtuous man, as perhaps the nature of human frailty will permit.'

As an author, Hume is to be viewed principally in two ways, as an historian and as a philosopher. The merits and the demerits of his history are generally very well known. It is written in a very easy and animated as well as thoughtful and philosophic style; but on the other hand it is disfigured by partiality, misrepresentation, and want of accuracy. He could not tolerate the labour of research into original documents, and he had not sufficient knowledge of the subject to indicate the steps by which the constitution has attained its present form, and the effect which successive enactments have had on the fundamental laws of property. As a philosopher, it has been observed that Hume is acute and ingenious, but not profound; and the remark is just, if applied to what he has done, rather than to what he perhaps might have accomplished. His treatises contain no complete system of any branch of philosophy; and the separate essays are chiefly valuable for acute observations and just deductions expressed in clear, concise, and appropriate words. Many of them will suggest further matter for reflection, though we think that few can be viewed as possessing the character of completeness. His observations on Association have been already referred to under that article. In his essay on Miracles, the ingenuity and the value of his remarks on evidence are generally admitted, even by those who do not follow him in all the consequences which he would deduce from them. It seems to have been the fate of this essay to have been to a certain extent misunderstood, even by those who would not quarrel with the author simply for the consequences which flow from his principles of evidence. As a political writer, Hume cannot be ranked in the first class. The justness of many of his strictures on the absurd fiction of the 'Original Contract,' as applied to any existing government, stands in striking contrast with his admission of an original contract, as expressed in the following terms: 'The people, if we trace government to its first origin in the woods and deserts, are the source of all power and jurisdiction, and voluntarily, for the sake of peace and order, abandoned their native liberty and received laws from their equals and companions.' An assertion so monstrous, so unsupported by any evidence, and expressed in words involving so many assumptions and contradictions, is not a little surprising in a man who wrote the remainder of this essay. To many of the literary essays of Hume we should assign a higher degree of merit than perhaps, at the present day, most people are disposed to give them. They appear to us to contain many most important truths expressed with great felicity; and if they seldom or never exhaust the subject, they perhaps always dispose the reader to further investigation. In his 'Enquiry concerning the Principles of Morals' he has made many ingenious elucidations of the principle of utility, as the fundamental principle of morals, but he has at the same time admitted a principle of conscience, independent of that principle of utility.

The editions of Hume's History are innumerable; and, as is well known, it now always goes along with that of Smollett. In the last edition which has been published, the narrative is carried on to the present time, from where Smollett left it, by Mr. Smart Hughes of Emmanuel College, Cambridge. The best edition of Hume's philosophical works is one published in Edinburgh, in 1826, in 4 vols. 8vo.

HUMITE. This mineral occurs in attached crystals, the primary form of which is a right rhombic prism. Cleaves readily parallel to the base of the primary form. Fracture uneven. Hardness 6·5 to 7. Scratches glass readily. Colour, various shades of yellow and brown, sometimes nearly colourless. Translucent, transparent. Streak white. Lustre vitreous. Heated by the blow-pipe, it becomes opaque, but is not fusible; with borax it gives a transparent glass.

HUMMEL, JOHANN-NEPOMUK, a composer and performer highly distinguished during the present century, was born at Presburg, in 1778. At a very early age he received instructions in music from his father, a master at the military institution of Wartberg, and evinced so decided a talent, that, when he had scarcely completed his seventh year, he was sent to Vienna, and placed under Mozart, who, though he had a natural repugnance to teaching, took so promising a genius into his house as a pupil, where he remained two years, and imbibed much of the knowledge and laid the foundation of that fine taste which at a later period of life were developed in so striking and profitable a manner. In his tenth year he set out on a visit to the principal cities of Germany, Denmark, and Holland, and reached London in 1791, where he was much noticed, and had the honour to perform at Buckingham House before the royal family.

At the expiration of six years, Hummel returned to Vienna, pursued the study of composition under Albrechtsberger, and further improved himself by friendly intercourse with Salieri. In 1803 he engaged in the service of Prince Esterhazy; and a few years after, when the Imperial Theatre fell into the hands of some noblemen, with that wealthy and powerful prince at their head, Hummel took an active part in the management, and produced several successful operas. In 1811 he withdrew from the prince's establishment, and wholly dedicated the next five years to the lucrative branches of his profession.

In 1816 he became Kapellmeister to the king of Würtemberg, in whose service he remained till the year 1818, when he engaged himself in the same capacity to the grand-duke of Weimar, which appointment he retained to the close of his life. But his duties at the court of Weimar were not of a nature to prevent his frequent journeys to other countries. In 1821 he made a very profitable visit to Petersburg and Moscow, and two years after to Amsterdam. In April, 1830, M. Hummel arrived in London, and immediately gave a concert at the Hanover-Square Room, which was so crowded, and his performance of his own compositions made so great a sensation, that it was followed by two other concerts in May and June, which were as fully attended as the first. This success induced him to return in the spring of the following year, when he also gave three concerts; but trusting too much to his individual exertions, they proved rather less attractive than those of the preceding season. In 1833 he repeated his visit to London, and a single concert convinced him that his popularity had deserted him; he was no longer new, and had no connection to supply the want of that novelty for which in our fashionable circles there is so insatiable a thirst. M. Hummel returned to Weimar, and had the order of the White Eagle conferred on him. He died, of water on the chest, in October, 1837, leaving a widow and two sons amply provided for by a good fortune acquired by his talents and accumulated by his prudence.

M. Hummel's compositions are very numerous. Of his operas, *Mathilde von Guise* is the best; and in his two masses—in D minor and E flat—are clever and charming movements. But his reputation will rest on his piano-forte works. Some of these will not soon be forgotten, particularly his beautiful and masterly concerto in A minor. He certainly was an imitator of his master, Mozart, and not over scrupulous in adopting the ideas of others; but, says the *Harmonicon*, from which work the remainder of this article is quoted, changing the present into the past tense, 'Like a man of taste, he interwove them so skilfully with his own, that there is nothing heterogeneous in the composition of the whole. As a performer, he was master of all styles, but excelled more in the brilliant than the pathetic, though he never carried the former to excess. . . . The strength, and still more the equality, of his fingers, were among the distinguishing features of his playing; and the pendulum-like accuracy of his time was too remarkable not to be noticed by all who heard him. . . . His execution was perfect, but his good sense taught him that great velocity renders it next to impossible to discern the delicacy of an air or the beauty of a modulation—that racing and leaping on the piano-forte are generally resorted to by those who are conscious of possessing none of the higher powers, and feel obliged to supply the want of pure taste and deep feeling by mechanical dexterity.'

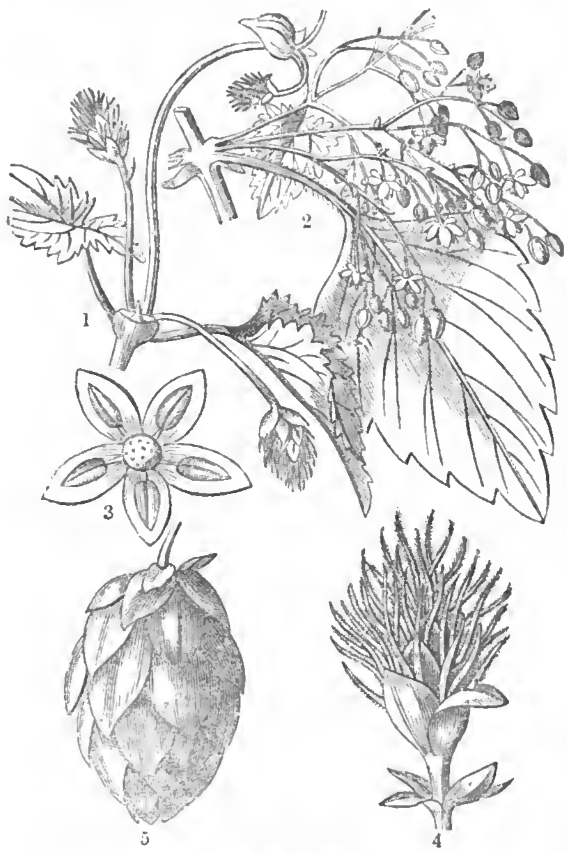
HUMMING BIRDS, the name of a brilliant family which includes the smallest of birds. [TROCHILIDÆ.]

HU'MULUS LU'PULUS, a perennial plant belonging to the natural order Urticaceæ (the female inflorescence of which forms the substance called hops, the use of which in brewing is so well known), is a coarse twiner inhabiting hedges in many parts of Europe, and also found apparently wild in the United States of America. It has rough, opposite, cordate, lobed leaves, and numerous greenish-white flowers, of which the sexes are distinct. In the male hop the flowers form loose drooping panicles, and each consist of 5 sepals, 5 stamens, and a convex centre representing the ovary. In the female the flowers are arranged in little axillary, stalked, scaly tufts; each consists of a naked ovary, with two spreading downy stigmas, and is enclosed by a concave bract. These bracts increase in size after the flowering is past, are collected into a loose head of imbricated scales, within which are placed the small seed-vessels, or seeds, as they are usually called.

HU'MULUS LU'PULUS. The female flowers, termed cones, strobuli, or catkins, of this plant, when ripe, constitute the hops, which, independent of their employment in brewing, are of considerable utility in medicine. The mature hops consist of a number of imbricated membranous scales, having the fruit at their base: the surface both of the scales and of the fruit is studded with aromatic glands, which prepare a material bearing considerable resemblance to the pollen of the anthers, and termed *lupuline.* This is the most valuable part, as in it reside the essential properties of the hop: it possesses a cellular structure, and in the cells are contained volatile oil, resin, a bitter principle, with tannin, and a trace of malic acid, with acetate, hydrochlorate, and sulphate of ammonia.

'The superiority of the hop, as an ingredient in our malt liquors, depends upon the fact of its containing within itself several distinct and independent elements of activity, which the bitter herbs that have at different times been employed as a substitute do not possess. The bitter principle imparts to the beverage a tonic quality and an agreeable flavour; while at the same time an aromatic ingredient adds a warmth and stimulating property, and modifies the bitterness: it likewise contains an astringent principle (tannin), the effects of which are to precipitate the vegetable mucilage, and thus to remove from the beer the active principle of its fermentation: every attempt therefore to substitute an ordinary bitter for that of the hop must necessarily fail, unless a compound can be so artfully constructed as to contain in due proportions the principles of bitterness, astringency, and aroma. (Paris, *Pharmacologia.*)

The aromatic bitter gives to the hop a very marked power over the digestive organs when debilitated. A narcotic property has also been ascribed to this article, which is denied to it by some writers, who attribute the intoxicating power of beer entirely to the alcohol and carbonic acid which it contains. Yet there can be no doubt that tincture of hops, and even extract of hops, possess sedative powers, and often procure quiet and sleep, where opium cannot be borne. Decoction does not seem to be a judicious mode of preparation, and should not be practised. Lupuline has been administered alone, but this does not possess any advantages over the common plan.



Humulus Lupulus.

1, a branch of the female plant; 2, a branch of the male plant; 3, a male flower; 4, a head of young female flowers; 5, a head of ripe flowers and fruit in the state of Hops.

HUMUS. [ARABLE LAND, vol. ii., p. 221.]

HUNDRED; HUNDRED COURT. [SHIRE.]

HUNDRED WEIGHT. [AVOIRDUPOIS.]

HUNDSRÜCK. [GERMANY.]

HUNGARIAN BANAT. [HUNGARY.]

HUNGARY. This name has been used sometimes in a more general, sometimes in a more limited sense. Under the denomination of Hungarian Hereditary Dominions are comprehended Hungary Proper, Slavonia, Croatia, Transylvania, Dalmatia, and the Military Frontier. The kingdom of Hungary united under the same civil government, as determined after the peace in 1815, comprehends Hungary, Slavonia, and Croatia, to the last of which the circle of Carlstadt (which previously made part of Illyria), and the Hungarian Littorale, or sea-coast, were annexed in 1822. The Military Frontier, though geographically a part of Hungary, is under a peculiar and entirely distinct form of government. The kingdom, within the above limits, is bounded on the north by Moravia, Silesia, and Galicia; on the east by Transylvania; on the south by the Military Frontier (which separates it from Turkey), and by the Gulf of Quarnero; and on the west by Illyria, Styria, Lower Austria, and Moravia. It extends from 14° 26′ 22″ (the most westerly point at Fiume on the sea-coast), to 25° 3′ 24″ (the most easterly point of the county of Marmaros on the Bistriza) E. long., and from 44° 43′ 25″ (the most southern point of the Banat, near Neu-Moldava) to 49° 34′ 45″ N. lat. (the most northerly part of the Arva on the mountain of Zsylec). The area of the kingdom, according to the Survey of the Imperial General Staff, amounts to 87,812 square miles: namely, the Hungarian counties, 78,275; the Hungarian districts (not included in the counties), 2301; Slavonia, 3616; and Croatia 3620 square miles. The population cannot be so accurately stated as in some other countries of Europe; but the most recent authorities agree, that in 1834 it might be taken in round numbers at 10,195,000 souls, and it was rapidly on the increase, having been, in 1825, 9,471,263. The 'Weimar Almanac' for 1838 states the population of the kingdom of Hungary at 11,404,350. The most remarkable increase in the population has been that of the Jews, who in 1785 were 25,377; in 1804, 63,908; and in 1827, 191,970. From the differences in the accuracy of the returns, and the different dates at which they were made, the several items will not strictly agree with the sum total.

Divisions.—The kingdom of Hungary is divided into Hungary Proper, Slavonia, Croatia, and certain privileged districts, viz. 1. in Hungary, Jazyga (Jaszág), Great Kumania (Nagy-Kunsag), Little Kumania (Kis-Kunsag), the Heyduke towns (Hajdu-Varosok), and sixteen towns of the county of Zips; 2. in Croatia, the Hungarian Littorale or sea-coast.

I. HUNGARY PROPER is divided into four circles.

The Circle on this side of the Danube has an area of 22,368 square miles, 2,659,653 inhabitants, 26 cities, of which three are bishops' sees, 176 towns, 2507 villages, and 93 hamlets, called prædia. It includes 13 counties, and 3 small districts. 1. *Presburg* (area 1717 sq. miles, 267,746 inh.): chief towns, Presburg, 38,386 inhabitants; Tyrnau, 6790 inh. 2. *Neitra* (area 2562 sq. miles, 380,327 inh.): chief towns, Neitra, with a Roman Catholic bishop, 4800 inh.; Neuhäusel, 6700 inh.; Skalitz, 7126 inh.; Freystädt on the Waag, 4000 inh., a splendid country-seat of Count Erdödy; Neustadt on the Waag, 4700 inh.; Mijawa, 8600 inh. 3. *Trentsin* (area 1843 sq. miles, 294,345 inh.): chief towns, Trentsin, 3350 inh.; Rajecz, 4360 inh. 4. *Thurocz* (area 447 sq. miles, 39,462 inh.): chief town, St. Martin, 1900 inh. 5. *Arva* (area 785 sq. miles, 101,734 inh.): chief towns, Also-Kubin, 1100 inh.; Trsztena, 2650 inh. 6. *Liptau* (area 882 sq. miles, 74,378 inh.): chief towns, St. Nicholas, 4160 inh.; Deutsch-Liptsch, 3000 inh.; Rosenberg, 2532 inh. 7. *Sohl* (area 7010 sq. miles, 91,043 inh.): chief towns, Neusohl, 10,069 inh.; Bries, 3500 inh.; Harpfin, 3360 inh. 8. *Bars* (area 1033 sq. miles, 137,210 inh.): Kremnitz, 5500 inh.; Königsberg, 3800 inh. 9. *Honth* (area 960 sq. miles, 125.427 inh.): chief towns, Schemnitz, 23,000 inh,; Pukanz, 2512 inh. 10. *Gran* (area 399 sq. miles, 54,636 inh.): chief town Gran, an archbishop's see, had 1136 houses, and 11,600 inh.; but half the town was destroyed by the late inundation of the Danube in the spring of 1838. 11. *Neograd* (area 1629 sq. miles, 193,740 inh.): chief towns, Balassar-Gyarmath, 4300 inh.; Gatsch, 4000 inh. 12. *Pesth* (area 4011 sq. miles, 433,419 inh.): chief towns, Pesth, which before the late inundation had 3860 houses, and 65,000 inh., besides the garrison of 10,000 men; but above 1200 houses having been destroyed, the actual population cannot be stated: many thousands of the inhabitants have taken refuge at Ofen (or Buda) on the other side of the Danube, the capital of the kingdom, which has 30,000 inh.; Waitzen, 11,271 inh.; Ketskemet, 35,876 inh.; Great Koros, 13,697 inh.; Little Koros, 8000 inh.; Czegled, 14,662 inh.; Kalotscha, an archbishop's see, 7406 inh. 13. *Bacs*, or *Batsch*: chief towns, Zombor, 21,086 inh.; Maria Theresienstadt (or Theresiopel), 34,924 inh.; Neusatz, 20,231 inh.; Baja, 14,534 inh.; Szenta, 13,937 inh.; Old Becze, 11,132 inh.; Kanisa, 9137 inh. In this county is the privileged Theiss district, an inalienable domain of the crown, containing sixteen large villages.

The Circle beyond the Danube has an area of 6632 square miles, 1,974,772 inh., 10 cities, of which 2 are bishops' sees, 190 towns, 2571 villages, 1059 hamlets. It includes 11 counties. 1. *Wieselburg* (area 739 sq. miles, 64,486 inh.): chief towns, Wieselburg, 2957 inh.; Ungrisch-Altenburg, 2586 inh., the capital of a lordship belonging to the Archduke Charles, containing 24 villages. 2. *Oedenburg* (area 1212 sq. miles, 193,745 inh.): chief towns, Oedenburg, 13,000 inh.; Eisenstadt, 5386 inh.—near it is a splendid palace of Prince Esterhazy, with an extensive park, and a collection of 70,000 of the rarest plants, in two hothouses, each 340 paces in length. 3. *Komorn* (area 1128 sq. miles, 128,660 inh.): chief towns, Komorn, a strong fortress, with 17,782 inh.; Tata, or Dotis, 8740 inh. 4. *Raab* (area 604 sq. miles, 89,200 inh.): chief town Raab, 16,168 inh. 5. *Stuhlweissenburg* (area 1570 sq. miles, 128,904 inh.): chief towns, Stuhlweissenburg, 20,069 inh.; Moor, 5300 inh. 6. *Wesprim* (area 1585 sq. miles, 171,736 inh.): chief town Wesprim, 8930 inh. 7. *Eisenburg* (area 2016 sq. miles, 310,218 inh.): chief towns, Güns, 5960 inh.; Stein am Anger (the Roman Sabaria), a bishop's see, 3980 inh. 8. *Szalad* (area 2104 sq. miles, 266,625 inh.): chief towns, Szala-Egerszegk, 3116 inh.; Kessthely, 6930 inh.; Gross-Kanisa, 5900 inh. 9. *Tolna* (area 1365 sq. miles, 173,682 inh.): chief towns, Szekszard, or Sexard, 8150 inh.; Földvar, 8979 inh.; Paks, 7292. 10. *Szümegh* (area 2400 sq. miles, 202,684 inh.): chief town Kaposvar, 3072 inh. 11. *Baranya* (area 1911 sq. miles, 244,830 inh.): chief towns, Fünfkirchen, a bishop's see, 11,322 inh.; Mohacs, 8316 inh.

The Circle on this side of the Theiss has an area of 6248 square miles, 1,746,821 inh., 8 cities, of which 2 are bishops' sees, 120 towns, 2285 villages, 505 prædia. It includes 10 counties, and 2 small districts. 1. *Heves* (area 2535 sq. miles, 232,706 inh.): chief towns, Erlau, an archbishop's see, 18,247 inh.; Gyöngyös, 11,820 inh.; Szolnok, 11,565 inh.; Mezo-Tur, 4160 (some say 16,900) inh. 2. *Borsod* (area 1375 sq. miles, 163,255 inh.): chief towns, Miscolcz, 27,638 inh.; Diös-Györ, 4500 inh. 3. *Torna*: the smallest county in Hungary, its area being but 214 square miles, with only 24,500 inh.; 1 town, Torna, with 1400 inh., 41 villages, and 12 prædia. 4. *Abaujvar* has an area of 1152 square miles, 159,571 inh., 1 city, a bishop's see, 11 towns, 239 villages, 28 prædia: chief towns, Kaschau, 13,600 inh.; Upper and Lower Metzenseifen, together 5459 inh. 5. *Gömör* has an area of 1601 square miles, 179,546 inh., a bishop's see, 13 towns, 261 villages, 35 prædia: chief towns, Sajo-Gömör, 4000 inh.; Rosenau, a bishop's see, 9000 inh.; Gross-Steffelsdorf, 8927 inh.; Dobschau, 4836 inh. 6. *Zips* has an area of 1396 square miles, 191,763 inh., 2 cities, 20 towns, 175 villages, 21 prædia, and 16 privileged towns not under the jurisdiction of the county: chief towns, Leutschau, 5175 inh.; Kesmark, or Kaisersmark, 5900 inh.; Göllnitz, 5000 inh.; Schmollnitz, 5500 inh. The sixteen towns belonging to the crown, with their dependencies, are scattered in different parts of the country; the area of the whole is 210 square miles, and the population 41,700. The chief town, Neudorf, or Iglo, the seat of the administration, has 5252 in habitants. 7. *Sarosch* has an area of 1365 square miles, 184,518 inhabitants, 3 cities, 12 towns, 359 villages, and 14 prædia: chief towns, Eperies, 9000 inhabitants; Zeben, 2930 inhabitants; Bartfeld 5100 inhabitants; Salzburg, or Sovar, 4000 inhabitants. 8. *Unghvar* has an area of 1239 square miles, 94,420 inhabitants, 5 towns, 206 villages, 15 prædia: chief town Unghvar, 6224 inhabitants. 9. *Zemplin* has an area of 2278 square miles, 278,642 inhabitants, 28 towns, 420 villages, 16 prædia: chief towns, Sator-Allya-Ughely, 6520 inhabitants; Saros-Patak, 9500 inhabitants; Tokay, 4200; Zemplin, which gives its name to the country, is a small place. 10. *Beregh* has an area of 1417 square miles, 98,698 inhabitants, 9 towns, 258 villages, and 7 prædia. Two-thirds of the county belong to Count Schönborn. Beregh-Szass, the chief town, has 4500 inhabitants, and Munkatsch, the see of a Greek bishop, 5000 inhabitants.

The Circle beyond the Theiss has an area of 26,528 square miles, 2,242,530 inhabitants, 6 cities, of which 2 are bishops' sees, 1782 villages, 478 prædia. It includes 12 counties, and 1 district. 1. *Szabolcs* has an area of 2431 square miles, 153,840 inhabitants, 16 towns, 131 villages, 46 prædia: chief towns, Nagy-Kallo, 5342 inhabitants; Nyir-Egybaza, 15,640 inhabitants. The Heyduke towns are in this county. 2. *Szathmar* has an area of 2230 square miles, 212,876 inhabitants, 2 cities, 17 towns, 245 villages, and 12 prædia: chief towns, Neustadt, or Great Banya, 4928 inhabitants; Great Karoly, 11,055 inhabitants; Ungrisch-Neustadt, or Felso Banya, 4700 inhabitants; Szathmar-Nemeti, 14,279 inhabitants. 3. *Marmaros* has an area of 3570 square miles, 130,705 inhabitants, 5 towns, 136 villages, 1 prædium: chief towns, Szigeth, 6500 inhabitants; Huszth, 2712 inhabitants; Visk, 2036 inhabitants; Korosmezo, the largest village in the county, has 3856 inhabitants. 4. *Bihar* has an area of 4200 square miles, 457,329 inhabitants, 2 cities, 21 towns, 460 villages, and 170 prædia: chief towns, Gross-Wardein, 16,000 inhabitants, a bishop's see; Debreczin, 45,375 inhabitants. 5. *Ugocs* has an area of 474 square miles, 41,034 inhabitants: chief town Nagy (*i. e.* great) Szöllos, or Gross Alesch, 2300 inhabitants. 6. *Bekes* has an area of 1375 square miles, 117,830 inhabitants, 5 towns, 15 villages, 71 prædia: chief towns, Gyula, 13,751 inhabitants; Bekes, 14,682 inhabitants; Szarvas, 14,131 inhabitants; Csaba is a village, the largest in Europe, having 22,143 inhabitants. 7. *Csongrad* has an area of 1302 square miles, 108,335 inhabitants, 1 city, 3 towns, 16 villages, 26 prædia: chief towns, Szegedin, 32,209 inhabitants; Hod-Mezo-Vasarhely, 25,806 inhabitants; Szentes, 15,800 inhabitants; Csongrad, 12,422 inhabitants. 8. *Csanad* has an area of 611 square miles, 41,945 inhabitants, 2 towns, 91 villages, 30 prædia: chief towns, Mako, 17,148 inhabitants; Csanad, 6730 inhabitants. 9. *Arad* has an area of 2276 square miles, 222,114 inhabitants, 1 city, 23 towns, 160 villages, 27 prædia: chief towns, Alt-Arad, 13,824 inhabitants; Peczka, 13,440 inhabitants.

The following three circles form the district called the Banat.

10. *Torontal* has an area of 2772 square miles, 249,500 inhabitants, 2 cities, 9 towns, 186 villages, 9 prædia: chief towns, Nagy Beczkerek, 12,623 inh.; Nagy St. Miklos, 14,222 inhabitants; Nagy Kikinda (a village, 12,344 inhabitants). 11. *Temes* has an area of 2486 square miles, 285,776 inhabitants, 2 cities, 9 towns, 186 villages, 3 prædia: the chief towns are Temesvar, 12,666 inhabitants; Versecz, 17,000 inhabitants. 12. *Krassova* has an area of 2289 square miles, 16 towns, 249 villages, and 10 prædia: chief town Lugos, 6150 inhabitants.

Besides these 46 counties Hungary includes the following privileged districts:—1. Jasyga (Jaszag), in the county of Pesth, has an area of 370 square miles, 48,926 inhabitants: chief town Jasz Berény, 15,529 inhabitants. 2. Great Kumania (Nagy-Kunsag), situated north-east and south-east of Jazyga, has an area of 430 square miles, and 42,200 inhabitants: chief town Karszag Uj-Szallas, 12,000 inhabitants. 3. Little Kumania (Kis-Kunsag) consisting of five portions, is larger than Great Kumania, having an area of 1020 square miles, 52,200 inhabitants: chief town Felegyhaza, 15,000 inhabitants. 4. The district of the seven Heyduke towns, within the county of Szabole, has an area of 380 square miles, and about 40,000 inhabitants: chief town Boszormeny, 14,660 inhabitants.

II. Slavonia is divided into three counties. 1. *Posega* has an area of 950 square miles, 81,067 inhabitants, 1 city, 6 towns, and 251 villages: chief town Posega, 4100 inhabitants. 2. *Verovicz* has an area of 1734 square miles, 158,490 inhabitants, 1 city, 17 towns, 234 villages: chief town Essek, 11,077 inhabitants. [Essek.] 3. *Syrmia* has an area of 908 square miles, 108,583 inhabitants, 13 towns, 86 villages, and 12 prædia. One-third of the county (the lordship of Illok, or Uylak, with the town of the same name) belongs to the Odescalchi family, at Rome, and one-third (the lordship of Bukovar, with the town of the same name, 5700 inhabitants) to the family of Count Elzy, in

Germany; chief towns, Illok, the capital, and Ruma, 6170 inhabitants.

III. CROATIA. [See article CROATIA.]

The entire Military Frontier is a tract of land extending from the Adriatic Sea along the Turkish frontier to the Buckowina. It has an area of 18,123 square miles. At the close of the last century the population was 823,950; in 1815, 940,598; in 1822 it was estimated at 1,010,878; in 1827 at 1,083,435.

Frontiers.—Hungary is on all sides separated from its neighbours by natural boundaries. From Presburg to Skalitz it is bounded by the river March, and from Skalitz, by the Carpathian Mountains, which run in a north-east direction to Mount Trojatska, thence eastward, near the frontier of Galicia, and afterwards to the south-east to the vicinity of the Buckowina. From the border of Transylvania the frontier runs, with many great bends, first to the west, and then to the south, to Orsowa and Mount Allion, on the Danube. On the south, from Orsowa to Essek, the Danube separates the kingdom from Servia and Slavonia; and from Essek to the Styrian frontier the Drave separates it from Slavonia and Croatia. On the west various small rivers divide Hungary from Styria and Austria.

Neither the natural rampart of the Carpathians could protect the Hungarians against the incursions and cruelties of the Tartars, nor the Danube against the Turks. The kingdom now derives greater security from being surrounded, on the west, north, and south, by countries which, like itself, are subject to the Austrian sceptre: to the south it is defended against the Turks by a living rampart of 789,740 men. From these antient enemies, weakened as they now are, the Hungarian can scarcely have anything to fear; but the powerful and ambitious Russian approaches his frontier.

Face of the Country, Soil, Climate.—The northern and western parts of the kingdom are very mountainous. The Carpathians on the north, and the Alps on the frontier south of the Danube, surround almost the whole kingdom like a girdle, and send out numerous branches which cover nearly thirty-three counties, with elevations varying in magnitude and character. These heights enclose many beautiful valleys drained by large and small rivers, verdant meadows, rich corn-fields, and gardens yielding a variety of excellent fruit, vineyards many leagues in extent, and vast forests. The Carpathians, which begin at Presburg and sweep round the north and east frontier of Hungary and Transylvania, cover all the country between the 48th and 49th degrees of latitude, and are divided into several groups, distinguished by different names. The most elevated portion is that called Tatra, in the counties of Zips and Liptau. The loftiest summits are the Eisthal (8100 Vienna feet), the Lomnitz (8133 feet), the Hundsdorff, Csabi, Wysoka, Mengsdorfer, Hreben (each 7800 feet), and the great Kryvan (according to Wahlenburg, 7538, and to Townson, 7818 feet high). Tho mountains on the south side of the Danube are branches of the Styrian and Julian Alps, among which the Rissniak, north-east of Fiume, attains an elevation of 4820 feet, and the Schneeschik, near Kameniak, 4760 feet. [CARPATHIANS.] Of the numerous valleys enclosed in the Carpathian mountains, the Waagthal (Valley of the Waag) is generally considered the most beautiful, hut there are numerous others perhaps equally picturesque; for instance, the Mengsdorforthal, which is distinguished by the grandeur of its forms, its magnificent views, and noble waterfalls. But while one part of the kingdom is covered with mountains, another spreads out into interminable plains, somo resembling the Pampas of South America, and others being oceans of sand, like the Sahara. In the Carpathians and in other mountains there are innumerable caverns, some of which are remarkablo for stalactites of extraordinary heauty, and in others are found the fossil remains of enormous animals, the gigantic inhabitants of the primitive world.

Nearly tho whole of Hungary lies within the basin of the Danube, which is shown by all the numerous rivers flowing into the Danube, with the single exception of the Poprad, which flows in a northern direction. The Theiss, itself a branch of the Danube, is one of the chief rivers, and its basin may be considered as forming a distinct part of Hungary. The Drave, the Raab, the Leitha, tho March, the Waag, the Gran, &c. flow into the Danube. The Zagyva, Sajo, Hernad, Bodrog, Koros, Maros, Temes, &c. flow into the Theiss. Of the lakes the most considerahle are,—1, the Plattensee [BALATON], 48 miles long, and from 3 to 69 broad; 2, Neusiedl, about 24 miles long, and from 3 to 7 miles broad; both of which are in the west part of the country. Lake Politsch in the county of Bars is 14 miles in circumference. There are numerous lakes among the Carpathians which are situated from 4000 to 6300 feet above the level of the sea. On the banks of the Danube, Theiss, Drave, and other rivers there are extensive marshes which cover 2000 square miles. The Hamag, in the counties of Oedenburg and Wieselburg, is a quaking bog, 18 miles in length and 9 in breadth, and contains some small lakes, or meres. It is overgrown with reeds, rushes, and in many parts with low bushes, and has some little copses of alder and beech. Many years ago (in 1813) a canal several miles in length was dug through the Hamag; hut it was nearly destroyed by inundations in the same year. Many canals have been made in different tracts of Hungary, partly to drain the marshes, and partly for the purposes of commerce.

The *soil* of Hungary is for the most part clayey and sandy. The best and richest mould is in the southern part, on the rivers Koros, Theiss, and Danube: the northern part is in general clayey and often stony. The counties next the Carpathians are the most barren. The climate varies considerably. In the counties nearest the snow-covered mountains it is so cold, and the winter so long, that the snow generally begins in September, and does not melt till May or even June. In the southern counties the air is so warm, and the winter so short, that the snow seldom lies on tho ground more than two or three weeks. When the heat in the Banat is intolerable, the mountains of Marmaros are still covered with snow, and fires are necessary in the middlo of summer. Foreigners in general have a very unfavourahle opinion of the climate of Hungary, which they decry as extremely unhealthy; hut M. Beudant, an eminent French traveller, says that the climate of Hungary is in general very healthy, and that disorders are neither so frequent nor so fatal as in the neighbouring countries.

In the abundance, variety, and value of its natural productions Hungary excels almost any country in Europe. Corn is the main product of Hungarian agriculture, but in the north there is not sufficient for home consumption, while the south not only supplies the deficiency of tho north, but exports to Germany and Italy. Barley and rye are grown in the north; oats everywhere in great abundance; wheat, millet and maize, in the south. Maize is more extensively cultivated than in any other part of Europe, and in the Banat produces 24, 48, and sometimes 60 fold. Potatoes are now cultivated to a great extent. Garden vegetables of every kind are of good quality and abundant. More millet is produced than is required for home consumption. Fruit grows everywhere, even at the foot of the Carpathians. There are whole forests of cherry, plum, and chestnut trees. In the south, lemon and orange trees blossom the whole summer in the open air, and the fruit ripens perfectly well. No country in the world, France perhaps excepted, produces such an abundance and variety of wines as Hungary; and with respect to quality, aroma, sweetness, strength, and fire, no wine in tho world perhaps, says a Hungarian writer, is equal to that of Hungary; at least the wine of the Hegyalla district is renowned throughout the world by the name of Tokay.

The land employed as vineyards is estimated at a million of acres; and the annual produce, even of middling years, at 24,000,000 eimer (the eimer is 4 gallons), and the value at 110,000,000 florins. Timber is most abundant, there being 9,000,000 acres of forests of oak, beech, lime, hirch, maple, and pines. In some counties however so much timber has been exported and so much consumed by the smelting-houses, that fuel and timber are six times as dear as they were 60 years ago. Tohacco grows everywhere, except in a few of the colder counties, and is nearly as good and cheap as the American. The annual produce is estimated at 300,000 cwt., of which 200,000 cwt. are exported. Of domestic quadrupeds the horned cattle bred on the luxuriant pastures of Hungary are some of the finest in Europe; a race peculiar to the country, of a greyish white, with large wide-spreading horns, is remarkable for size and beauty. The horses are small and weak, hut swift and hardy. Of sheep it was stated in 1811 that there were 8,000,000, though others affirm there were not above

6,000,000. Of late vast improvements have been made in the breed by the importation of merinos from Spain. Hundreds of thousands of swine are bred in the forests. Besides four-footed game of all kinds, the forests are the retreat of bears and of hordes of wolves. Domestic poultry of every kind is extremely plentiful. In the great heath of Debreczin there are millions of geese; turkeys are seen in large flocks, and vast numbers of pigeons, wild and tame, do no little injury to the corn-fields. The standing waters, marshes, and lakes are full of wild-fowl, especially countless flocks of wild geese and ducks. Flocks of bustards, often to the number of 40 or 50, are seen in the extensive plains. There are various species of birds of prey, the eagle, the vulture, falcon, &c. The mineral treasures of Hungary entitle it to the name of South America in miniature. Beudant, Von Humboldt, and other scientific travellers have noticed the striking analogy between the two countries. It has metals of every kind except tin. The annual produce is stated as follows:—gold, 10 cwt.; silver, 40 cwt.; copper, 40,000 cwt.; lead, 25,000 cwt.; antimony, 5000 cwt.; quicksilver, 130 cwt.; iron, (not certain, but supposed to be) 190,000 cwt. Hungary produces likewise a great variety of precious stones, such as amethyst, agate, jasper, Hungarian diamonds, garnets, &c. The more useful mineral products are coals, 400,000 cwt.; salt (especially in the counties of Saros and Marmaros), 1,000,000 cwt. The country abounds in mineral springs; the number hitherto known is said to be about 300, many of which are highly celebrated, and much frequented for their medicinal virtues.

Manufactures and Trade.—Though considerable improvements have been made in manufactures since the encouragement given by the ordinances of Joseph II., and by the increase of luxury, the Hungarians have not yet attained to any degree of eminence in manufactures. But the inland trade of the kingdom is very active, and the foreign commerce of great importance. The exports consist of the natural produce of the kingdom; the imports chiefly, though not entirely, of manufactures (of which woollens, cottons, silks, and linens make one-half of the whole imports), and some foreign luxuries. The value of the exports exceeds that of the imports by a third, so that the balance, as Hungarian writers say, is from 6,000,000 to 8,000,000 of florins in their favour.

Variety of Nations and Language.—There is perhaps no country of the same extent which contains such a variety of nations as Hungary. The Magyars, or proper Hungarians, are originally an Asiatic people; there are also Wallachians, Armenians, Germans, Italians, Jews, Servians, and a medley of tribes distinguished by names not easily accommodated to English orthography or English pronunciation; Russniaks, Slovacs, Croats, Wendians, improperly called Vandals (these four and the Servians are of Slavonian origin). The Slovacs, who inhabit exclusively a large portion of the north-east of the kingdom, and some districts in other parts, are above 2,000,000 in number. The inhabitants, except the Jews, are all Christians. The Roman Catholic religion is predominant; but Joseph II. established complete toleration, and his successors went much farther, and placed the other Christians on an equal footing with the Roman Catholics, so that all enjoy by law equal religious liberty, though not perhaps with equal security. The members of the Greek church are divided into United (that is, such as have joined the Roman Catholics, and are often blended with them) and the Not-united. According to an authentic account, drawn up twelve years since, there were—

Roman Catholics . .	5,140,443
United Greeks . . .	625,000
Not-united Greeks . .	1,114,076
Calvinists	1,338,623
Lutherans . . .	837,800
Jews	191,976
	9,247,918

Though the population has increased, the proportions have probably remained nearly the same. The Roman Catholics have three archbishops and seventeen bishops. The united Greeks have four bishops. The Not-united Greeks have an archbishop and six bishops. Since 1792 their bishops have had seats in the diet of the kingdom. The Protestants have no bishops, but are governed by superintendents and synods. The Romish superior clergy are well provided for, but the inferior clergy have inadequate incomes. The Protestant clergy are in general ill provided for. There are still many convents, though Joseph II dissolved 600 of them.

With respect to Education Hungary is in a very backward state, though there are schools in every parish. There are also a few academies, many gymnasia, a lyceum at Erlau, a university at Pesth, two schools for philology, a famous mining-school at Schemnitz, and many others. One great obstacle to Hungarian literature has been the great variety of languages and dialects, which has led to the use of Latin, not only in the affairs of government, the debates in the diet, &c., but even in ordinary life. Of late years great efforts have been made to introduce the Hungarian language into public transactions, and even into the debates in the diet, but the emperor has hitherto declined to assent to this innovation. Though Hungary has produced some very able writers and learned men, Hungarian works are little known in foreign countries. The great Hungarian nobles are highly educated and polished men, and in general well versed in foreign languages.

The Constitution of Hungary is called a limited monarchy, of which it has indeed all the forms, but aristocracy is predominant, and the nobles have very great power. The king possesses great prerogatives, but often finds very obstinate opposition in the diet, especially if he attempts to restrict the overbearing power of the nobles, and to lighten the vassalage of the oppressed peasantry. The diet consists of the Catholic prelates, the magistrates, the representatives of the inferior nobles, and the representatives of the towns. These classes call themselves the nation, and treat the peasants as an inferior race, whose business it is to pay all the taxes (the nobles, about 350,000 in number, being exempt), and to bear all kinds of burthens. Those to whom this constitution gives most enormous powers and privileges, are of course enthusiastically attached to it. Hence a late native writer says, 'It was here that the late government (that of Francis I.) met with insurmountable obstacles, raised on the ground of the wretched constitution which originated in an age of the most licentious barbarism, ignorance, and blind prejudices, and is defended by a people full of fanatical national pride and obstinate adherence to hereditary intolerant principles. Open resistance, insurrection, revolt, were the inevitable consequences of any violation of supposed rights, the maintenance of which even now is a continual impediment to all improvement, and condemns the great mass of the people to the most wretched slavery, disgraceful to humanity and to our age. That great idol the constitution is therefore untouched, and Hungary remains, as it always has been, three centuries behind the age.'

Another writer says, 'I am satisfied with my own position in society, and envy none of my fellow-countrymen his rights and privileges, his power, his possessions, or his riches; but I confess that it grieves my heart to see nine-tenths of the inhabitants of my beloved country in a condition, in which poverty and contempt reduce the great mass to crawl in the dust; so that they are unable to raise themselves from their moral and intellectual debasement to a condition of greater respectability, worthy the dignity of human nature.'

The Revenue is derived partly from the income of the inalienable domains of the crown, which amount to about 120,000*l.* (one authority states the income at 400,000*l.*), and partly from certain regalia, of which that of salt is the most considerable, being estimated at 2,000,000*l.*, the mines and mint 110,000*l.*, post-office 50,000*l.*, tax paid by the Jews for being tolerated, 16,000*l.*, taxes regularly voted by the diet, paid by the peasants and the citizens not nobles, 500,000*l.*, other charges on the peasants towards supporting the military, 300,000*l.* The amount of the several items is of course variable; the average may be taken between 3½ and 4 millions sterling per annum: the extraordinary subsidies granted by the nobility in time of war, not being annually given, cannot be taken into account here.

The Military Establishment consists of 12 regiments of infantry (2 of which however belong to Transylvania), and 10 complete regiments of hussars, all of which are among the choicest troops of the army. Each regiment of infantry consists of 3857 men, and each regiment of hussars of 1698 men; making nearly 64,000 men. They are not kept up at their full complement in time of profound peace. In time of war an extraordinary levy, called the *insurrectio*, is made on a call from the crown. These *insurrections* are general or partial During the late wars with France there were three general insurrections: that in 1797 amounted to 21,525 men; that in 1800 to 38,000; and that in 1809 to 40,000, in which year the free cities and privileged districts furnished in addition 45,000 infantry and cavalry, making a total of 85,000. The singular institution of the Military Frontier will be found under MILITARY FRONTIER.

History.—The oldest known inhabitants of the country were the Pannonians. In the year 377 the Huns established a power here, which was vastly increased under Attila, but was overthrown in 489 by the Goths and Gepidæ. These yielded in 526 to the Lombards; and when the latter removed to Italy, in 568, the Avari entered, who extended their dominion to Bavaria, but were conquered and compelled to embrace Christianity by Charlemagne. In the ninth century the Magyars, originally a people from central Asia, penetrated into the country, and conquered it in ten years. Their chiefs divided the country among them: Arpad, their leader, took half for his own share; the remainder was divided among the inferior chiefs and their followers, and the antient inhabitants became slaves. Arpad's grandson Geysa embraced the Christian religion, and his son Stephen, the last duke, assumed in the year 1000 the title of king, and added Transylvania to the kingdom. Ladislaus I. and Colomann subdued Slavonia and Croatia, and, after many wars, Dalmatia; Bela II. obtained Bosnia; Emerich, Servia; and Andrew II. and his son Colomann, Galicia. The family of Arpad became extinct in the male line in 1301. In 1310 Charles, brother to Louis IX. of France, was crowned king of Hungary, which he raised to a high degree of splendour. Charles having married a sister of Casimir, king of Poland, Louis, one of his sons, succeeded to that kingdom in 1370. This prince, who is called Louis the Great, reigned from 1342 to 1382, and his united kingdoms extended from the Baltic to the Adriatic. On his death Poland and Hungary were again separated, and internal troubles broke out. Sigismund, who reigned from 1386 to 1437, lost almost all the annexed dominions, the Turks approached the frontiers, and took part in all the intestine broils. Albert, archduke of Austria, having married the only daughter of Sigismund, succeeded to the crown in 1437, but died in the campaign against the Turks in 1439. Under Ladislaus V. and VI. these powerful enemies were successfully resisted by the brave John Hunyades, whose son Matthias I. was made king in 1458. He proved a very able and fortunate king: he brought under his dominion Moldavia, Wallachia, Moravia, Silesia, Lusatia, and great part of Austria, forming an empire of 256,000 square miles in extent, about equal to the present Austrian empire. After his death in 1490 the kingdom fell to pieces; civil commotions and bad government made it an easy prey to the Turks; and Louis II. lost his crown and life in the fatal battle of Mohacs, which so weakened the Hungarians that they were unable for 160 years to free their country from the enemies of Christendom. Ferdinand I. of Austria, who had married the sister of Louis, being raised to the throne, the strength of Austria was indeed added to that of Hungary, but he was obliged to leave Ofen and the finest part of Hungary in the hands of the Turks, who were not expelled till 1686. This was partly owing to the unpopularity of the house of Austria, whose despotic habits and religious intolerance were most distasteful to the Hungarian nobles. Hence arose continued disputes, and frequent insurrections, in which the insurgents even went so far on some occasions as to call the Turks to their aid. This was done by the celebrated leader Tekely, who with his Infidel allies had nearly got possession of Vienna in 1683, which was chiefly indebted for its preservation to the Poles under John Sobieski. The treaty of Carlowitz, 1699, delivered Transylvania and Hungary, and that of Passarowitz, in 1718, the Banat, from the Turkish yoke. The fatal civil wars and insurrections ceased in 1711, and the house of Austria has ever since remained in undisturbed possession of the country, whose inhabitants have on various trying occasions shown themselves among the most loyal and devoted subjects of their sovereigns, from the days of Maria Theresa to the present time. The nation has in fact had great reason to be attached to its sovereigns, who have been desirous of doing much more to improve the condition of the great mass of the people than the nobles have been willing to concede.

(*Neueste Statistisch-Geographische Beschreibung des Konigreichs Ungarn, Croatien, Slavonien, &c.*, 1834; *Historisch-Statistischer Umriss von der Oesterreichischen Monarchie*, 1834; *Neuestes Gemälde der Oesterreichischen Monarchie*, von W. C. W. Blumenbach; *Das Oesterreichische Kaiserthum*, von D. G. Hassel.)

HUNGERFORD. [BERKSHIRE.]

HUNS, HUNNI, the name given by historians to several nomadic Scythian tribes which devastated the Roman empire in the fifth century. It appears that these people inhabited the plains of Tartary near the borders of the Chinese empire for several centuries before our æra, and that they were known to the Chinese by the name of Hiong-nu, and also Han. They made many incursions into China, and it was to put a stop to them that the Chinese built their great wall, about two centuries B.C. In after-times they became divided into the Northern and Southern Huns. The Northern Huns, being defeated by the Chinese about A.D. 93, emigrated westward as far as the Volga, where they met the Alanni, or Alani, another powerful Scythian tribe, which they routed and drove beyond the Tanais, or Don. The Huns then encamped in the plains between the Volga and the Tanais, and as far south as the ridge of the Caucasus, where they remained for more than two centuries. Under the emperor Valens they first crossed the Cimmerian Bosporus, drove before them the Ostrogoths and Visigoths, and obliged the latter to cross the Danube, when the emperor granted them lands in Thrace. The Huns were joined by numerous other Scythian hordes, and were looked upon with equal dread by the Gothic and Teutonic nations and by the Romans. Their features and general appearance are described by the Roman historians as hideous and repulsive, and their manners as savage in the extreme. (*Ammianus*, b. 31.) The description of their features seems to correspond in some degree with that of the Calmucks of the present day. The Huns being now on the frontiers of the empire, had frequent wars with the Romans, and their incursions were dreadful though not lasting. [ATTILA.] After the death of Attila the various tribes under his sway quarrelled among themselves, and being attacked by the Goths they were driven back beyond the Tanais. Part of them settled in Pannonia, to which they gave the name of Hungary, but the present Hungarians, or Magyars, came from a different and much later immigration. The Huns are mentioned in subsequent history as being sometimes at war with the emperors of Constantinople, and at times as their allies against the Persians. Under Heraclius many of the Huns embraced Christianity. After that period their name is no longer mentioned in history. (Des Guignes, *Histoire des Huns*.)

HUNTER, WILLIAM, was born in 1718 at Long Calderwood, near Glasgow. He was entered at the university of Glasgow in 1732, and remained there for five years studying for the church; but while hesitating whether he should pursue that profession he met with Cullen, who was at that time practising as a surgeon and apothecary at Hamilton. An intimate friendship was soon formed between them, the result of which was that Hunter determined to study medicine, and to practise in partnership with Cullen. Part of the agreement into which they mutually entered was, that each of them should alternately pass a winter at some large medical school, while the other remained in charge of the business in the country. The success of Cullen, and his exaltation to the highest celebrity in Scotland, has been already mentioned [CULLEN, WILLIAM], and Hunter was destined to attain a reputation scarcely inferior in England. In 1741 he visited London, where he resided with Smellie, the celebrated accoucheur, and studied anatomy under Dr. Nicholls, and surgery at St. George's Hospital. Dr. Douglas, to whom he brought a letter of introduction, engaged him soon after his arrival to assist him in completing an anatomical work which he was publishing, and to educate his son. He resided in the family till 1744, when Mr. Sharpe having resigned a lectureship on surgery to a Society of Naval Surgeons, Hunter was elected to fill his place, and at once met with the most marked success. In 1746 he commenced lecturing on anatomy, and in 1747 became a member of the Corporation of Surgeons. But he had always preferred the practice of midwifery to that of surgery; and several circumstances coinciding to give a favourable prospect of success, he determined in 1749 to confine himself exclusively to the former subject. In 1750 he took a Doctor's degree at Glasgow; in 1764 was appointed physician extraordinary to the queen; in 1767 he became a Fellow of the Royal Society. His time was now so completely occupied in the practice of his profession, that he was obliged to give up a part of his lectures, and his brother John, Hewson, and Cruickshank, were successively his partners. He amassed a large fortune, and died in 1783, with a reputation inferior only to that of his brother, of whom it was not his least honour that he had been the preceptor aud first patron. They had been unhappily estranged for many years before Dr. Hunter's death, in consequence of a dispute relative to their mutual claims to the discovery of the structure of the placenta: which was most in fault is still unknown; but their hostility, which was at first very warm, did not cease till William was on his death-bed. Even then the reconciliation was only partial, for he left nearly the whole of his large property to those who were distantly connected with him, although his brother was at the time in embarrassed circumstances.

William Hunter's principal work was the 'Anatomy of the Gravid Uterus,' on which he was engaged for nearly thirty years. It contains thirty-four folio plates, most accurately and beautifully engraved from dissections by himself and his brother, illustrative of the most important subjects in obstetrics. A work descriptive of these plates, and containing several other points of great interest collated from the original MS., was published after Dr. Hunter's death by his nephew Dr. Baillie. He was also the author of numerous essays in the 'Philosophical Transactions,' and the 'Medical Observations,' of which the most important are those relating to his discoveries of the varicose aneurism, of the origin and use of the lymphatics, the retroversion of the uterus, and the membrana decidua reflexa. William Hunter had long wished to found an anatomical school in London, and in 1765 he offered to expend 7000*l.* on a building fit for that purpose, to endow a professorship, and to give his museum and library, if the government would grant him a piece of ground to build upon. This munificent offer was refused, and he therefore bought some ground in Windmill-street, where he built a private house, with a museum and dissecting-rooms adjacent to it. He at the same time added to his museum, which already contained a large number of very valuable anatomical and pathological preparations, a choice library of Greek and Latin works, a cabinet of the rarest antient medals, which cost him 20,000*l.*, and numerous objects of natural history. He bequeathed all these to Dr. Baillie, who was to hold them for thirty years, and then to transmit them to the university of Glasgow, to which he had also left 8000*l.* for their maintenance and increase.

If William Hunter was inferior in intellect to his brother John, he was free from many of his faults; he was a good scholar, a clear and elegant writer, and an accomplished gentleman. He was the most scientific man that ever practised as an accoucheur; and midwifery is as much indebted to him as surgery is to his brother. Each not only improved the practice of his profession, but conferred a far greater benefit by introducing the scientific principles of physiology into what had, before their time, been little more than mechanical arts.

HUNTER, JOHN, was born in 1728, at Long Calderwood, in Kilbride, a village near Glasgow, where his father possessed a small farm. Being the youngest of ten children, and his father dying when he was very young, his education was almost entirely neglected. His whole time was devoted to the amusements of the country till he was 17 years old, when he went to stay with his brother-in-law Mr. Buchanan, who was a cabinet-maker at Glasgow, and who needed his assistance to extricate him from some pecuniary difficulties. Hunter worked at the trade for nearly three years, and probably thus acquired much of his manual dexterity. At the end of that time, hearing of the great success which his brother [HUNTER, WILLIAM] had met with in London as an anatomical and surgical lecturer, he wrote to offer him his services as assistant in the dissecting-rooms. His offer was accepted, and in 1748 he commenced his anatomical studies, in which he at once distinguished himself both by his ardour and his skill. In 1749 Hunter became the pupil of Cheselden, then surgeon to Chelsea Hospital, where he attended for nearly two years, and in 1751 he went to St. Bartholomew's Hospital, and attended the practice of Mr. Pott. In 1753 he entered as a gentleman-commoner at St. Mary's Hall, Oxford, intending to practice as a physician; but he seems soon after to have given up this idea, for in 1754 he entered as a surgeon's pupil at St. George's Hospital, in the hope of becoming at some future time a surgeon to that institution. In the same year his brother made him his partner in the school, and he delivered a part of each annual course of lectures till 1759, when his constant and severe labours in anatomy, to which he had lately added comparative anatomy and physiology, began to affect his health so seriously that it became advisable for him to resort to some milder climate. With this view he obtained an appointment as staff-surgeon, and early in 1771 proceeded to Belle-isle with the armament ordered to lay siege to that town. He afterwards went to the Peninsula, and remained in active duty till the end of 1763, when a peace was negotiated, and, his health being completely restored, he returned to London, and commenced practice.

At first Hunter met with little success in his profession; the roughness of his manners, the consequence in part of his hasty disposition, but more of his deficient education, prevented him from rising in public estimation. Besides, he paid but little attention to his practice, regarding it, as he always did, only as a source from which he might obtain the means of carrying on the scientific investigations to which he was far more attached, and which he had steadily pursued while in the army. To defray the expenses which these entailed, he again commenced lecturing on anatomy and surgery; but notwithstanding the talent and extensive knowledge which his lectures evince, they were little appreciated, and he never had a class of more than twenty pupils, so that he was constantly obliged to borrow money for the purchase of animals and other similar purposes, after he had spent on them all that he did not require for the actual necessaries of life. Every year however added to his reputation, and in 1767 he was elected a Fellow of the Royal Society, and in 1768 surgeon to St. George's Hospital. The latter appointment was of the greatest value to him it increased his income, both by adding to his surgical reputation, and by enabling him to take pupils, from whom he received large fees. Among his pupils were Jenner, with whom he remained throughout his life on terms of the closest intimacy, and Sir Everard Home, whose sister he afterwards married. From the time of his appointment to St. George's, Hunter's life was occupied with a constant and laborious investigation of every branch of natural history and comparative anatomy, physiology, and pathology, to all of which he devoted every hour that he could snatch from the requirements of an increasing surgical practice. In 1773 he suffered from the first attack of the disease of the heart, of which he ultimately died He had a severe spasm of the chest, and remained pulseless and cold, though perfectly sensible, for three-quarters of an hour. For many years after however his health seemed pretty good, and he was subject to slighter returns of the disease only when much excited or fatigued; but in 1785 the attacks became more frequent, and he was obliged to leave London. In the following years he became gradually more debilitated, and the slightest fit of anger, to which he was unfortunately prone, was sufficient to induce severe spasms. In October, 1793, he was engaged in warm disputes with his colleagues at the hospital; and a remark being made by one of them at a meeting of the governors, which Hunter regarded as an insult, he left the room that he might repress or at least conceal his rage, and had scarcely entered the adjoining apartment, when he fell dead in the arms of Dr. Robertson, one of the physicians of the hospital.

The extent and importance of John Hunter's works will be best shown by a brief account of his museum and his chief publications. The museum consisted, at the time of his death, of upwards of 10,000 preparations, illustrative of human and comparative anatomy, physiology and pathology, and natural history. The main object which he had in view in forming it was to illustrate as far as possible the whole subject of life by preparations of the bodies in which its phenomena are presented. The principal and most valuable part of the collection, forming the physiological series, consisted of dissections of the organs of plants and animals, classed according to their different vital functions, and in each class arranged so as to present every variety of form, beginning from the most simple, and passing upwards to the most complex. They were disposed in two main divisions: the first, illustrative of the functions which minister to the necessities of the individual; the second, of those which provide for the continuance of the species. The first division commenced with a few examples of the component parts of organic bodies, as sap, blood, &c.; and then exhibited the organs of support and motion, presenting a most interesting view of the various materials and apparatus for affording the locomotive power necessary to the various classes of beings. It was succeeded by series illustrating the function of digestion (which Hunter placed first because he regarded the stomach as the organ most peculiarly characteristic of animals), and those of nutrition, circulation, respiration, &c. These were followed by the organs which place each being in relation with the surrounding world, as the nervous system, the organs of sense, the external coverings, &c. The other chief division of the physiological part of the collection contained the sexual organs of plants and animals in their barren and impregnated states; the preparations illustrative of the gradual development of the young, and of the organs temporarily subservient to their existence before and after birth. Parts of the same general division, though arranged separately for the sake of convenience, were the very beautiful collections of nearly 1000 skeletons; of objects illustrative of natural history, consisting of animals and plants preserved in spirit or stuffed, of which he left nearly 3000; of upwards of 1200 fossils; and of monsters.

The pathological part of the museum contained about 2500 specimens, arranged in three principal departments: the first illustrating the processes of common diseases and the actions of restoration; the second the effects of specific diseases; and the third the effects of various diseases arranged according to their locality in the body. Appended to these was a collection of about 700 calculi and other inorganic concretions.

These few words may give some idea of Hunter's prodigious labour and industry as a collector. But his museum contains sufficient proof that he was no mere collector; it was formed with a design the most admirable, and arranged in a manner the most philosophic; and when it is remembered that it was all the work of one man, labouring under every disadvantage of deficient education, and of limited and often embarrassed pecuniary resources, it affords perhaps better evidence of the strength and originality of Hunter's mind than any of his written works, where he speaks of the facts which in his museum are made to speak for themselves. Nor should it be omitted, that the manual dexterity exhibited in displaying the various objects is fully equal to the intellectual power which determined their arrangement. The museum was sold after Hunter's death, to pay the debts which he had incurred in its formation, and to afford the means of support to his family, to whom it was almost all that he had to leave, although for many years before his death he had been earning a very large income. The government gave 15,000*l.* for it, and presented it to the College of Surgeons (London), by whom it has at a very heavy expense been greatly augmented and maintained.

For several years before his death Hunter had been anxious to form a complete catalogue of his collection, and to embody in one large work the results of all his labours and observations. He died when he had completed but a small portion of his design, and left only the materials, with which his successors might have completed a work which would undoubtedly have been the most valuable of its kind ever published. These materials were contained in nineteen folio MS. volumes written under Hunter's dictation, and the ten most valuable of them contained records of his dissections, of all of which he had made copious notes. The formation of the catalogue was entrusted to Sir Everard Home, the brother-in-law and only surviving executor of Hunter, but from year to year he deferred his task, and after supplying only two small portions of his undertaking, he at length announced that in accordance with a wish which he had heard Mr. Hunter express, he had burned the manuscripts which he had taken without leave from the College of Surgeons, and among which were the ten volumes of dissections, and numerous other original papers. Thus nearly the whole labours of Hunter's life seemed lost: a few only of the least important of his writings remained, unless indeed we reckon as his the numerous essays which Sir E. Home published as his own in the 'Philosophical Transactions,' and subsequently collected in six volumes 4to. of 'Lectures on Comparative Anatomy.' Many of these give strong evidence of his having used Hunter's writings in their composition; and the fear lest his plagiarism should be detected is the only probable reason that can be assigned for so disgraceful an act. The papers being thus lost, the formation of the catalogue was necessarily dependent on the arrangement of the preparations themselves, the published works, and the few scattered manuscripts that remained, and such information as those who had associated with Hunter could give. It is fortunate however that by these means, and by making numerous fresh dissections and comparing them with the original preparations, the Catalogue is now formed in a manner which, although it cannot compensate for the loss of the other, confers the highest credit on those by whom it has been made.

Hunter's principal published works were the 'Treatise on tho Natural History of the Human Teeth,' 2 vols. 4to., 1771—78; 'Treatise on the Venereal Disease,' 4to., 1786; 'Observations on certain Parts of the Animal Œconomy,' 4to., 1786; and 'Treatise on the Blood, Inflammation, and Gun-shot Wounds,' 8vo., 2 vols., 1794. Of these the two last afford the best proofs of his genius. The 'Animal Œconomy' consists of a republication of several papers from the 'Philosophical Transactions,' and of nine others relating to various anatomical and physiological discoveries which Hunter had made. It is difficult to say which deserves the most admiration, the faultless accuracy of the observations themselves, or the clearness and simplicity of the deductions drawn from them. His 'Treatise on the Blood,' &c., although he had been collecting materials for it from the time of his entrance into the army, was not written till late in his life, when he was worn down by disease; and it was rather carelessly completed after his death by his executors Sir E. Home and Dr. Baillie. It contains his opinions on disease in general, the results of his long experience, illustrated by numerous physiological investigations. As a collection of observations these volumes are invaluable; but it is unfortunate that Hunter's reputation has been based upon them rather than upon his museum or his strictly physiological writings, for in the former his mode of reasoning is often obscure and hasty, and his conclusions far more general than the evidence warranted. His doctrines were purely vital. The *materia vitæ diffusa*, a term which he says was recommended to him by his friends to express the power, or, as he supposed, the subtle matter, which he believed to be contained in the blood and all the tissues, and to govern all the functions of the living body, was to him the sole agent in the phenomena of life. But his errors were those of ignorance of collateral subjects, rather than of a deficient acquaintance with that which he made the object of his study; and when we consider that he was so little educated, that he was not even well acquainted with his own language, and was ignorant of all others, and that he had only the most superficial knowledge of the physical sciences, which every year now shows to have more applications in the study of the living body, we can only wonder the more at the genius which could surmount such difficulties.

Hunter is, by the common consent of all his successors, the greatest man that ever practised surgery. Considered merely as a surgeon, and with reference only to the direct improvements which he effected in its practice, he stands inferior to few: his improvement of the operation for aneurism [ANEURISM] was undoubtedly the most brilliant discovery in surgery of his century. He first described the important disease of inflammation of the veins; he first published lucid views on the venereal disease; and by his work on inflammation improved the modes of practice applicable to nine-tenths of the diseases which fall within the province of the surgeon. But it was less by individual discoveries than by the general tone of scientific investigation which he gave to surgical practice that he improved it. Before his time surgery had been little more than a mechanical art, somewhat dignified by the material on which it was employed. Hunter first made it a science, and by pointing out its peculiar excellence as affording visible examples of the effects and progress of disease, induced men of far higher attainments than those who had before practised it, to make it their study.

As an anatomist and physiologist, his museum alone is sufficient to show that he has had no superior; and while his published works confirm this opinion, and exhibit what he knew, they add to the regret that so much more should have been lost. Every year, as his museum is more closely studied, proves that Hunter had been well aware of facts for the *discovery* of which other observers have since his death received the honour. His remarks on fossil bones, for example, evince his knowledge of the principle carried out by Cuvier, by which their investigation might be made the clue to the history of a former world. His notices, though short, of monstrosities prove that he knew the fact that they are, as it were, representations of the natural form of animals lower in the scale of creation, and possess the form natural to themselves at an earlier period of development, a law since more fully demonstrated by Geoffroy St. Hilaire, Meckel, Von Baer, &c.; and it is now certain from the drawings which he had made from his preparations that he was well acquainted with nearly the whole of that most interesting department of physiology which relates to the development of the embryo. The number of individual facts for the discovery of which he has lost his due honour by the destruction of his manuscripts cannot now be calculated.

As a natural historian, Hunter's merits were of no ordinary character, as is sufficiently shown by his descriptions of various animals from New South Wales, published in Mr. White's 'Voyage' to that country, and by his papers on the wolf, &c. He seems however to have regarded the study of zoology as very inferior to that of physiology, and it is probable that the large collection of animals which he left preserved in spirit was only intended as a store of subjects for future dissection.

The whole of John Hunter's works have been lately edited in four volumes 8vo., by Mr. James F. Palmer, who has added to those published by himself numerous papers from different periodicals, his surgical lectures, from notes taken by some of his pupils, and his Croonian Lectures. Biographies of Hunter have been written by Sir Everard Home, Mr. Jesse Foote, and Dr. Adams. A Life by Mr. Drewry Ottley is prefixed to Mr. Palmer's edition of his Works.

HUNTINGDON, SELINA, COUNTESS OF, born 1707, died 1791, a lady distinguished in the religious history of the century to which she belonged, was one of the three daughters and co-heirs of Washington Shirley, Earl Ferrers; the other two being Lady Kilmorey, and Lady Elizabeth Nightingale, the lady for whom there is the monument in Westminster Abbey which is so highly admired. Selina, the second daughter, married, in 1728, Theophilus Hastings, earl of Huntingdon, a nobleman of retired habits, with whom she appears to have had a very happy life till his sudden death on October 13, 1746, of a fit of apoplexy. She had many children, four of whom died in youth or early manhood.

It was probably these domestic afflictions which disposed this lady to take the course so opposite to that which is generally pursued by the noble and the great. She became deeply religious. It was at the time when the preachers and founders of Methodism, Wesley and Whitefield, were rousing in the country, by their exciting ministry, a spirit of more intense devotion than was generally prevalent, and leading men to look more to what are called the distinguishing truths of the Gospel than to its moral teachings, to which the clergy had for some time chiefly attended in their public ministrations. She found in these doctrines (painful as some of them must be to every benevolent and hopeful mind) matter of consolation and delight, and she sought to make others participate with her in the advantages they were supposed by her to afford.

The doctrine to which she most inclined was that of Whitefield, who founded his Christian exhortations on a system of Gospel truth which was high Calvinism, rather than the doctrine of Wesley, which was Arminian: and to the Whitefieldian section of Methodism she may therefore be said to belong. But she chose to act herself as the founder of a sect; and however nearly the two may approach, and, in the estimation of those who view them at a distance, appear to coalesce, there is, we believe, a distinction between those who are properly called Whitefieldian Methodists and those who belong to 'the Countess of Huntingdon's connexion.' She had the command of a considerable income during the forty-four years of her widowhood, and as her own personal expenses were few, and she engaged the assistance of other opulent persons, members of her own family or other persons who were wrought upon as she was, she supported a college which she established at Trevecca in Wales, for the education of ministers, built numerous chapels, and assisted in the support of the ministers in them. The number of her chapels at the time of her death is stated to have been 64, the principal of which was that at Bath, where she herself frequently attended. She created a trust for the management of her college and chapels after her death.

Other ladies of the family of Hastings were distinguished for their piety and zeal. Lady Elizabeth Hastings, half-sister to her lord, died in 1739, when Methodism was first beginning to attract very much of the public attention. She made large gifts to religious objects, but she confined them to the church, and subjected them to the general regulations of the affairs of that well-ordered community. Lady Margaret, the own sister of the earl, gave herself in marriage to one of the Methodist preachers, Mr. Ingham; Lady Catherine, another sister, married a clergyman, the Rev. Granville Wheeler. Of Ferdinando Hastings, a brother of the earl, who died in 1726, at the age of 27, there is an agreeable picture of a pious and amiable person in Wilford's 'Memorials.'

HUNTINGDON. [HUNTINGDONSHIRE.]

HUNTINGDONSHIRE, an inland county of England, situated between 52° 8′ and 52° 36′ N. lat. and 0° 3′ E. and 0° 30′ W. long. It is bounded on the north and north-west by Northamptonshire, on the south-west by Bedfordshire, and on all other sides by Cambridgeshire. There are two outlying portions, the parish of Swinesbead, which is surrounded by Bedfordshire, and the parish of Everton, which is included between Bedfordshire and Cambridgeshire. The form of the county approximates to that of a lozenge, the longer diagonal of which is from north to south, from the Nene at Peterborough to Tetworth, 29 miles, and the shorter diagonal from east to west, from Earith to near Keyston, 23 miles. The area of the whole county is by one calculation 241,690 acres; by another 372 square miles. The population was, in 1831, 53,192, being 143 to a square mile. It is in size one of the smallest of the English counties, only Middlesex and Rutland being less; in population it is the lowest, except Rutland; and in density of population it is the thirty-fourth. Huntingdon, the county town, is in 52° 21′ N. lat. and 0° 12′ W. long., 57 miles from St. Paul's, London, in a direct line almost due north, or 59 miles from Shoreditch Church by the road through Ware and Royston.

Surface, Hydrography, and Communications.—Huntingdonshire has no high hills. An elevated ridge enters the county from the south, near Potton in Bedfordshire, and runs northward till it subsides in the valley of the Ouse near Huntingdon. Another elevated tract runs west from the border of Cambridgeshire to Huntingdon, and from thence turns north-west to the valley of the Nene at Wansford, west of Peterborough: to the north and north-east of this ridge the county is comprehended in the great fen district of the lower Ouse, Nene, and Welland.

The principal rivers are the Ouse and the Nene, with their respective tributaries. The Ouse touches the border of the county about a mile and a half above St. Neots, and flows past that town 3 miles along the border to the junction of a stream from the neighbourhood of Higham Ferrers (Northamptonshire); after which it flows in a northerly direction about 8 miles to Huntingdon; from thence 7 miles in an easterly direction to Holywell, on the border of the county below St. Ives; and from thence 5 miles along the border of the county to Earith, where it enters Cambridgeshire: its whole length within the county or on the border is 23 miles, all navigable. The stream which comes from the neighbourhood of Higham Ferrers has a course of 17 miles through Northamptonshire, Bedfordshire, and Huntingdonshire; it passes Kimbolton. A stream about 14 miles long rises on the north-western border of the county near Thurning, and flows south-east into the Ouse at Huntingdon: it receives, just before its junction with the Ouse, a stream 13 miles long from Hargrave in Northamptonshire, and another yet smaller from Old Weston, Huntingdonshire. The other feeders of the Ouse are all small.

The Nene has no part of its course within the county, but only along the border. It first touches it at Elton, below Oundle, from whence it flows northward 4 or 5 miles to Wansford; it then turns eastward, and flows about 9 miles to Standground Sluice, a little below Peterborough, where it leaves the county. It is navigable throughout all this part. The old channel of the river, now no longer continuously navigable, parts from the present navigable channel at Standground Sluice, and runs first along the border of the county, being navigable for a mile or two, and then through the county, through Whittlesea and Ugg

Meres. Near Ramsey Town it becomes navigable again, and passing close to Ramsey Mere quits the county and enters Cambridgeshire. It rejoins the present channel at Wisbeach. Whittlesea Dyke, which is partly on the border of Huntingdonshire and partly in Cambridgeshire, is a navigable cut from the short navigablo part of the old channel of the Nene at Standground Sluice, to the navigable part of the same river below Ramsey; and the Forty Foot Drain, or Vermuiden's Drain, is a navigablo cut from the Old Nene, near Ramsey, to the Old Bedford River in Cambridgeshire, which belongs to the system of the Ouse. These several navigable streams or cuts provide for tho exportation of agricultural produce, and the import of timber, groceries, and general goods.

Tho three 'Meres,' Whittlesea, Ramsey, and Ugg, are large pools or lakes. Whittlesea Mere, the largest, covers an area of several square miles; it affords excellent sailing and fishing, and is much frequented in tho summer by parties of pleasure. These meres are visited by abundance of aquatic wild-fowl. A considerable part of the county is destitute of springs, and is supplied with water from ponds.

The high north road, travelled by the mail to York, Edinburgh, Inverness, and the north of Scotland, after passing through Ware and Royston, enters this county on the south-east side between Caxton in Cambridgeshire and Huntingdon; and passing through Huntingdon, Stilton, and Norman Cross, quits the county on the north-west sido. Another road from London, which passes through Barnet and Baldock, unites with the high north road at Alconbury Hill, between Huntingdon and Stilton: this road is travelled by the Glasgow, Carlisle, and Wetherby mail. The Louth and Boston mail, which passes through Ware, and the Hull and Lincoln mail, which passes through Baldock, turn off from the high north road at Norman Cross, and follow a road which leads by Peterborough into Lincolnshire. A road which branches off from the north road through Baldock, just on the border of the county, passes through Kimbolton, from whence one branch leads to Higham Ferrers, Harborough, and Leicester, and another to Uppingham and Nottingham. There are roads from Huntingdon to St. Neots, Cambridge, Ramsey, and other places.

Geological Character.—The south-eastern part of tho county is occupied by the iron-sand. Whether the formations locally termed 'clunch' (indurated chalk marl) and 'galt' (which may perhaps be identified with the Folkstone clay or the Weald clay of Kent and Sussex), which overlie the iron-sand and occupy the adjacent parts of Cambridgeshire and Bedfordshire, extend into Huntingdonshire is not clear, the district not having been fully examined, and being covered with the diluvial débris of the neighbouring chalk range. The iron-sand rises in Huntingdonshire into low hills. The rest of the county, excepting the Fens, and perhaps a narrow strip on the western side of the county, is occupied by the Oxford clay, which forms the separation between the middle and lower assemblage of oolites. The thickness of this formation is probably from 500 to 700 feet: its position is nearly horizontal. The hills on the confines of Huntingdonshire and Northamptonshire which overhang the valley of the Nene are of the stonebrash, or forest marble.

Agriculture.—The climate of Huntingdonshire partakes of that of the inland counties. The low and flat districts, which are mostly drained fens, are subject to fogs, and not so healthy as the higher parts; but when well drained and cultivated they become more healthy. The county contains a surface of nearly 195,000 acres, of which a very small portion only remains unproductive.

The soil varies considerably, and may be said to lie in patches of gravel, sand, and clay, intermixed with muddy alluvial vegetable earth, wherever the level of the surface is lowest, and the waters have formerly flowed over it, or stagnated upon it. Peat is found in many spots and dug out for fuel. The clay predominates generally.

Although water abounds, there are not many springs, but the inhabitants are supplied from ponds, rivers, and wells. The well-water is not of the best quality: in this respect the county resembles the lower parts of Holland. The farms are mostly of considerable extent and the farm buildings are generally situated at an inconvenient distance from the most productive fields. This is owing to the nature of the soil; a drier spot, rather higher than the level of the fens, is chosen for the buildings. Leases are not so common in this county as they might be, with great advantage to both landlord and tenant; and rents are not high in proportion to the produce. The expense of cultivation on the fen land, when it is first drained, bears no proportion to the produce. Paring and burning the surface is the general practice. The ashes being spread and thinly ploughed in, rape seed is sown, which is fed off with sheep the first year, and left to ripen its seeds the next. The stem or straw of the rape is burned on the land, after the seed has been thrashed out; and this is all the manure required to produce a good crop of wheat, if the land is sufficiently mellow. Where it is wet and heavy, oats are substituted for the wheat, and are more profitable from the greater certainty of the crop on such lands. The next crop is beans, which are sown or drilled after a good dressing with dung, and with a deeper ploughing. Tho next crop is barley with grass seeds, which are mown or pastured from three to five years. The land is then pared and burned again, and the same rotation is repeated. There is no fault to find with this system, if it be accompanied with sufficient tillage. A fallow may be advantageously introduced; and without it the land will scarcely be kept sufficiently free from weeds, especially the coarse natural grasses, of which the roots remain in the soil, when it is not summer fallowed. The following rotation is more extensive, and, on good land, very profitable,—1, rape, after paring and burning; 2, wheat; 3, beans; 4, barley; 5, clover; 6, wheat; 7, fallow; 8, wheat; 9, beans; 10, barley; and grass seeds to lie 3 or 4 years. After 15 years the paring and burning may be repeated with advantage: oats are not included; but they may be sown on a portion of the wheat land after clover. Where land is rich, oats are not a profitable crop, and should be sown on the poorer lands. There is always a portion of a farm where oats may be more profitable than wheat, and there the rotations may be different. On the lighter soils, where turnips will grow, paring and burning are not so advantageous, except in first converting waste lands, or old pastures over-run with coarse grass and rushes, into arable-land. On such lands the usual course is—1, turnips off with sheep; 2, oats; 3, beans; 4, barley; 5, clover; 6, wheat. The course then begins again, or seeds are sown amongst the wheat in spring, to lie several years, which greatly invigorates the soils, and, with good management, is the most profitable system.

The average produce of the county, according to the Agricultural Survey published in 1813, does not denote great fertility in the soil, or good tillage and management: of 94 parishes of which returns are given there are only seven which produce 25 bushels of wheat per acre, and only two which produce 30 bushels; while there are 23 of which the average is under 20 bushels. There are 16 which produce 40 bushels of barley, and 35 which average under 30 bushels; 21 produce 40 bushels of oats per acre, and 32 under 30 bushels. There has no doubt been a considerable increase of the average produce by a better system of cultivation, but in many farms there is very little improvement. The reason of this low average must be ascribed to a long system of over-cropping, which all the fen-lands have been subjected to when first drained. The fertility was thought inexhaustible, because great crops were obtained at first with little trouble; but the vegetable portion of the soil was soon exhausted, and no subsequent manuring could adequately replace it. Folding sheep on the fallows is a very general practice; but, except on light soils, which are benefited by the treading of the sheep and by their urine, without injuring the health of the animal, folding on fallows is a most expensive mode of manuring, more being lost by the harm done to the sheep than can be gained by the increase of the crop. On dry grass-land the case is different; there the sheep will not suffer, and the grass is much benefited. Mustard-seed is grown to some extent in this county, and in good soils gives a good return: it is thought to exhaust the land, but it does not do so more than rape. It requires to be well manured, and not repeated too often. The price of mustard-seed varies much, and there is not always a demand for it; but it may be stacked, and will keep well for a long time.

On the borders of the Ouse and Nene are some very rich meadows, but there is not a sufficient supply of running water to form artificial water-meadows. The grass is coarse naturally, but by close feeding with sheep in summer its quality is much improved.

A great part of the county is still in pasture, although much has been broken up and coverted into arable land. In 1813, according to the survey, the meadows and pastures were nearly equal in extent to half the arable land. It is calculated that the best pastures will produce 420 lb. of meat per acre, which, at 4*d.* per lb., would give five guineas per acre. It is not surprising then that they should not be ploughed up. The pastures are not sufficiently subdivided; a greater number of ditches would keep them much drier and more productive. A contrivance is noticed in some of the pastures to enable the sheep to rub their backs. It consists of two short posts put in the ground at ten feet apart, and a strong rail fastened to them a little lower than the height of a sheep, so that by going under it they can rub their backs. This contrivance prevents their rolling, and consequently being cast, as often happens to fat sheep. Another mothod has been found out, which is to dip them in a liquor which kills the ticks; the desire of rubbing is thus prevented, and the wool is not damaged.

The county of Huntingdon is rather bare of trees. There are a few woods and coppices, but not many trees in the hedgerows. In the marshy parts willows grow rapidly, and are profitable, although not ornamental.

Horses are invariably used for the plough; but, with a few exceptions, the number of horses kept on a farm is greater than is necessary. The custom of using four strong horses one before the other in the plough is not yet generally abandoned, even in comparatively light soils. In some improved farms in the fens they use three horses abreast in a plough without any driver, than which nothing can be better where the soil is really too heavy to be ploughed to a sufficient depth with two horses.

The cows kept for the dairy are mostly of the Yorkshire or Durham breed of short-horns. The cows bred in the county are not good; too little attention is paid to keep any breed select and pure.

Although Stilton is in this county, and it is asserted that the cheese which bears that name was originally made there, none of that kind is now produced in any of the dairies; all such cheeses are made in Leicester or Lincolnshire.

The sheep are mostly of the Leicester breed. The hogs are of the Berkshire or Leicestershire breeds, with various crosses.

The following are the principal fairs held in the county:—

Bluntesham-cum-Erith, fairs for cattle, on May 4, July 25, and November 1; Godmanchester, Easter Tuesday; Kimbolton, Easter Friday, December 11; Leighton-Bromeswold, May 12, October 5: St. Ives, Whit-Monday, October 5; St. Neots, Saturday before the third Tuesday in January (old style), Holy Thursday, Corpus Christi day, August 1, December 17; Spaldwick, Wednesday before Whit-Sunday; Yaxley Holy Thursday.

Divisions, Towns, &c.—The county of Huntingdon is divided into four hundreds as follows:—

Name and Situation.		Area in Acres.	Population in 1831.
Norman Cross	N.	52,070	8,828
Hurstingstone	E.	77,440	17,427
Leightonstone	W.	56,130	9,525
Toseland	S.	56,050	17,412
		241,690	53,192

There is one parliamentary borough, and county and market town, Huntingdon, including the municipal boroughs of Huntingdon and Godmanchester; and four other market-towns, Kimbolton, Ramsey, St. Ives, and St. Neots.

Huntingdon is on the Ouse, 59 miles from Shoreditch Church, London, by the road through Ware and Royston. It is on the Ermin Street, and there was a Roman station, the Durolipons, or Duroliponte, of Antoninus, on the site either of the town or of its suburb Godmanchester. In the year 917 Edward the Elder built, or rather rebuilt, a castle at Huntingdon, of which traces of the entrenchments or outworks yet remain. King Stephen gave this castle to David, earl of Huntingdon and king of Scotland; but Henry II. had it rased to the ground on account of the disputes which it occasioned between the earls of Huntingdon and tho neighbouring barons, as well as on account of its affording a retreat to the disaffected. Before the Reformation there were several religious houses. The most antient was a priory of Augustine canons, founded in the tenth century and removed out of the town and enlarged in the reign of Stephen or Henry II. Its annual revenue at the Dissolution was 232*l.* 7*s.* 0½*d.* gross, or 187*l.* 13*s.* 8½*d.* clear. The other houses were of less extent: they were an Augustine Friary, and two hospitals for lepers and infirm or poor people. One of the hospitals had at the Dissolution a yearly revenue of 9*l.* 4*s.* 0*d.* gross, or 6*l.* 7*s.* 8*d.* clear. Some fragments of the garden-wall of this hospital are the only remains of any of these establishments. In the civil war of Charles I., A.D. 1645, the king's forces entered Huntingdon after a short resistance and plundered it. Henry of Huntingdon, one of our antient chroniclers, and Oliver Cromwell, were born in this town.

The town is on a gently rising ground on the left or north bank of the Ouse, and is connected with the village of Godmanchester by a causeway across the meadows, which in time of floods are overflowed by the Ouse. In this causeway are three bridges: the principal one, over the main channel of the Ouse, is of stone, and antient; it has six arches. Our antient historians tell that Huntingdon was once much larger. According to Leland it had once fifteen churches; in his time they were reduced to four; but traces of their walls and of their churchyards were yet to be seen. At present there are only two churches, St. Mary's and All Saints; but the town is still divided into four parishes. The area of the four parishes of Huntingdon is 1230 acres; that of Godmanchester parish, included in the parliamentary borough, is 5590: together 6820. The population of Huntingdon in 1831 was 3267, that of Godmanchester 2146: together 5413. The principal street of Huntingdon extends about a mile north-west from the bridge ovor the Ouse, and consists for the most part of respectable houses; it is lighted with gas: there are some smaller streets or lanes, chiefly of inferior houses, branching off from it on each side. St. Mary's Church is of perpendicular character; it was rebuilt in A.D. 1620, but is much mutilated. All Saints has a fine perpendicular tower, with a good entrance on the west side; the chancel and some other parts of the church are in tho early English style. The market-place is tolerably spacious; the town-hall is a good brick building stuccoed, with two court-rooms below for the trial of civil and criminal causes at the assizes, and an assembly-room above. Thero is a new county gaol and house of correction, and a borough gaol, formerly the county-gaol. The trade of the town is considerable, principally in wool and corn; the market, which is on Saturday, is well supplied with corn and provisions. According to some of our authorities, there are two yearly fairs for cattle, and a statute fair shortly before Michaelmas. There are a small theatre and a race-course; the races are in the beginning of August. There are two or threo reading societies and a horticultural society. The borough council of Huntingdon consists of four aldermen and twelve councillors. The united rectories of All Saints and St. John are of the clear yearly value of 190*l.* without a glebe-house: the united rectories of St. Mary and St. Benedict, or Benet, are of the yearly value of 162*l.* with a glebe-house; both benefices are in the gift of the lord chancellor. There are several dissenting meeting-houses.

The four parishes had, in 1833, an endowed grammar-school with 77 boys; four day and boarding-schools with 98 children; seven day-schools (one of them endowed) with 172 children; two national day and Sunday-schools with 169 children; and three Sunday-schools with 190 children.

Godmanchester is a large village, in which the population of the parish, which is chiefly agricultural, is condensed. It is said to derive its name from Gormund, or Gothrum, a Danish chieftain of considerable note in Alfred's time, to whom Alfred ceded the possession of East Anglia, and who perhaps established a military post here. The church has a tower and spire of tolerable outline, but of poor details: some parts of the church are of perpendicular character and of tolerable execution. Godmanchester was for many centuries famed for the goodness of its husbandry; the inhabitants used to boast that they had received the king when he passed through the town 'with nine score ploughs, brought forth in a rustical kind of pomp for a gallant show.' (Camden.) The place was early incorporated; the governing charter is of the time of James I. The borough council consists of four aldermen and twelve councillors. The living of Godmanchester is a vicarage of the clear yearly value o 328*l.* with a glebe-house. There were, in 1833, two infant or dame-schools with 40 children; ten day-schools, one of 60 boys, partly supported by endowment and the contribution of an individual; one of 35 children, partly supported by voluntary contributions, and eight others with 144 children; one day and Sunday-school of industry, attended by 47 girls daily, and by 100 on Sundays; and one Sunday-school with 125 boys.

Camden fixed the site of the Roman Duroliponte, or Durolipons, at Godmanchester, and his opinion is supported by the termination 'chester,' the frequent ploughing up of Roman coins, and the account of Henry of Huntingdon, that this village was in remote times a noble city; but other antiquaries, with perhaps better reason, fix the station at Huntingdon, on the site of the castle 'rebuilt' by Edward the Elder. The name, which Camden derives from Durosiponte (more accurately Dwr Osi ponte, signifying in British 'the bridge over the water Ose'), is applicable to either position.

Kimbolton is in the hundred of Leightonstone, on the western side of the county, on a branch leading from the high north road into Northamptonshire and other midland counties: it is 63 miles from Hicks's Hall, London. The parish has an area of 6200 acres, and had in 1831 a population of 1584, of which from one-third to one-half was agricultural. The town is pleasantly situated, but is small and unimportant. The church has a tower with a lofty spire, and some portions of its architecture are deserving of attention. Kimbolton Castle, an antient stone building, the seat of the Montagues, dukes of Manchester, was the residence of Catherine of Aragon, first wife of Henry VIII., after her divorce: it has undergone many alterations since that period. Several of the Montague family are buried in Kimbolton church, where they have monuments. There are three or four dissenting meeting-houses. Kimbolton has little trade: some lace is made. The market is on Friday, and there are two yearly fairs. The living is a vicarage, of the value of which no return has been made. There were in the parish, in 1833, eight infant or dame schools, with 93 children; an endowed grammar-school; another school endowed for the instruction in reading of nine poor boys of the hamlet of Stonely in this parish, and three other day-schools, with 35 children; there are also three Sunday-schools with 304 children; and several 'lace-schools,' where the children attending them are taught to read.

There was at Stonely, in this parish, a small priory of Austin canons, containing, at the dissolution, seven canons, and having a revenue of 62*l.* 12*s.* 3½*d.* gross, or 46*l.* 0*s.* 5½*d.* clear.

Ramsey is in Hurstingstone hundred, on the edge of the fens, 69 miles from Shoreditch church, London, and 10 from Huntingdon. The parish has an area of 17,660 acres (about 100 acres of which are in North Witchford hundred, Cambridgeshire), and had, in 1831, a population of 3006, about half agricultural. The town derives its origin from a Benedictine abbey, founded on an island or dry spot in the marshes, called Ram's ey, *i.e.* Ram's island, in the reign of Edgar, A.D. 969, by Ailwine, duke or earl of the East Angles, at the instigation of Oswald, successively bishop of Worcester and archbishop of York. The abbey attained great wealth and repute. Many of the abbots and monks were men of considerable learning. A school almost coeval with the abbey itself was established within its walls; and the library was celebrated for its stock of Hebrew books, previously belonging to the synagogues at Stamford and Huntingdon, and purchased at the confiscation of the Jews' property in England, in the reign of Edward I., by Gregory Huntingdon, a learned monk of the abbey. Robert Dodford, another monk, was also eminent for his attainments in Hebrew; and a third, Lawrence Holbeach, of the time of Henry IV., profiting by the labours of his predecessors, compiled a Hebrew lexicon. The Reformation broke up the library, and interrupted the studies that had distinguished this secluded spot in the dark ages. The abbots of Ramsey were mitred. The yearly revenue of the abbey at the dissolution was 1983*l.* 15*s.* 3¼*d.* gross, or 1716*l.* 12*s.* 4*d.* clear.

Ramsey consists chiefly of one long street running east and west, with another street running northward along the Bury brook, a feeder of the Nene, which waters the town. There is a weekly market, which had on the dissolution of the abbey fallen into disuse, but was afterwards revived: there is also a yearly fair. The church is spacious, consisting of a nave, aisles, and chancel, with an embattled tower at the west end. Some of the piers and arches of the church are in the Norman and early English styles intermixed. The only remains of the abbey, which stood not far from the church, are the ruined gateway, a rich specimen of decorated English architecture, but in very dilapidated condition; and a statue of Earl Ailwine, the founder, supposed to be one of the most antient pieces of English sculpture extant. The living is a perpetual curacy, of the yearly value of 47*l.*

In the time of the plague, A.D. 1665—66, four hundred people died of that disease, which was brought into the place by some infected woollen cloth. In May, 1731, eighty dwelling-houses, besides shops, granaries, barns, &c., and a great quantity of malt and flour, were destroyed in the town by fire.

There were in the parish in 1833 two endowed day-schools, one for 70 boys, another for 50 girls, and three other day-schools, with 79 children; also two Sunday-schools with 255 children.

St. Ives is in Hurstingstone hundred, on the north bank of the Ouse, 59 miles from Shoreditch church, London, and 6 miles east of Huntingdon. The parish has an area of 2330 acres, and had in 1831 a population of 3314. St. Ives was in the Saxon times called Slepe, which name is still attached to one of the two manors comprehended in the parish; its more modern name is derived from Ivo, or St. Ives, a Persian ecclesiastic said to have visited England as a missionary about A.D. 600, and whose supposed remains were discovered here some centuries afterwards. On the spot where they were found the abbots of Ramsey, to whom the manor belonged, built first a church, and then a priory, subordinate to Ramsey abbey, which priory remained till the dissolution. The town stands on a slope; the lower part, close on the bank of the Ouse, is liable to be inundated in the floods of that river. A good stone bridge of six arches forms the entrance to the town on the London side; there is an antient building, propably intended for a chapel, but now occupied as a dwelling-house over one of the piers. The approach to the bridge on the south is by a causeway raised on arches, to admit the passage of the waters in the time of floods. The streets of St. Ives are well paved and lighted, and in the outskirts of the town are some good houses inhabited by respectable families. Brewing and malting are carried on, but there are no manufactures. Considerable business is done by means of the navigation of the Ouse, on which there is a wharf, rebuilt and widened by the duke of Manchester A.D. 1724. The market is on Monday, and is one of the largest in the kingdom for cattle; there are two large yearly fairs for cattle, second-hand clothes and haberdashery; at the Michaelmas fair much cheese is sold. The church is a light neat building, with some antient portions deserving attention, and a handsome tower and spire at the west end. The dove-house and barn of the antient priory are yet standing, but do not exhibit anything remarkable. There are several dissenting meeting-houses. The living is a vicarage united with the chapelries of Old Hurst and Wood Hurst; no return of its yearly value was made. There were in the year 1833 two boarding and day-schools, with 85 children, two day-schools, partly supported by subscription, with 84 children; seven other day-schools with 246 children; also three Sunday-schools with 395 children.

St. Neots is in Toseland hundred, on the right or east bank of the Ouse, just out of the line of the great north road through Baldock, 56 miles from Hicks's Hall, London. The parish has an area of 4750 acres, and had in 1831 a population of 2617, about one-sixth agricultural. This place appears to have been antiently called Ainulphsbury, or Enolfesbury. A Benedictine monastery was early established here, to which the remains, or part of the remains, of Neot, a Saxon saint, were transferred from Neotstock in Cornwall, but afterwards removed to Croyland. From this Neot is derived the present name of the town. The monastery, after undergoing various changes, was finally suppressed at the dissolution, when its yearly revenues were 256*l.* 1*s.* 3½*d.* gross, or 240*l.* 11*s.* 4*d.* clear. The town consists of a large market-place and several streets of respectable appearance, but from the low site on which it is built it is liable to be overflowed. The church is a remarkably fine edifice in the perpendicular style. Its plan is perfectly regular; it consists of a nave, aisles and chancel, with a tower at the west end 150 feet high, of fine proportions and good composition. The church has a fine wood roof, and there is some antient screenwork. There is a very large paper-mill at St. Neots worked by patent machinery. There is a bridge of five arches, one large and four small, over the

Ouse, and there are six arches to the approaches across the low grounds on the banks, which are liable to be flooded. There are three dissenting places of worship. The market is on Thursday; there are three yearly fairs, beside a statute fair for hiring servants. The living is a vicarage of the yearly value of 163*l.*, with a glebe-house, in the gift of the lord chancellor. There were in 1833 in the parish nine day-schools with 270 children, and four Sunday-schools with 515 children.

Two or three villages deserve notice. Yaxley is in Norman Cross hundred, just on the right of the road which leads from Norman Cross on the high north road to Peterborough. It is 77 miles from Hicks's Hall, London. The parish has an area of 4290 acres, and had in 1831 a population of 1140, nearly three-fifths agricultural. Yaxley is small, and irregularly laid out, but the houses are neatly built, and the situation, on a fine gravelly eminence, is good. The church has various portions in the perpendicular style, intermixed with others of earlier date; it has a tower and fine crocketed spire with pinnacles and flying buttresses. At Norman Cross, on the high north road, in this parish, are extensive barracks, partly of wood and partly of brick, used during the late war as a depôt for French prisoners, of whom many thousands were confined here: the barracks are now partly dismantled. Yaxley is called Takesle in Domesday; it had formerly a market, which, after being discontinued, was revived when the barracks were occupied, but has since fallen again into disuse. The living is a vicarage of the yearly value of 177*l.*, with a glebe-house, in the gift of the lord chancellor.

There were in the parish in 1835 five infant or dame-schools with 77 children; one day and boarding school with 24 children, two day and Sunday-schools, with nearly 60 children, and one Sunday-school with 40 children. One of the day and Sunday-schools is endowed.

Stilton is in Norman Cross hundred, on the high north road, 75 miles from Hicks's Hall, London, through Huntingdon. The parish has an area of 1620 acres, with a population, in 1831, of 793, above one-third agricultural. Stilton was once a market-town, but has dwindled into insignificance. The Stilton cheese takes its name from this village. The living is a rectory of the clear yearly value of 355*l.*, with a glebe-house. There were in 1833 seven day-schools, with 124 children, and one Sunday-school, with 100 children.

Divisions for Ecclesiastical and Legal Purposes.—Huntingdonshire is in the diocese of Lincoln, and in the ecclesiastical province of Canterbury. It constitutes an archdeaconry, comprising the five rural deaneries of Huntingdon, St. Ives, Leightonstone, St. Neots, and Yaxley: a very few parishes are in the archdeaconry of Bedford. The number of parishes given in the population returns is 106; but of these 20 are, for ecclesiastical purposes, annexed to or dependent on other parishes; thus reducing the number of benefices to 86, namely, 53 rectories, 27 vicarages, and 6 perpetual curacies. The yearly revenues of 11 benefices are under 100*l.*, of 29 under 200*l.*, of 13 under 300*l.*, of 12 under 400*l.*, of 9 under 500*l.*, of 5 under 750*l.*, and of 4 over 1000*l.* Of 3 there was no return made.

The county is included in the Norfolk circuit; the assizes and quarter-sessions are held at Huntingdon, where is the county-gaol. Huntingdonshire and Cambridgeshire form but one shrievalty.

The county returns two members to parliament; the election takes place at Huntingdon; the polling-stations are Huntingdon and Stilton. Two members are returned for the borough of Huntingdon, to which the parish and municipal borough of Godmanchester was added by the Boundary Act. The Reform Act made no change in the number of members sent from this county.

History and Antiquities.—Huntingdonshire is generally considered to have formed part of the territories of the Iceni, but it must at least have been on the western frontier of that nation, towards the Catyeuchlani. Upon the subjugation of Britain by the Romans, it was included in the province of Flavia Cæsariensis. Two Roman stations are considered to have been in this county: Durolipons, or Duroliponte, noticed above in our account of Huntingdon and Godmanchester; and Durobrivæ, which is by many fixed at Water Newton, on the Nene, near the high north road. The fort or station appears to have been on the south or Huntingdonshire side of the river. The town connected with it, or which rose from it, extended to the northern or Northamptonshire side. Stone coffins and other funereal antiquities have been dug up in the neighbourhood, as well as many coins. Various fragments of Roman pottery have been dug up at Holywell, near St. Ives, a small urn and a variety of Roman coins on the road from Somersham to Chatteris, in the Fens, and some Roman coins near Sawtry, on the high north road. Of antient roads the Roman Ermin Street crossed the county, from south-by-east to north-by-west, through Durolipons and Durobrivæ, and nearly in the line of the present north road through Royston. Another road, which some distinguish as the 'British Ermin Street,' is thought to have entered the county from Bedfordshire, and run due north to Godmanchester, and from thence to have nearly coincided with the Roman Ermin Street. The Via Devana crossed the county, passing from near Cambridge by Durolipons to Ratæ, or Leicester.

In the earlier part of the Saxon period this county was included in the kingdom of the Eastern Angles, and is said to have been even then called Hunteduneseyre, or Huntandunescyre: it was subsequently annexed to Mercia, and shared the fate of that kingdom. In the latter period of the Anglo-Saxon dynasty it constituted an earldom or county, and was held by Siward, a noble of considerable power in the time of Edward the Confessor. Waltheof, son of Siward, having married Judith, William the Conqueror's niece, was made by that monarch earl of Huntingdon. He held most of the land in the county. He was beheaded by the Conqueror's order. The earldom of Huntingdon was successively conferred on Simon de St. Liz, and David, prince (afterwards king) of Scotland, who married Maud or Matilda, daughter of Waltheof. The earldom and estates thereof continued in the royal family of Scotland, until seized by the kings of England in the wars occasioned by the contests of the Bruce and Baliol families for the crown of Scotland. The earldom, after having passed through various families, was conferred by Henry VIII. on one of the Hastings family, in which it continued till A.D. 1789, when it was supposed to have become extinct; but a claimant having made out a good title A.D. 1819, it was revived, and still exists.

Huntingdonshire was in antient times very woody, and appears to have been a forest till the time of Henry II., who disafforested the greater part: the remainder was not disafforested till the reign of Edward I.

There were antiently two abbeys in the county; one at Ramsey, noticed above, and one of the Cistertian order at Sawtry St. Judith. The yearly revenues of the latter, at the dissolution, amounted to 199*l.* 11*s.* 8*d.* gross, or 141*l.* 3*s.* 8*d.* clear: there are no remains of the buildings. Beside other religious houses noticed above, there was a Benedictine nunnery on the site of Hinchinbrook House, whose yearly revenues, at the dissolution, were 19*l.* 9*s.* 2*d.* gross, or 17*l.* 1*s.* 4*d.* clear.

Of the churches, Alwalton, Conington, Hartford, and Leighton Bromswold, have some portions of Norman architecture. The tower of Chesterton Church is a good specimen of early English, with a fine spire. Upton and Wootton churches have also some fine portions of early English architecture. Besides Kimbolton and Huntingdon Castles there was one at Conington, on the border of the fens; but there do not appear to be any remains of it.

In the civil wars of Charles I. Huntingdon was plundered A.D. 1645, by the royalists, under the king's own command. In A.D. 1646, the earl of Holland and the duke of Buckingham, who had assembled troops for the relief of Colchester, having been driven from Kingston-on-Thames by the Parliamentarians, and compelled to wander over the country with 100 horse, came to St. Neots, where they were beset by their pursuers. The duke of Buckingham forced his way through the enemy, but the earl of Holland surrendered without resistance.

An establishment which existed at this period in the parish of Little Gidding deserves notice. Mr. Nicholas Ferrar, a lawyer of eminence, led by the seriousness of his disposition, purchased the lordship of Little Gidding, repaired and fitted up a large dilapidated mansion-house, the only habitation in the village, repaired the church, which had been converted into a barn, and settled there with several of his kindred, servants, and others, to the number of nearly forty persons. Having been ordained deacon, he formed rules for his establishment, the members of which passed their time in study and the exercises of devotion. Charles I. twice visited the establishment, which was kept up after the death of Mr. Nicholas Ferrar. It was broken up by some zealots of the parliamentary army, to whom it had become obnoxious under the title of the Protestant Nunnery, which the common people had given to it. In the churchyard are several memorials of the Ferrars.

An incident of rather earlier occurrence, but illustrative of the age, took place at Warboys, in this county, near the close of the sixteenth century. The children of Robert Throckmorton, Esq., having been afflicted by fits of a peculiar kind, and the lady of Sir Henry Cromwell having died, after experiencing similar fits, a family of the name of Samuel or Samwell, consisting of an old man and his wife and daughter (Agnes), were charged with bewitching them; and being found guilty at the Lent assizes, A.D. 1593, were executed. They are traditionally known as 'the Witches of Warboys.' Sir Henry Cromwell, to whom, as lord of the manor, their goods were forfeited, gave them as an endowment for ever for preaching an annual sermon at Huntingdon against the sin of witchcraft; and the sermon continued to be preached long after the statutes against witchcraft were repealed.

(*Beauties of England and Wales*; Paterson's *Roads*; Rickman's *Gothic Architecture*; *Clerical Guide*; *Parliamentary Papers*, &c.)

Statistics.

Population.—Huntingdonshire is entirely an agricultural county, ranking in 1831 the second in that respect among all the counties of England; in 1811 it ranked the fourth. None of the population are engaged in manufactures of any kind. Of 13,001 males twenty years of age and upwards living in the county (in 1831) 7221 were occupied in agricultural pursuits.

The population of Huntingdonshire at each of the four periods when the census was taken was—

	Males.	Females.	Total.	Increase per cent.
1801	18,521	19,047	37,568	..
1811	20,402	21,806	42,208	12·35
1821	24,020	24,751	48,771	15·54
1831	26,377	26,815	53,192	8·97

showing an increase between the first and last periods of rather more than 41½ per cent., which is 15¼ per cent. below the whole rate of increase throughout England.

The following table contains a summary of the population, &c., of every hundred, as taken in 1831:—

Summary of the County of Huntingdon.

Hundreds, Cities, or Boroughs.	Houses.				Occupations.			Persons.			
	Inhabited.	Families.	Building.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.	Males, twenty years of age.
Hurstingstone, Hundred	3,141	3,711	17	79	2,088	985	638	8,738	8,689	17,427	4,389
Leightonstone	1,778	2,054	1	49	1,393	461	200	4,743	4,782	9,525	2,311
Norman-Cross	1,754	1,935	9	47	1,240	424	271	4,418	4,410	8,828	2,186
Toseland	2,690	2,908	10	78	1,508	757	643	6,935	7,210	14,145	3,347
Huntington, Borough	627	670	3	37	2	313	355	1,543	1,724	3,267	768
Totals	9,990	11,278	40	290	6,231	2,940	2,107	26,377	26,815	53,192	13,001

County Expenses, Crime, &c.—The sums expended for the relief of the poor at the four dates of—

1801	were £23,867,	being 12*s* 8*d*.	for each inhabitant.
1811	„ 35,413	„ 16 9	„
1821	„ 39,429	„ 16 2	„
1831	„ 40,474	„ 15 2	„

The sum expended for the same purpose for the year ending March, 1837, was 21,676*l*.; and assuming that the population had increased at the same rate of progression as in the ten preceding years, the above sum gives an average of 7*s*. 8¾*d*. for each inhabitant. All these averages are above those for the whole of England and Wales.

The sum raised in Huntingdonshire for poor-rate, county-rate, and other local purposes, in the year ending the 25th of March, 1833, was 46,733*l*. 17*s*., and was levied upon the various descriptions of property as follows:—

On land	£38,399	7
Dwelling-houses	7,082	2
Mills, factories, &c.	1,105	3
Manorial profits, navigation, &c.	147	3

The amount expended was—

For the relief of the poor	£39,576	18
In suits of law, removal of paupers, &c.	1,092	12
For other purposes	6,169	10
	46,839	0

In the returns made up for subsequent years, the descriptions of property assessed are not specified. In the years 1834, 1835, 1836, and 1837, there were raised 45,500*l*. 8*s*., 42,098*l*. 12*s*., 35,757*l*. 15*s*., and 29,404*l*. respectively; and the expenditure for each year was as follows:—

	1834. £.	s.	1835. £.	s.	1836. £.	s.	1837. £.
For the relief of the poor	35,844	2	31,254	17	27,273	4	21,676
In suits of law, removals, &c.	1,146	5	846	1	1,064	9	453
Payment towards the county-rate	7,472	13	4,359	11	4,348	6	3,818
For all other purposes			3,967	18	3,244	16	1,924
Total money expended	£44,463	0	40,428	7	35,930	15	27,871

The saving effected on the sum expended for the relief of the poor in 1837, as compared with the expenditure of 1834, was therefore more than 36 per cent.; and the saving effected on the whole sum expended in 1837 was more than 37 per cent., as compared with that expended in 1834.

The number of turnpike trusts in Huntingdonshire, as ascertained in 1835, is 7; the number of miles of road under their charge is 146; the annual income in 1835, arising from the tolls and parish composition, was 10,707*l*. 4*s*. 5*d*.; and the annual expenditure, 11,406*l*. 11*s*. 7*d*.

The county expenditure in 1834, exclusive of that for the relief of the poor, was 4150*l*. 9*s*. 5*d*., disbursed as follows:—

	£.	s.	d.
Bridges, building, and repairs, &c.	255	12	9
Gaols, houses of correction, &c., and maintaining prisoners, &c.	910	18	0
Shire-halls and courts of justice, building, repairing, &c.	7	7	5
Prosecutions	555	19	11
Clerk of the peace	180	0	4
Conveyance of prisoners before trial	9	6	8
„ transports	124	0	0
Vagrants, apprehending, and conveying	225	5	3
Constables, high and special	290	18	0
Coroner	54	6	6
Payment of debt, principal and interest	1,140	0	0
Miscellaneous	396	14	7

The number of persons charged with criminal offences in the three septennial periods ending with 1820, 1827, and 1834, were 197, 205, and 313 respectively, making an average of 28 annually in the first period, of 29 in the second period, and of 44 in the third period.

The number of persons tried at quarter-sessions in each of the years 1831, 1832, and 1833, in respect to which any costs were paid out of the county rates, were 15, 22, and 27 respectively. Among the persons charged with offences, there were committed for—

	1831.	1832.	1833.
Felonies	11	17	22
Misdemeanors	4	5	5

The total number of committals in each of the same years was 14, 18, and 23 respectively.

	1831.	1832.	1833.
The number convicted was .	9	16	20
„ acquitted .	2	4	6
Discharged by proclamation .	1	3	5

At the assizes and sessions in 1837, there were 67 persons charged with crime in Huntingdonshire. Of these, 5 were charged with offences against the person, 4 of which were for common assaults; 5 for offences against property committed with violence; 52 for offences against property committed without violence; 3 for arson; and 2 for uttering counterfeit coin. Of the number convicted, 2 were sentenced to death, the sentence of one of whom was commuted to transportation for life, and of the other to imprisonment for one year; 7 others were sentenced to transportation for life, 2 for 14 years, and 4 for 7 years; 6 were to be imprisoned for one year or above 6 months, and 24 for 6 months or under; one was fined. Of the whole number of offenders, 46 were convicted, 8 were acquitted, 6 were not prosecuted, and no bill was found against 7. In this number 59 were males and 8 were females; 34 could neither read nor write; 27 could read and write imperfectly, and 6 could read and write well.

The number of persons qualified to vote for the county members of Huntingdonshire is 2744, being about 1 in 19 of the whole population, and rather less than 1 in 5 of the male population twenty years of age and upwards, as taken in 1831. The expenses of the last election of county members to parliament were to the inhabitants of the county 33*l.* 8*s.* 6*d.*, and were paid out of the general county-rate.

There is one savings' bank in this county. The number of depositors and amount of deposits on the 20th of November in each of the following years were—

	1832.	1833.	1834.	1835.	1836.
Number of depositors	776	888	968	991	1,108
Amount of deposits	£22,474	£24,014	£26,276	£28,650	£30,926

The various sums placed in the savings' bank in 1835 and 1836 were distributed as under:—

		1835. Depositors.	1835. Deposits.	1836. Depositors.	1836. Deposits.
Not exceeding	£20	586	£3,891	666	£4,325
„	50	237	7,092	269	8,181
„	100	95	6,583	96	6,800
„	150	50	5,761	56	6,687
„	200	13	2,208	14	2,369
Above	200	10	3,115	7	2,564
		991	28,650	1,108	30,926

Education.—The following summary is taken from the Parliamentary Returns on Education, made in the session of 1835:—

	Schools.	Scholars.	Total.
Infant schools	38		
Number of infants at such schools; ages from 2 to 7 years:—			
Males		257	
Females . . .		354	
Sex not specified .		201	
			812
Daily-schools	190		
Number of children at such schools; ages from 4 to 14 years:—			
Males . . .		1,932	
Females . . .		1,798	
Sex not specified .		1,263	
			4,993
Schools .	228		
Total of children under daily instruction			5,805
Sunday-schools	115		
Number of children at such schools; ages from 5 to 15 years:—			
Males		2,618	
Females . . .		2,725	
Sex not specified .		1,001	
			6,344

Assuming that the population between the ages of 2 and 15 has increased in the same proportion with the whole population since 1821, when the relative population at different ages was last taken, and likewise assuming that the whole population has increased since 1831 in the same ratio as it did the 10 years preceding that date, we find by approximation that there were 18,209 children between the ages of 2 and 15 in the county of Huntingdonshire in 1834, the time the Educational Inquiry was made. Nine Sunday-schools are returned from places where no other school exists, and the children (334 in number) who are instructed therein cannot be supposed to attend any other school; at all other places Sunday-school children have opportunity of resorting to other schools also; but in what number or in what proportion duplicate entry of the same children is thus produced must remain uncertain. Seventeen schools containing 743 children, which are both daily and Sunday schools, are returned from various places, and therefore duplicate entry is known to be thus far created. Making allowance from this cause for a number of children having been entered twice as under instruction, we may perhaps fairly conclude that little more than half of the children between the ages of 2 and 15 are receiving instruction in this county.

Maintenance of Schools.

Description of Schools.	By endowment.		By subscription		By payments from scholars.		Subscrip. and payment from scholars.	
	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.
Infant Schools	—	—	3	217	32	437	3	158
Daily Schools	29	833	14	605	129	2,820	18	735
Sunday Schools	5	170	102	5,645	..	..	8	529
Total...	34	1003	119	6,467	161	3,257	29	1,422

The schools established by dissenters, included in the above statement, are—

	Schools.		Scholars.
Infant schools . .	—		—
Daily-schools . .	6,	containing	153
Sunday-schools . .	29	„	2,150

The schools established since 1818 are—

			Scholars.
Infant and other daily schools	97,	containing	2,597
Sunday-schools . .	83	„	5,189

Three boarding-schools are included in the number of daily-schools given above. No school in this county appears to be confined to the children of parents of the Established church, or of any other religious denomination, such distinction being disclaimed in almost every instance, especially in schools established by Dissenters, with whom are here included Wesleyan Methodists.

Lending libraries of books are attached to 10 schools in this county.

HUNTSVILLE. [ALABAMA.]

HURD, RICHARD, D.D., born 1720, died bishop of Worcester 1808, is eminent rather as an elegant scholar than a divine, and is more spoken of on account of his connection with Warburton than for his own merits, which were however of no mean order. He was born in Staffordshire, the son of John and Hannah Hurd, 'plain, honest, and good people,' as he himself has described them, renting a considerable farm in that county. It was the good fortune of Hurd to live in his childhood near a well conducted grammar-school, that of Brewood, where he had an excellent master, who prepared him well for the university. He went to Cambridge at a much earlier age than is now the custom, about fifteen; and his history from that time is that of a scholar, university man, author, and divine, taking his degrees, being ordained, gaining some little preferment, which is followed by greater, and publishing sundry sermons, tracts, and books. An ample detail of all this may be read in the sixth volume of Nichols's 'Literary Anecdotes of the Eighteenth Century.'

Dr. Hurd continued to reside at Cambridge as a Fellow of Emmanuel till 1757, when he became rector of Thurcaston in Leicestershire, where he went to reside. In 1765 he was made preacher of Lincoln's Inn, and in 1767, archdeacon of Gloucester, by his friend Bishop Warburton. In 1775 he was made bishop of Lichfield and Coventry, from whence, in 1781, he was translated to Worcester, where he continued till his death, declining the offer which was made him of becoming archbishop of Canterbury on the death of Archbishop Cornwallis in 1783. The writings of Bishop Hurd are too many to be particularly named. The most remarkable are his 'Dialogues,' his 'Letters on Romance and Chivalry,' his 'English Commentary on the Epistle of

Horace on the Art of Poetry' and the ingenious Essays published with it, his 'Twelve Discourses on the Prophecies,' his Sermons, and his Life of his friend Bishop Warburton. There is also an octavo volume of the correspondence between Warburton and Hurd, a very pleasing book, and calculated to remove some portion of the ill opinion which many persons have formed of the real character of Warburton, and of the nature of that friendship which so long subsisted between 'Warburton and a Warburtonian.'

HURDIS, JAMES, was born at Bishopstone, in Sussex, in the year 1763, and brought up at Chichester school, where he early showed a taste for poetry and music. In 1780 he entered at St. Mary Hall, Oxford, and was subsequently elected demy and fellow of Magdalen College, in that university, and took orders. In 1788 he published 'The Village Curate,' which seems to have been first produced anonymously. This work was followed by a tragedy, called 'Sir Thomas More,' and some other poetical works, as well as by two theological critiques on Genesis, and 'Remarks on the Arrangement of the Plays of Shakspeare.' In 1793 he was elected professor of poetry in the university of Oxford, and in 1801 he died.

Hurdis is now remembered chiefly for his friendship with Cowper, which began about the beginning of the year 1791. Several letters to him appear in Hayley's 'Life of Cowper,' and the compiler hints that these were only a selection made from a larger number. We wish also to call attention to him as one of those who awakened or attempted to awaken interest on the subject of Shakspeare criticism, as it is most desirable that all who study Shakspeare should be made acquainted with the several steps which have been made both here and elsewhere, in the critical investigation of his writings. (Chalmer's *Biog. Dict.*; Hayley's *Life of Cowper.*)

HURDWAR. [HINDUSTAN.]

HURON, LAKE. [CANADA.]

HURO'NIA, the generic name assigned by Mr. C. Stokes to certain remarkable articulated bodies, of a partially radiated structure, found in the transition limestone of Lake Huron by Dr. Bigsby. Until lately these fossils were referred to the group of Polyparia, but from a careful study of specimens more complete than those which he first observed, Mr. Stokes has found that the parts represented as lamelliferous corals are really only the siphuncular portions of shells of Cephalopoda, which may be included in the family of Orthoceratites. The structure of the siphuncular parts in these and other chambered shells from the limestone of various parts of North America has led Mr. Stokes to propose two other new genera, viz. Actinoceras and Ormoceras, whose characters, as well as those of Huronia, can only be well traced in comparison with the ordinary structure of ORTHOCERAS, under which head we propose to present a brief synoptic view of the whole group of straight chambered shells. (For figures of Huronia, see *Geol. Trans.*, vol. i., new series.)

HU'RRIA, Daudin's name for certain Indian Colubers, the scales or plates on the base of whose tails are constantly simple and those of the point double.

HUSBAND. [WIFE.]

HUSBANDRY. The origin of the simplest arts of life is involved in the obscurity which envelops the early history of the human race. Before there can be any motives to record events, some considerable progress must have been made in civilization. When attention is altogether directed to obtaining the means of subsistence, there is little leisure; nor is there any great desire to communicate the knowledge acquired by experience. Warlike achievements are the first things recorded; and the peaceful labours of the husbandman are overlooked. In the fables which in the early ages of the world supplied the place of authentic histories, some conspicuous character was always made the inventor of the various arts of which the origin was unknown; and to such personage a divine origin was frequently ascribed. Thus Cadmus is said to have invented letters, and Triptolemus to have made the first plough.

In the oldest writings which have been handed down to us, the common operations of husbandry are mentioned, or alluded to, in nearly the same terms in which we should describe them now—the same implements were then in use, and the same productions raised which are now found in the same climates: but they are only mentioned incidentally. It requires a very advanced state of the arts and of literature to produce a treatise on any one practical subject exclusively: and the simpler and more common the arts, the less they are noticed in the early literature of a nation. We have however no other means of tracing the progress of husbandry than by the works of those who have written on the subject, until we come to our own times, when everything is noted and commented on, and every one who makes any discovery or improvement is anxious that the public should be acquainted with it. We have already mentioned some of the early Greek authors [ARABLE-LAND, vol. ii., p. 229], and likewise some of the Latin authors most generally known as having treated of husbandry in general. (*De Re Rustica.*) From these authors we learn that considerable progress had been made in the tillage of the ground and in the breeding and rearing of the domestic animals: and it appears that wherever the Romans carried their victorious arms, they also introduced improved methods of cultivation. The practice of fallowing land, to restore its fertility, can be clearly traced to them. For a long time the Latin authors were the source from which all writers on husbandry derived their knowledge; and hence many useless and absurd rules, which were connected with the pagan superstition were perpetuated.

The Mediterranean Sea and the countries situated around it were once the centre of all the arts, which had slowly travelled westward from Asia and from Egypt; and the colonies which the Greeks and Romans planted on all the coasts of this sea, and in the countries which they conquered, contributed to diffuse a knowledge of the various products of the earth. The irruption of the barbarians into the Roman empire greatly checked the progress of husbandry; but the destruction of the Eastern empire, while it made the Greeks retrograde in civilization, tended to introduce improvements into those countries where men of learning and science sought a refuge from the invaders.

British Husbandry.—The husbandry of the aboriginal Britons was probably very imperfect before the invasion of Julius Cæsar; but we have no records to inform us. Rural matters were of too little importance in the eyes of conquerors to engage much of their attention, but the mildness of the climate and the general fertility of the country induced many of the Romans to settle here: and from them the natives learned a better system of cultivation than that of their ancestors.

As far as we can learn from antient documents, the land in England formerly consisted chiefly of woods and of extensive pastures, in which sheep and cattle were bred, which constituted the chief wealth. A very small proportion of the soil was cultivated; and, while the population was thin, there was no difficulty in obtaining land which had never before been broken up, and which with little trouble or manuring produced moderate crops of corn. But this system could not last long. The proprietors of land would soon perceive that the produce fell off, and would consequently restrict the breaking up of pastures, and thus more attention was necessarily paid to the arable lands in cultivation.

Through the deficiency of the laws, or the difficulty of executing them, and the frequent intestinal wars between the barons, depredations were often committed with impunity; and the cultivators of the soil congregated in villages for mutual protection and defence. The best land nearest to the habitations was cultivated, and the common pastures fed the cattle without much trouble or expense. The consequence of this system was, that very little manure was made, and the cultivated fields scarcely produced a return adequate to the expense of cultivation. Four times the seed was a full average for corn crops, and the land was overrun with weeds after a single crop. Hence it was not an uncommon practice to have a fallow every other year, and this was considered a superior system to having two crops between the fallows, which has been more common since. Wheat was very little cultivated; barley, rye, and oats were the principal produce.

The woods nourished many hogs on the acorns and beech-mast which abounded there, and the right of turning hogs into the king's forests was granted under the barbarous terms of *mastagium* and *rootagium*.

The religious orders, to whom extensive grants of waste lands were made, greatly contributed to the improvement of agriculture. The monks by their knowledge of Latin were enabled to study the Roman authors on husbandry, and, by applying the rules and principles which they drew from that source, they greatly improved their estates, and made the land more productive: teaching and encouraging their tenants to till the land more effectually, they were, upon th whole, better and more indulgent landlords than the nobles, who, provided they secured retainers and supplied their households with necessaries, gave themselves little trouble about anything else. Bread made of rye, barley, peas, or beans, was the principal food of the labourers, who were attached to the soil, and had no right to remove to another place or serve any other master. The immediate tenants of the lord of the soil cultivated a portion of the lands which they held for their own use, and let the remainder to smaller tenants, who, although born free, were little above the condition of the labourers, and lived much in the same manner. There was so little capital among the farmers, that the live stock was frequently the property of the landlord, and was let with the land, as well as the servants. As to implements, they were very few in number, and rudely made by the farmer himself; an iron plough-share, an axe, and a spade, were the principal instruments for which he had to pay.

Oxen, which could be kept on the common pastures at little expense, were used for the plough; and so badly fed were they in general, that it required six oxen to draw a plough, which barely turned up half an acre in a summer's day. These oxen consumed all the straw of the farm in winter, and little was left to make manure of. Horses carried the corn to the mill or market on their backs, the roads being mostly impassable for wheel-carriages, which indeed were unknown in many parts of the country.

These particulars can only be gleaned out of various authors, who incidentally mention the state of the agricultural population, and from antient deeds and documents.

With the revival of letters, and especially with the invention of the art of printing, greater attention began to be paid to rural affairs: but all the early English or foreign authors who touch on the subject of agriculture took their notions from the authors *De Re Rustica*, and rather say what should be done, than what really was done.

The first English author of any note who wrote on husbandry was Sir Antony Fitzherbert, who has by many been looked upon as the father of English husbandry. He published his 'Book of Husbandrie' in 1523. This work throws considerable light on the state of the farmers in those days, who, with their wives and children, worked hard, and were little raised above the common labourers, except that they were freemen. A yeoman who had land of his own was a very independent man; but his mode of living was extremely plain, and he had no luxuries. Money was seldom seen in his possession. He lived on the produce of his land, and fed his labourers at his own board. Wool was the principal article sold. The sheep were kept on extensive commons, at little expense; and in some places the folding of them on the land was the principal mode of recruiting it when exhausted. The great difficulty was to keep them alive in severe winters, and many perished every year. The only provender they had was hay; and as artificial grasses and turnips were unknown, natural meadows paid an enormous rent, when compared with arable land. For want of winter provender for cattle, many were killed which were not sufficiently fat. Very little fresh meat was eaten after Christmas, and every family had oxen and sheep killed and salted in autumn to last till the next summer.

In the time of Elizabeth some attention began to be paid to the improvement of husbandry, but no works of any note have come down to us in which we can discover that any considerable change was made in the common modes of tillage or in the rearing and feeding of cattle.

The situation of the farmers however appears to have improved: they began to acquire wealth and to increase their domestic comforts. The farm-houses were more solidly built and commodious, having before been chiefly constructed of wood, and the walls plastered with clay.

Cromwell encouraged husbandry, and gave a pension to Hartlib, who published in 1641 a work on the husbandry of Flanders, and another in 1651, called the 'Legacy of Husbandry.' Walter Bligh, the friend and contemporary of Hartlib, published in 1652 another work called 'The Improver Improved.' This work is deserving of notice. It contains very sound principles of husbandry, with many excellent observations, which may be of great use even in our days. The author mentions clover as an important object of cultivation introduced from the Netherlands; and he may be considered as the first who recommended sowing this plant for feeding cattle. Sir Richard Weston, who soon after gave an account of the cultivation of turnips in Flanders, laid the foundation of the improved system of husbandry, of which the feeding of cattle and sheep on turnips in winter is the chief feature.

From that time to the present day husbandry has improved slowly but regularly. With the increase of population and a consequent increased demand for the produce of the soil, there has arisen a new species of speculation, that of reclaiming waste lands, by which the estates of many landed proprietors have been greatly improved. But the most important step has been the granting of long leases to those who were inclined to lay out their capital and employ their skill in improving farms. The security which the law gives to a leaseholder, and his independence of his landlord, provided the rent be duly paid, is the greatest encouragement to industry; and it will be invariably found that the improvement of any district is proportioned to the length of time for which leases are granted there, at a fair annual rent, without uncertain fines.

The spirit of improvement and the hope of increasing his income often lead a man to mistaken experiments and consequent loss; but the experience thus gained is always valuable to the community. Jethro Tull, a gentleman who had a property near Hungerford in Berkshire, introduced a mode of cultivation which was prevalent in Lombardy, and was borrowed from the practice of gardeners, who sow and plant their vegetables in rows with wide intervals. Finding that in rich soils the produce was much increased by stirring the earth round the roots of plants, he formed a theory respecting the food of plants, which he imagined to be extremely finely attenuated earth. He thought that manures acted only mechanically, and that by continually stirring the soil it might be kept perpetually fertile. The attractive part of this theory was, that whereas the supply of manure is limited, there is no limit to labour, and that consequently an increase of population only required an increase of tillage to supply it with food. Tull was admired, and his theory adopted by many eminent men. His practical system, to which the name of *drill-husbandry* has been given, was looked upon as one of the most important discoveries. But it was soon found that his imagination had led him too far; and he injured his fortune greatly by his experiments and his practice. Notwithstanding this, he must be considered as one of the great promoters of good husbandry. Even his errors have been useful by making men observe and reflect; and the introduction of machines to drill the seed in rows, and of others to clean and hoe the intervals, which he principally suggested, has been of infinite use to the improved cultivation of the soil.

The rearing and fattening of cattle on the produce of arable land, which followed the introduction of sainfoin, lucern, and other artificial grasses, and the cultivation of roots for the same purpose, have made a great change in the old systems. Manure is produced in greater quantity; the land increases in productive power, and will bear more frequent crops of corn; better implements have been invented to save labour and to do the work more completely; and a system of draining has been introduced, which has corrected the great fault of most strong soils in northern climates — excessive moisture which cannot evaporate. Many causes have concurred to produce these improvements. At one time high prices induced men to lay out their capital on the cultivation of the soil; at another, low prices stimulated industry, to make up by an increased production for a deficiency in the value; and what has contributed greatly to keep attention directed towards agricultural improvements is the rapid increase of the means of communicating information by the press. Every successful experiment, every new method which the inventor thinks of importance, is speedily announced to the public.

The improvements which have been made in the breeds of cattle and sheep may be considered as entirely modern. The profit which some eminent breeders have made, and, to some extent, still make, by their attention and their skill, is a sufficient inducement to excite competition. Mr. Collins and Mr. Bakewell may be cited as examples of successful attention to breeding. Mr. Collins obtained at a public sale of his cattle—

For 17 cows of all ages . . .	£2663
For 11 bulls	2249
For 7 bull-calves under 1 year old	655
For 7 heifers	808
For 5 heifer-calves under 1 year .	306
Making for 47 head of cattle of all ages	£6687

At another sale, of Mr. Fowler's stock in 1791, fifty head of cattle brought 4289*l*. 4*s*. 6*d*.

Such prices are a great inducement to pay attention to breeding.

To enumerate the various works which have come from the press on subjects connected with husbandry would be to give a catalogue of a large library. We can only mention some of the principal authors, such as Lord Kames, Marshall, Arthur Young, Sir John Sinclair, and Dickson. Of these the most original author is the first. His 'Gentleman Farmer' contains much excellent information and useful practice. The others, although confessedly compilers, have great merit in the manner in which they have brought forward the various information which they have collected. The 'Farmer's Magazine,' which appeared in 1800, and continues under a new set of editors to this day, has done much good in disseminating useful practices in husbandry. British husbandry owes much to the zeal and activity of individuals who have formed societies for its improvement. The Bath and West of England Society, which still exists, has been greatly instrumental in spreading the knowledge of practical husbandry, and much useful information is contained in the Reports of its Transactions. The Highland Society of Scotland, of which all the principal proprietors and most of the large occupiers of land in Scotland are members, has greatly contributed to encourage experiments, and to promote improvements in every branch of husbandry.

The Board of Agriculture, at the head of which was Sir John Sinclair, the zealous promoter of all measures for diffusing agricultural information, although it has rather disappointed the hopes and expectations formed at its commencement, and has for some time ceased to exist, was the means of diffusing a knowledge of the state of husbandry throughout Britain, at the beginning of this century, by the publication of the Agricultural Surveys of the different counties, the substance of which has been condensed in the 'British Husbandry,' in 2 vols., lately published under the superintendence of the Society for the Diffusion of Useful Knowledge. The newly-established English Agricultural Society leads us to cherish the best hopes of a new stimulus being given to the improvement of British husbandry.

To complete this short sketch of British husbandry, it only remains briefly to mention the different systems which have been most prevalent at different times.

The first and most inartificial is that which consists in breaking up portions of pasture-land and sowing corn on a slight ploughing, which cannot fail to be productive for some time. Several crops may thus be taken, until the land is so exhausted, that the crop no longer repays the seed and labour. To defer this time, experience soon pointed out the crops which succeeded best after each other. Wheat or barley were probably the first crops; afterwards peas, beans, or oats, until the ground, being overrun with weeds, would be left to the renovating effect of time, and a fresh spot would be broken up.

The first improvement on this system is that of infield and outfield. The infield is cultivated more carefully, somewhat like a garden, and all the dung of the cattle is exclusively put upon this part. The outfield is a continuation of the first-mentioned system. The infield consisted of inclosures or open fields near the dwelling, which it was most convenient to cultivate as arable land. Thus two distinct systems of husbandry were carried on at the same time; and whatever improvements were introduced in the management of the infield, the outfield continued to be managed as it was before.

The mode of recruiting lands which had been exhausted by crops, or were overrun with weeds, by means of a fallow, seems to have been introduced into England by the Romans, and never to have reached Scotland till the eighteenth century, a thing almost incredible, if it were not capable of explanation by the circumstance that there had generally existed a hostile spirit between the two nations, and that communications were not frequent between English and Scotch yeomen, except on the field of battle. The alternate crop and fallow seem to have been later introduced than a fallow after several crops. The triennial system, which consists of a summer fallow, a winter crop, and a spring crop, was probably longer established than any other, and is still the practice in many parts of England. The deteriorating effect of the outfield system would lead to its abandonment as soon as population increased, and with it the want of land for infield. The common-field lands, which were so extensive till within the last fifty years, many of which have since been inclosed by special acts of parliament, were probably at first only portions of commons, which were broken up by common consent, and formed into outfields. The right of pasture over them, after the crops are removed, strengthens this supposition.

When common-fields are divided and inclosed, a better system of husbandry generally follows. Clover and turnips are more regularly sown, and, on the light lands, take the place of summer fallow. Clover generally comes after a crop of corn, in which it was sown the preceding year in spring; and as most crops succeed well after clover, wheat was usually chosen for the next crop as the most profitable. Thus arose the Norfolk system, without any very sudden departure from the old rotations. Two crops raised for the food of animals in four years require more cattle on the farm to expend them profitably: and thus more manure is made. In the light soils the sheep when folded on the turnips not only enrich the land by their dung and urine, but likewise render it more compact by treading it, which is advantageous to the clover and wheat which come after. If the land is a good loam, beans are sometimes sown after wheat, the land having been recruited with manure; and if the beans are kept clean by hoeing, another good crop of wheat may be obtained after them. Thus arises the improved rotation of turnips, barley, clover, wheat, beans, wheat; after which the land is again cleaned and prepared for turnips with all the manure that can be spared. As in this system there is always a crop with succulent leaves intervening between two which have a white straw, it has been called the *alternate* system of husbandry. These are the most common systems in England. The removal of the fallow year, provided the land be kept clean, is a decided step towards improvement. The best farmers effect this by the introduction of artificial grasses and tares fed off by sheep, and especially by sowing every crop in rows and keeping the intervals stirred, which is a partial fallow without loosing a crop. Here Tull's system is introduced, which in its complete state, as the author recommended it, was soon abandoned.

As the English systems have taken their origin chiefly from the infield cultivation, so the Scotch appear to have arisen from that of the outfield. Fallows were unknown; but the invigorating effect of grass fed off by cattle must soon have been perceived: and instead of leaving the land to recover slowly by the spontaneous growth of natural herbage, which on poor land takes a long time, it was obvious that this might be accelerated by sowing grass-seeds. Hence the origin of the Scotch convertible system of husbandry, which is gaining ground daily, and bids fair, in remote situations where no manure can be purchased, to be firmly established. The order of the conversion has been somewhat altered from what it was originally. Instead of sowing grass-seeds after the land is exhausted, it has been found advantageous to accelerate the growth of grass by manuring the crop in which it is sown; and experience has proved, that the richer the grass is, the more productive are the crops which come after. The grass, instead of being a mere substitute for fallowing and manuring, is made highly profitable by feeding cattle and sheep; and the profit of the years when the land rests, as it were, by being depastured, is often as great as that of the years when it is cropped; and the risk and expenses are much less. The convertible system is not very generally known or adopted in England, and is often confounded with the alternate system. The alternate system interposes a green crop between two white-straw crops. On good land the convertible husbandry may consist of three or four years' tillage and three years' grass. If the land is not quite clean, a summer fallow on heavy soils, or a turnip fallow on light soils, should begin the course; and only one crop should be taken after the fallow in which the grasses are sown, whether it be wheat, rye, barley, or oats. It should be fed off the first year, mown the second, and fed off again in the third: when it is broken up, oats are usually sown as the first crop in Scotland, then beans, if the land admits of them, and then wheat. If a fallow is intended, a crop of peas may be sown after the wheat, and then the course begins again, as before, with a clean fallow or with turnips. In this manner the land may be kept clean, and continually improve in fertility by means of the cattle which are kept upon it, without the aid of any purchased manure, except lime, the expense of which is in most cases well repaid by the crop. These are the only regular systems in Britain; and every mode of cultivation and cropping may be reduced to one of them, unless it be capriciously anomalous.

What renders the improved systems of British husbandry so superior to that of all other nations is the attention paid to the perfection of the different breeds of domestic animals, especially the horse, the ox, and the sheep. In this respect British husbandry surpasses every other. No expense or trouble is spared to improve the qualities of cattle and sheep. It has been objected, that the rewards given by different societies for excessively fat cattle are not judicious, as those animals are never profitable to the feeder. The same might be said of very high-bred racehorses; they are not so useful as a good hackney or hunter; but unless some individual animals possess the power, courage, and speed which is the mark of the best blood, it would soon degenerate; so likewise if some oxen were not occasionally fatted to an extraordinary degree, the fatting qualities of the breed could not be proved. A badly bred ox will never become so fat, whatever food may be given him, as one of a choice breed. This the breeders are well aware of, and never hesitate to pay a good price for a young bull related in blood to a prize ox.

The great variety of new instruments which are daily invented, and some of which gradually come into use, however expensive they may appear, is another feature in British husbandry; and the letting out of drills and threshing machines, which are kept for profit by men who have little or no land to cultivate, is a step to that division of labour which has done such wonders in manufacturing industry, and which will no doubt in time do the same in the operations of husbandry. There is a fresh spirit of improvement arising among practical agriculturists, and not the least favourable symptom is, that it begins to be acknowledged that 'much may yet be learned,' and that 'husbandry is still comparatively in its infancy.' This admission is a great step towards improvement; and coupled with the establishment of the English Agricultural Society before referred to, leads us to hope with confidence that husbandry in Britain will improve rapidly, and keep pace with other sciences and arts.

Husbandry in Italy.—It might be expected that Italy would present some remains of the Roman husbandry, but such has been the pernicious effect of wars and intestine commotions, that this fine country, with all the advantages of soil and climate, is far behind less favoured regions in the cultivation of the soil and the rearing of cattle. The plains of Lombardy alone are an exception; but the cultivation of maize, the principal produce there, partakes more of the garden husbandry than that of any other grain. The abundance of water which descends from the Alpine regions fertilizes a great extent of soil by artificial channels, in which it is made to disperse itself, and produces a vegetation which requires little assistance, except that of weeding. Italy was however the country where, on the revival of letters, the first books were published on the practice of husbandry. Pietro di Crescenti, a citizen of Bologna, born in 1230, after thirty years' experience in all parts of Italy, wrote a treatise entitled 'Opus Ruralium Commodorum,' printed in 1474. There is a doubt whether it was first written in Latin or Italian, but it was soon translated into French and German. The author quotes Cato, Varro, and Palladius, but not Columella, who probably was not then generally known, or perhaps his works had not yet been rescued from the libraries in which antient works were long buried. In the succeeding century many of the Greek and Latin authors on husbandry were translated and published. Tavello, in his 'Recordo d'Agricoltura,' 1561, ascribes the deterioration of agriculture to the practice of letting land for three years only, which had been introduced very generally, and perpetuated the triennial system in its worst form. Johannes Baptista Porta, in 1592, published his 'Villæ,' in 12 books, a work which has had a considerable reputation, and is considered by many as still well worth consulting. A variety of authors on different parts of husbandry wrote about this time, in consequence of the frequent famines which arose in Italy from a very imperfect state of husbandry. The 'Vinti Giornate dell' Agricoltura,' Venetia, 1569, which had been first published in 1550, under the title of 'Deci Giornate,' went through more than 20 editions in Italy, besides being often translated. The author ridiculed the foolish astrological notions prevalent at the time, and his work is full of good sense. But all these writers had little influence on the improvement of the actual practice of husbandry in Italy. If a spirited proprietor attempted to introduce improvements, the prejudices and obstinacy of the country-people soon disheartened him, and to this day the systems adopted are extremely defective, if there is any system at all. In many places the ploughman still stands on the heel of the plough to keep it in the ground, and a straight furrow is not thought of. The earth is scratched rather than tilled; and if good crops arise from the natural fertility of the soil, they are generally choaked with weeds before harvest.

An attempt had been made by Leo X. to drain the Pontine marshes, and it was renewed in 1586 by Sextus V. Pius VI. spent great sums on the same object; but to this day little has been effected; and instead of the fertile plain which once was covered with a golden harvest, there is nothing but a dreary marsh producing pestilential vapours pregnant with disease. Sicily and Sardinia, once the granaries of Rome, now produce only a very small quantity of corn. The best cultivated districts in Italy are Piedmont, Lombardy, Tuscany, and the country about Ferrara; but, except in the two first, they are behind the rest of Europe in the management of a farm. The proprietor of the land, if he does not cultivate it by his own servants, is also the proprietor of all the live stock and implements of the farm.

Husbandry of Spain.—Spain possesses a considerable extent of fruitful soil, and the husbandry of the Romans, which the irruption of the barbarians had interrupted, was in some measure revived by the Moors. When they were expelled, Spain lost many industrious husbandmen and manufacturers. A work on husbandry by a Moor, called Ebd-el-awam, who is supposed to have lived about the thirteenth century, was published with a Spanish translation at Madrid in 1802, and does credit to the agricultural knowledge of the author. The cultivation of the sugar-cane and of saffron are mentioned in this work.

Herrera, who wrote on husbandry at the desire of Cardinal Ximenes, is one of the most esteemed authors of his time. His works have been frequently republished; and are now in great reputation, and looked upon as quite classical in agricultural literature. He laments that mules are generally used in Spain for the plough and other purposes of husbandry, instead of the ox. But Herrera did not succeed in changing the custom; and mules are still in general use. The great object of attention in Spain is the production of fine wool; and the privileges given to the Mesta, a kind of corporation of shepherds, tend greatly to retard the introduction of a better cultivation. The Merino breed of sheep is said to have been imported originally from Britain. But it is evident that, if it is necessary to its perfection that the flocks should run over half the kingdom every year, the profit which is made by the exportation of fine wool is dearly purchased by the disadvantages of a miserable state of agriculture. Instead of producing a superabundance of grain and supplying other countries, Spain is obliged frequently to import corn in order to prevent a scarcity. The state of Portugal is not better, and the vine is the only plant of which the cultivation is moderately well understood in the whole of the peninsula.

Husbandry of Germany.—The husbandry of Germany varies greatly in such an extent of country. In the time of Tacitus half the country was covered with impenetrable woods. As population extended the forests were cut down, and the sickle succeeded to the axe. The republic of the Swiss cantons and the Hanseatic towns gave the first examples of encouragement to husbandry. In 1571 the work of Heresbach, entitled 'Rei Rusticæ, libri iv.,' was reprinted at Cologne. Heresbach was born in the duchy of Cleves in 1509, and is considered the father of husbandry in Germany.

Augustus I., elector of Saxony, wrote a treatise on the cultivation of the vine, which was published in 1636, entitled 'Churfürsten's Augusti zu Sachsen Obstgartenbuchlein.'

In Prussia, Mecklenburg, and Holstein, husbandry has made the greatest progress in modern times. The Prussian government, from the time of Frederick the Great, has taken agriculture under its especial protection. In Prussia there are several schools of agriculture, where the art is taught on scientific principles, and where the practice is shown on large farms. That of Mögelin, over which A.

Thaer presided, has become conspicuous from the excellent work on rational husbandry, 'Rationellen Landwirthschaft,' which he published. The introduction of the Dutch system of dairying in Holstein, and the breeding of fine horses there, has given a reputation to this part of the Danish dominions. In Bavaria, along the banks of the Rhine, from Basel to Darmstadt, there is a fine fertile plain which is cultivated with some care; and although subjected generally to the triennial system (which is called in England the three-course shift), the husbandry of that part of Germany is not to be despised. In Switzerland the management of grass-lands and water-meadows is carried to great perfection. The cultivation of lucern and sainfoin is very general; potatoes are raised to a very considerable amount; and the soiling of cattle in the stables is universal. The scientific writers of Geneva have contributed greatly to throw light on the theory of vegetation; and it is scarcely necessary to mention Theodore de Saussure, Pictet, De Candolle, and Macaire, as men who have contributed more than any others to explain the functions of vegetable life.

As a practical promoter of husbandry we cannot pass over M. de Fellenberg at Hofwyl, near Bern. [HOFWYL.] On an estate of about 300 acres he has put in practice all that has been written by the most esteemed writers, taking Thaer as his text-book, and making himself acquainted with the best modern writers. He has established an agricultural school for poor children, which is a part of his great plan for general education, and which will contribute more to promote good practical husbandry in his native country than all the works of the most eminent writers.

Belgium has always been foremost among agricultural countries. In 1600 the Flemings were considered the best husbandmen in Europe. There are no early writers on husbandry in this agricultural nation, but all travellers bear witness to their industry and to the perfection of their agriculture. They were probably the first in modern times who cultivated turnips in the field to feed cattle in winter; and who, in the north of Europe, kept their cattle in the stables all the year round and cut green food for them, as had been done from time immemorial in southern climates, on account of the excessive heat of the day and the annoyance of flies. The Belgians are now far advanced beyond most other nations of Europe in the application and economy of manure. They fully make up by incessant attention and indefatigable industry for the inferiority of their climate to that of Italy or Spain, and their land produces abundantly every necessary of life. [FLANDERS.]

Husbandry of France.—France has always been looked upon as a country peculiarly agricultural. The climate, partaking of that of the north and the south, favours the cultivation of plants both of the warmer and of the colder regions; and there is no country where husbandry has been so much protected, or where more good works on husbandry have been published, without producing any very sensible effect on the general practices of the husbandmen. Charles Estienne is the first French writer on agricultural subjects whose works were published soon after the revival of letters; but together with many useful maxims which he has copied from the antient authors, he has repeated the most absurd superstitions. His works were collected and published in 1554, under the title of 'Prædium Rusticum,' and in 1565 he published his work called 'L'Agriculture et la Maison Rustique.' This work was reprinted with additions by his son-in-law Jean Libeaut, in 1570. But the author, who is still considered as the father of French husbandry, is Olivier de Serres, a gentleman of fortune, proprietor of the seigneurie of Pradel, near Villeneuve de Berg, in Languedoc. He was a friend of Sully, the favourite minister of Henry IV., and, at his request, about the year 1600, he wrote a work on husbandry, under the title of 'Théâtre d'Agriculture et Mesnage des Champs.' In this work he shows a thorough knowledge of the great principles of husbandry; and he gives rules and directions which, if they had been generally followed, must have advanced the agriculture of his country at least two centuries. But it is a general remark, that where there have been most good books written on the subject of husbandry, there the practice has derived least advantage from them. While France swarms with agricultural writers, the fields are still cultivated as they were centuries ago; and the Flemings, who never write on the subject, have for ages carried husbandry to the greatest perfection.

Of those who have written on husbandry, one of the most zealous and practical authors is Rozier, an ecclesiastic who devoted his life to this favourite pursuit. His 'Cours Complet d'Agriculture' is a text-book for all those who, within the last half century, have desired to become acquainted with the principles of husbandry. It has gone through several editions, and forms the groundwork of another 'Cours Complet,' which has been published by a society of writers on husbandry, and is now the best French work on every department of husbandry and cultivation.

There is now in France and throughout Europe a great desire to promote practical improvement in husbandry. Agricultural schools and veterinary colleges are multiplied; and the return of peace, if its blessings can be duly appreciated and maintained, cannot fail greatly to encourage the application of capital and skill to the improvement of that art which furnishes the staff of life.

HUSS, JOHN, was born at Hussinatz, a village of Bohemia, of humble parents, about the year 1370. He studied in the university of Prague, where he distinguished himself by his assiduity and talents. Being ordained priest in 1400, he soon after adopted the opinions of Wycliffe, which he proclaimed loudly from the pulpit, and by so doing gave offence to the archbishop of Prague, who denounced his tenets as heretical. But Huss was confessor to Sophia, queen of Bohemia, and was favoured by King Wenceslaus himself, and thus he was able to maintain his ground for several years. In 1408 the heads of the university declared that whoever taught the opinions of Wycliffe should be expelled from that body. Huss identified his cause with that of his Bohemian countrymen, ever jealous of German influence, and the consequence was that the German students withdrew from the university and the city of Prague, and repaired to Leipzig, where the elector of Saxony founded a university for them. Huss being now installed rector of the university of Prague, inculcated the doctrines of Wycliffe, whose works he caused to be translated into Bohemian. The archbishop of Prague ordered these works to be publicly burned, and excommunicated those who still adhered to the opinions contained in them. He also suspended Huss from his sacerdotal functions, who however assembled the people, either in private houses or in the fields, where he preached against the pope, against purgatory, and above all against indulgences. The people were thus invited and encouraged to examine doctrines, which till then had been considered the sole province of the clergy; the humblest among them, women as well as men, began to discuss the mysteries of grace, predestination, and justification. The archbishop of Prague took the alarm, and Huss was summoned by the pope, John XXIII., to appear in person at Bologna to answer the charges against him, which neglecting to do, he was excommunicated. Huss however had a strong party in his favour, and the consequence was that frequent tumults occurred in the streets of Prague between his partisans and those who supported the papal authority. Unwilling to appear as encouraging these disorders, Huss retired to his native village, and there both by his tongue and pen he defended the propositions of Wycliffe, rejecting at the same time all human authority in matters of faith, and exhorting the multitudes who flocked to hear him to make the Scriptures alone their rule of faith. Some time after, on the death of the archbishop, Huss returned to Prague, and there publicly opposed a papal bull which had been just issued by the court of Rome against Ladislaus, king of Naples, and which invited all Christians to a crusade against him. In the university of Prague Huss stood on vantage ground, and being assisted by his clever disciple Jerome, he began to denounce the sale of indulgences in the strongest terms.

Fresh tumults took place; and after more citations from the pope, which Huss disdained to obey, the council of Constance at last assembled. Huss was cited to appear before the council, and he obeyed in 1414, after receiving a safe conduct from the Emperor Sigismund. On arriving at Constance however he was arrested. The sequel of his melancholy story is given in the article CONSTANCE, COUNCIL OF. Huss died with a fortitude which was admired even by his antagonists. (Bracciolini, Poggio, *Epistle* to Leonardo Aretino; and Æneas Sylvius, *Historia Bohemica*.) The morals of Huss were irreproachable; his opinions, whether right or wrong, were conscientiously entertained; and it is but a poor excuse for the members of the council to say that they did not condemn him to death, but consigned him to the secular arm, as they were perfectly well aware of the meaning of that expression. The council thus gave a fatal example, which was followed over all Europe for centuries after, and almost to our own days. Jerome of Prague soon after met with the same fate as his master. The death of these two distinguished men created a revolt in Bohemia. The Hussites began a furious war against the Roman Catholics; they burned churches and monasteries, they overawed King Wenceslaus, and after his death his brother, the Emperor Sigismund, found himself opposed by the Hussite leader Ziska, a man of extraordinary powers, who had takon possession of Prague. Sigismund, after a great loss of men in the field, was glad to come to an accommodation upon the following terms:—1. That the church-service should be celebrated in the vulgar tongue; 2. That the communion should be administered in both kinds; 3. That clergymen should be deprived of all temporal jurisdiction; 4. That moral crimes should be punished with the same severity as violations of the criminal laws of the country. This truce however was of no long duration, and Ziska carried on the war with success against the emperor. The Hussites now divided into several branches, some very fanatical and cruel, such as the Taborites, the Horebites, and the Adamites, of whom strange but not well authenticated stories are told; and others more moderate and rational, such as the Callixtines. After the death of Ziska the warfare between the Bohemian Hussites and the Imperial troops continued until the convocation of the council of Basel, in 1431. After long and tedious conferences the council conceded to the Bohemian laity the use of the cup in the communion, and the Emperor Sigismund on his side agreed that the Hussite priests should be tolerated, even at court, that no more monasteries should be built, that the University of Prague should be reinstated in all its former privileges, and a general amnesty granted for all past disturbances. Thus peace was concluded in 1437. Bohemia however remained still in a feverish state until about a century after, when the reform of Luther revived old feelings and antipathies, of which the Thirty Years' War, which another century later desolated all Germany, may be said to have been the remote consequence.

There are a few Hussites now in Bohemia; the rest have merged into Calvinists, Lutherans, Moravians, and other sects. [BOHEMIA.]

HUTCHESON, FRANCIS, the reviver of speculative philosophy in Scotland, was born in Ireland, August 8, 1694. His father was minister to a Presbyterian congregation. After completing his studies at Glasgow, Hutcheson officiated for some time in a similar capacity in the north of Ireland. In 1720 he first became known to the literary world by the publication of his 'Inquiry into the Original of our Ideas of Beauty and Virtue, &c., with an attempt to introduce a mathematical calculation in subjects of morality,' and acquired by it the friendship of Archbishop King, author of the treatises on the 'Origin of Evil' and 'Predestination,' &c. His essay 'On the Nature and Conduct of the Passions and Affections' appeared in 1728, and in the following year he was appointed professor of moral philosophy in the university of Glasgow, where he was admitted to the degree of Doctor of Laws. He published, as manuals for his class, 'Synopsis Metaphysicæ Ontologiam et Pneumatologiam complectens,' and 'Philosophiæ Moralis institutio compendiaria Ethices et Jurisprudentiæ Naturalis Principia complectens.' His great work, in 2 vols. 4to., entitled 'System of Moral Philosophy,' did not appear until after his death, which took place at Glasgow in 1747. It was published by his son, Dr. F. Hutcheson, with a life of the author, by Dr. Leechman, which Sir J. Mackintosh characterizes as a fine piece of philosophical biography.

In his metaphysical system Hutcheson rejected the theory of innate ideas and principles, but insisted upon the admission of certain universal propositions, or, as he terms them, metaphysical axioms, which are self-evident and immutable. These axioms are primary and original, and do not derive their authority from any simpler and antecedent principle. Consequently, it is idle to seek a criterion of truth, for this is none other than reason itself, or, in the words of Hutcheson, 'menti congenita intelligendi vis.' Of his ontological axioms two are important:—Every thing exists really; and no quality, affection, or action is real, except in so far as it exists in some object or thing. From the latter proposition it follows that all abstract *affirmative* propositions are hypothetical, *i.e.* they invariably suppose the existence of some object without which they cannot be true.

Truth is divided into logical, moral, and metaphysical. Logical truth is the agreement of a proposition with the object it relates to; moral truth is the harmony of the outward act with the inward sentiments; lastly, metaphysical truth is that nature of a thing wherein it is known to God as that which actually it is; or it is its absolute reality. Perfect truth is in the infinite alone. The truth of finite things is imperfect, inasmuch as they are limited. It is however from the finite that the mind rises to the idea of absolute truth, and so forms to itself a belief that an absolute and perfect nature exists, which in regard to duration and space is infinite and eternal.

The soul, as the thinking essence, is spiritual and incorporeal. Of its nature we have, it is true, but little knowledge; nevertheless, its specific difference from body is at once attested by the consciousness. It is simple and active; body is composite and passive. From the spiritual nature however of the soul Hutcheson does not derive its immortality, but makes this to rest upon the goodness and wisdom of God.

In his moral philosophy Hutcheson adopted the views of Lord Shaftesbury. Accordingly his first endeavour is to show that man desires the happiness of others not less than his own, and that benevolence can no more be explained by selfishness than selfishness by benevolence. In proof of this he examines successively the several solutions of benevolence, and shows of all that they are contrary to facts. He then concludes that man desires the good of his fellows in consequence of having within him an original inclination which aspires to secure the good of others as its final cause. Benevolence therefore is primary and irreducible. There are then two classes of human affections; the one impels man to his own happiness, the other to the well-being of his fellows. But alongside of these two there exists a third, incapable of being reduced to either of them; the end it has in view is moral good, of which the idea is primary, simple, and irreducible.

In order to establish this proposition Hutcheson successively demonstrates that by moral good is understood neither that which pleases ourselves by gratifying our benevolent affections, nor that which is good to others, nor any conformity to the will of God, or to order, or law, or truth, nor any other idea distinct from that which the word itself expresses, and which is as simple and primary and incapable of being expressed by any other word as are taste and smell. From this simplicity and originality of the notion Hutcheson infers that the quality about which it is concerned can only be perceived by a sense, and that this sense must be special, because the quality it perceives is distinct from all others. In further confirmation of this conclusion he observes, that the perception of this quality, like all other sensuous perceptions, is accompanied with pleasure, and that moral good is an end and a motive, but that the understanding is incapable of discovering any of the ends of human conduct, or of exercising any influence on the will.

Moral good then is perceived by a sense, and the perception of it or its contrary is accompanied with an agreeable or disagreeable feeling. Now this feeling being a consequent of the perception of the quality, it is impossible to resolve into it either moral good or the approbation we award to moral virtue; for this would be to resolve the causo into the effect, and the principle into the consequence. This sense Hutcheson denominates, after Shaftesbury, the moral sense. Now as the quality of which it is percipient exists only in certain mental dispositions and the acts to which these give rise, it is necessarily internal. According to Hutcheson there are several internal senses; among others the sense of beauty, whose office is to perceive the primary and irreducible quality of beauty. This character of inwardness is all that distinguishes the inner from the outer senses. Although indeed they are not of the same gross nature, they are nevertheless subject to the same laws and conditions. The moral sense therefore, as a sensuous quality, is affected by its objects immediately, and according as the sensations it experiences are agreeable or disagreeable, they are accompanied by desire or repugnance, *i.e.* by approbation or disapprobation.

The moral sense moreover is capable of regulating all the other faculties of our nature. Whence it derives this authority Hutcheson does not attempt to show, and is content with observing that we are directly conscious of its rule.

As to the question, what are the mental dispositions which this sense approves as good and moral, he at once excludes all those whose end lies in the attainment of man's personal happiness. No action the end of which is the profit of the agent can be accounted virtuous: it may be blameless, it cannot be moral. Nevertheless the neglect of one's own interests becomes culpable whenever the advancement of them will enlarge the sphere and the means of beneficence. Benevolent dispositions and acts alone are the objects of moral approbation. Universal beneficence constitutes moral excellence, and the degrees of morality coincide with those of benevolence.

In this system the part of reason is very subordinate. Excluded from the privilege of determining the proper objects of human conduct and of acting directly on the will, it is a mere servant, whose task is to discover and to digest the proper means for the attainment of those ends which the moral sense proposes. As to the *motive* to virtuous determinations, Hutcheson is not more explicit than Shaftesbury. But as he makes the moral sense to be something more than a simply perceptive faculty, and, like all other senses, to influence the will, it would appear that he regarded it as the moral motive also.

As a writer Hutcheson is remarkable for chasteness and simplicity of style, with great clearness of expression and happy fullness of illustration.

HUTCHINSON, JOHN, author of a mystical and cabalistic interpretation of the Hebrew scriptures, was born in 1674, at Spennithorne in Yorkshire. Having received an excellent private education he became at the age of nineteen steward to Mr. Bathurst, in which capacity he afterwards served the duke of Somerset, who bestowed upon him many marks of confidence and esteem, and when master of the horse appointed Mr. Hutchinson his riding purveyor. Availing himself of the opportunities which his situation afforded him for cultivating his favourite pursuit of mineralogy and natural history, he made a large and valuable collection of fossils, which, with his own observations, he consigned to the care of Dr. Woodward to digest and publish. This duty Woodward failed to discharge, but bequeathed the task and the collection to the university of Cambridge. In 1724, Hutchinson published the first part of a curious work entitled 'Moses's Principia,' in which he attempted to refute the doctrine of gravitation as taught in the *Principia* of Newton. In the second part of this work, which appeared in 1727, he continued his attack upon the Newtonian philosophy, and maintained, on the authority of scripture, the existence of a plenum. From this time to his death, he published yearly one or two volumes in further elucidation of his views, which are written in a rambling and uncouth style, but evince a profound and extensive knowledge of the Hebrew scriptures. He died on the 28th of August, 1737.

According to Hutchinson, the Old Testament contains a complete system of natural history, theology, and religion. The Hebrew language was the medium of God's communication with man; it is therefore perfect, and consequently as a perfect language it must be coextensive with all the objects of knowledge, and its several terms are truly significant of the objects which they indicate, and not so many arbitrary signs to represent them. Accordingly Hutchinson, after Origen and others, laid great stress on the evidence of Hebrew etymology, and asserted that the Scriptures are not to be understood and interpreted in a literal, but in a typical sense, and according to the radical import of the Hebrew expressions. By this plan of interpretation, he maintained that the Old Testament would be found not only to testify fully to the nature and offices of Christ, but also to contain a perfect system of natural philosophy. His editors give the following compendium of the Hutchinsonian theory: 'The Hebrew scriptures nowhere ascribe motion to the body of the sun, nor fixedness to the earth; they describe the created system to be a *plenum* without any *vacuum*, and reject the assistance of gravitation, attraction, or any such occult qualities, for performing the stated operations of nature, which are carried on by the mechanism of the heavens in their threefold condition of fire, light, and spirit, or air, the material agents set to work at the beginning:—the heavens thus framed by Almighty wisdom are an instituted emblem and visible substitute of Jehovah Aleim, the eternal three, the co-equal and co-adorable Trinity in Unity:—the unity of substance in the heavens points out the unity of essence, and the distinction of conditions the trine personality, in Deity, without confounding the persons, or dividing the substance. And from their being made emblems they are called in Hebrew Shemim, the names, representatives, or substitutes, expressing by their names that they are emblems, and by their conditions or offices what it is they are emblems of.' As an instance of his etymological interpretation, the word *Berith*, which our translation renders Covenant, Hutchinson construes to signify 'he or that which purifies,' and so the purifier or purification *for*, not *with*, man. From similar etymologies he drew the conclusion 'that all the rites and ceremonies of the Jewish dispensation were so many delineations of Christ, in what he was to be, to do, and to suffer, and that the early Jews knew them to be types of his actions and sufferings, and that by performing them as such were in so far Christians both in faith and practice.'

A complete edition of the works of Hutchinson was published in 1748, entitled 'The Philosophical and Theological Works of the late truly learned John Hutchinson, Esq.,' 12 vols. 8vo.

HUTCHINSONIANS, the denomination of those who, without constituting a doctrinal sect, followed the philological and exegetical views of John Hutchinson. In their number they reckoned several distinguished divines in England and Scotland, both of the Established churches and of Dissenting communities. Among the most eminent of these were Bishop Horne and his biographer Mr. William Jones, Mr. Romaine, and Mr. Julius Bates, to whom the duke of Somerset, on the nomination of Mr. Hutchinson, presented the living of Sutton in Sussex; Mr. Parkhurst, the lexicographer; Dr. Hodges, provost of Oriel; and Dr. Wetherell, Master of University College, Oxford; Mr. Holloway, author of 'Letter and Spirit;' and Mr. Lee, author of 'Sophron, or Nature's Characteristics of Truth.' The principles of Mr. Hutchinson, which are far from new, are still entertained by many divines without their professing to be followers of Mr. Hutchinson, and the number of professing Hutchinsonians is fast decreasing.

HUTTON, CHARLES, was born at Newcastle-upon-Tyne on the 14th of August, 1737. He was descended from a family in Westmoreland which had the honour of being connected by marriage with that of Sir Isaac Newton. His father, who was a superintendent of mines, gave his children such education as his circumstances would permit, which did not extend beyond the ordinary branches. Charles, the youngest of the sons, manifested at an early period an extraordinary predilection for mathematical studies, and while yet at school he is said to have made considerable progress with little or no aid from his master. Upon the death of his father, which happened before he had completed his eighteenth year, he became teacher in a school at the neighbouring village of Jesmond, and some years afterwards his master, who was a clergyman, having been presented to a living, resigned the school in his favour. In 1760 Hutton married, and removed his establishment to Newcastle, where he met with considerable encouragement. While engaged in tuition he wrote his first work, entitled 'A Practical Treatise on Arithmetic and Book-keeping,' which appeared in 1764, and soon passed through several editions. In 1771 he published his 'Treatise on Mensuration,' 4to., Lond., and the same year the bridge of Newcastle having been nearly destroyed by a great flood, he drew up a paper upon the best means of securing its future stability, which was afterwards published under the title of 'Principles of Bridges and the Mathematical Demonstration of the Laws of Arches,' Newcastle, 8vo., 1772. In 1773 he became a candidate for the professorship of mathematics at the Royal Military Academy of Woolwich. The examination was conducted with exemplary impartiality by four eminent mathematicians—Dr. Horsley, afterwards bishop of Rochester, Dr. Maskelyne, the astronomer-royal, Colonel Watson, the chief engineer to the East India Company, and Mr. Landen. After its termination the examiners expressed high approbation of all the candidates, who were eight in number, but gave a decided preference in favour of Dr. Hutton, and he was accordingly appointed to the professorship. The 10th of November, 1774 (Thomson's *Hist. of the Royal Society*), Hutton was elected a fellow of the Royal Society, and upon the accession of Sir John Pringle to the presidency he was appointed foreign secretary to that body, which office he continued to hold with the greatest credit until he was displaced by Sir Joseph Banks in 1778-9, on the plea that it was requisite the secretary should reside constantly in London. [BANKS, SIR JOSEPH.] In 1775 the Royal Society instituted a series of experiments on the mountain Schehallien in Perthshire, with a view to determine the mean density of the earth. These were conducted principally under the direction of Dr Maskelyne, and when completed the labour of making the necessary calculations was allotted to Dr. Hutton, who was considered the most competent person for the undertaking. His report is contained in the 'Philosophical Transactions' of the year 1778. In the year 1779 the degree of LL.D. was conferred upon him by the university of Edinburgh. In 1781 he published his 'Tables of the Product and Powers of Numbers,' Lond., 8vo., and in 1785 his 'Mathematical Tables,' containing the common, hyperbolic, and logistic logarithms, with the sines, tangents, &c., both natural and logarithmic, Lond., 8vo. To these succeeded his 'Tracts on Mathematical and Philosophical Subjects,' in 4to., Lond., 1786, which were reprinted in 1812, Lond., 8vo., 3 vols. In 1795 appeared his 'Mathematical and Philosophical Dictionary,' in two large quarto volumes, which has since supplied all subsequent works of that description with valuable information both in the sciences treated of and in scientific biography.

About this time he undertook, in conjunction with Drs. Pearson and Shaw, the arduous task of abridging the 'Philosophical Transactions.' The work was completed in 1809, in 18 volumes, quarto, and Dr. Hutton is said to have received for his labour the sum of 6000*l*. In 1806 he was attacked by a pulmonary complaint, which a few years after led to his retirement from the academy; when the Board of Ordnance manifested their approbation of his long and meritorious services by granting him a pension for life of 500*l*. per annum. Dr. Hutton died the 27th January, 1823, in the eighty-sixth year of his age, and was buried at Charlton in Kent.

Dr. Olinthus Gregory, the successor and biographer of Dr. Hutton, says in his memoir, that as a preceptor he 'was characterized by mildness, kindness, promptness in discovering the difficulties which his pupils experienced, patience in labouring to remove those difficulties, unwearied perseverance, and a never-failing love of the art of communicating knowledge by oral instruction.' He was equally characterized by an unassuming deportment and general simplicity of manners, by the mildness and equability of his temper, and the permanency and warmth of his personal attachments. His benevolence was great, and he was a kind friend and benefactor to the needy votary of science.

Towards the close of the doctor's life, a subscription was entered into by his friends and pupils for a marble bust, which was admirably executed by Gahagan, and at his death was bequeathed to the Literary and Philosophical Society of Newcastle, where it now is.

Besides the works above mentioned, and the papers in the 'Transactions of the Royal Society,' Dr. Hutton was a constant contributor to the 'Lady's Diary,' of which periodical he was editor for many years. His remaining works consist of—'Elements of Conic Sections,' 1787, 8vo.; 'A Course of Mathematics, designed for the use of Cadets in the Royal Military Academy,' London, 1798—1801, 3 vols., of which several later editions have appeared; 'Recreations in Mathematics and Natural Philosophy, from the French of Montucla,' London, 1803, 4 vols. 8vo.; and some others.

(Thomson's *Hist. of the Royal Society; Gent. Mag.; Annual Register*, &c.)

HUYGHENS, CHRISTIAN, son of Constantine Huyghens, possessor of Zulichem, Zelhem, &c., in Holland; whence Huyghens (Latinized Hugenius) is often called Zulichemius, though his inheritance was the second-named estate, and the initials C. H. à Z., or C. H. D. Z., often appear on the titles of his works.

For the life of Huyghens our authority is the account prefixed by S'Gravesande to the edition of his works. The éloge by Condorcet is superficial, and appears to us partial. The various historical works on mathematics may of course be consulted on points of scientific character.

Christian Huyghens was born at the Hague, April 14, 1629. His father had been secretary to three princes of Orange, and was advantageously known by some Latin poems and other small works: he died in 1687, at the age of ninety. His eldest son, Constantine, succeeded him in the post of secretary, and accompanied William III. to England in that capacity in 1688. The subject of this article, his second son, from his boyhood showed an aptitude for mathematical and mechanical studies, and in 1645 he prosecuted them at the university of Leyden under the care of Schooten. In 1646—48 he studied civil law at Breda, a course being then and there established, partly under the management of his father. In 1649 he accompanied a count of Nassau to Denmark; and in 1655 he visited France. He then remained in Holland till 1660, when he went again to France, and in 1661 to England, both which voyages he repeated in 1663. In 1665 he was invited to France by Colbert, where he remained from 1666 to 1681, with the exception of two trips to Holland in 1670 and 1675, for health. This consideration prompted his final return to Holland in 1681: he was again in England in 1689, and died at the Hague, June 8, 1695. The preceding enumeration of changes of place is almost all that can be said of Huyghens unconnected with his philosophical fame. Condorcet informs us that the edicts against the Protestants occasioned his relinquishment of the honours and emoluments which he held in France, and that he refused to be made a special exception, we suppose to the edict incapacitating Huguenots from office. His family also, according to Condorcet, were displeased at this step, which may have been the case, since his father was a strong partisan of the French. (*Biogr. Univ.*, art. 'Const. Huyghens.') The same writer says it was reported at Paris that he wrote verses ('assez mauvais') to Ninon de L'Enclos.

The greater part of the works of Huyghens which were published during his lifetime were collected into four volumes by S'Gravesande, under the title of 'Christiani Hugenii Zulichemii dum viveret Zelemii Toparchæ, Opera Varia,' Lugd. Bat., 1724. But Huyghens left his papers* to the university of Leyden, with the request that two professors, De Volder and Fullen, would select and publish what they thought fit. The consequence was a volume entitled 'Christiani Hugenii, &c., Opuscula Posthuma,' Amsterdam (?), 1700. But in 1728 S'Gravesande completed his edition of the works printed by Huyghens himself, and also re-published the 'Opuscula Posthuma:' this edition, entitled 'Opera Reliqua,' was printed at Amsterdam. To these two works, which contain almost all that Huyghens wrote, and all that he published, with the exception of papers in the 'Philosophical Transactions' and other periodicals, we must add the mention of his correspondence, now publishing for the first time under the following title · 'Christ. Hugenii aliorumque Exercitationes Mathematicæ et Philosophicæ, ex MSS. in Bibl. Acad., Lugd. Bat., edente P. J. Uylenbroek,' Hag. Com., 1833. Two fasciculi are published, and it is understood that others are to follow. Weidler also mentions a volume of posthumous works published at Leyden in 1703. We shall presently notice the several writings of Huyghens, first observing that he occupies a most conspicuous place among the immediate precursors of Newton. Had it not been known that the latter was in possession of at least the main points of his system before 1674, it would undoubtedly have been fair to suppose that the researches of Huyghens gave most material suggestions to the investigator of the theory of gravitation. His writings seem to form the natural and proper step in the chain between those of Galileo and Newton.

We shall give the list of Huyghens's works in the order of subjects, with a short description of what is now memorable in each.

I. *Geometrical Works.*

'Theoremata de Quadraturâ Hyperboles, Ellipsis, et Circuli, ex dato portionum Gravitatis Centro; quibus subjuncta est 'Ἐξέτασις Cyclometriæ Cl. Viri Gregorii à S. Vincentio,' Lugd. Bat., 1651. The theorems have more merit than use: it is to be remembered that they followed the work of Guldinus. [GULDINUS.] The answer to the quadrature of the circle by Gregory of St. Vincent will be further noted in the article on that subject.

'De Circuli Magnitudine inventâ. Accedunt ejusdem Problematum quorundam illustrium Constructiones,' Lugd. Bat., 1651. In this work Huyghens gives some new and very close approximations to the quadrature of the circle. He was also engaged in a controversy with James Gregory on this subject, for the details of which see 'Journal des Sçavans,' July and November, 1668, and 'Phil. Trans.,' Nos

* In one of these manuscripts is found the remarkable assertion that Newton lost his reason about 1693, which is so fully discussed by Sir David Brewster in his 'Life of Newton.' [NEWTON.]

37 and 44. There are some minor geometrical writings of Huyghens in the 'Divers Ouvrages de Mathématique et de Physique,' Paris, 1693.

II. *Mechanical Works.*

'Horologium,' Hag. Com., 1658, and 'Horologium Oscillatorium, sive de Motu Pendulorum a Horologia aptato Demonstrationes Geometricæ,' Parisiis, 1673. In the first of these tracts Huyghens simply describes the application of the pendulum to the clock, of which improvement he is the inventor. The idea came to him in 1656, and the pendulum employed was the common circular one. In the second he describes the well-known but now disused apparatus by which the geometrically isochronous or cycloidal pendulum was obtained. But this is the least part of the celebrated work before us, which contains four distinct and new discoveries of first-rate importance. The first is that of the cycloid being the curve, all whose arcs measured from the lowest point are synchronous. [CYCLOID, vol. viii., p. 250.] The second is the invention of the involution and evolution of curves [INVOLUTE and EVOLUTE], in which the proposition is established that the cycloid is its own evolute. The third is the method of finding the centre of oscillation [OSCILLATION, CENTRE OF], being the first successful solution of a dynamical problem, in which connected material points are supposed to act on one another. The fourth is the announcement (without demonstration) of those relations between the centrifugal force and velocity of a body revolving in a circle, which were afterwards proved in the 'Principia.' It thus appears that Huyghens was in complete possession of the solution of the problem of circular motion. Had his mind not been preoccupied by the Cartesian system, it is most probable that he would have gone at least to the extent of deducing Kepler's laws from the assumption of gravitation. Demonstrations of the theorems on centrifugal force were found among his papers, and published in the 'Opera Reliqua.' It is possible that these might have been written after he had seen the 'Principia' of Newton.

The publication of the treatise above mentioned drew on a controversy with the Abbé Catelan, in which John Bernoulli, De L'Hôpital, and others, took part.

In the 'Journal des Sçavans,' Feb., 1675, Huyghens described the spring pendulum, such as is now used in watches. Though there can be no doubt that this was an independent invention, yet its priority has been questioned.

Huyghens was one of the first who gave the laws of impact; the Royal Society of London had invited attention to the question, and Huyghens, Wren, and Wallis sent solutions to the Royal Society about the same time (A.D. 1669). There is an extract from his paper in the 'Phil. Trans.' for that year; but the whole paper (perhaps enlarged) appears among the posthumous works.

The treatise 'Sur la Cause de la Pésanteur' was first printed in French (Leyden, 1690), at the end of the 'Traité de la Lumière.' Both are Latinized in the 'Opera Reliqua.' There are several minor pieces on different problems of mechanics.

III. *Astronomical Works.*

'De Saturni Lunâ Observatio Nova,' Hag. Com., 1656. This is a tract of two pages printed at the end of Borelli, 'De vero Telescopii Inventore.' It announces the discovery of a satellite to Saturn, being that which we now call the fourth. This took place on the 25th day of March, 1665, and Huyghens immediately (as was then common, see FLUXIONS) communicated the following cipher:—'Admovere oculis distantia sidera nostris *vvvvvvvcccrrhm bqx*;' which being transposed will make the following:—'Saturno luna sua circumducitur diebus sexdecim horis quatuor.' In the present tract he explains this enigma, and adds that he is about to publish on the Saturnian system. In the meanwhile he adds another logogryph to substantiate his right to another discovery. It is as follows:—'*aaaaaaacccccdeeeeeghiiiiiiillllmmnnnnnnnnnoooopp qrrsttttttuuuuu*.' The explanation of this dark saying was given in the 'Systema Saturnium,' printed at the Hague in 1759. It should be remembered that Galileo's telescopes showed him nothing more as to Saturn than that it appeared to have some lateral appendages which looked like handles. In 1655, Huyghens had applied himself, in conjunction with his elder brother Constantine, to the manufacture of large telescopes. The meaning of the enigma was:—Annulo cingitur tenui, plano, nusquam cohærente, ad eclipticam inclinato; that is, he had discovered Saturn's ring. The 'Systema Saturnium' gives an account of the discovery, fixes the position of the ring, and explains the phenomena of its appearance and disappearance, &c. This work also occasioned some controversy, now forgotten. It is worth while to take notice that Huyghens was prevented from looking for any more satellites by the notion, then not uncommon, that the whole number of satellites in the solar system could not exceed that of the planets.

The 'Cosmotheoros' was passing through the press when Huyghens died. It was printed at the Hague in 1698, and was twice printed in English, first in 1698, and next at Glasgow in 1757; besides several translations into Continental languages. It defends the Copernican system, and enters into a large number of speculations on the physical constitution and probable inhabitants of the planets.

IV. *Optical Works.*

These are, the 'Traité de la Lumière,' Leyden, 1690, Latinized in the 'Opera Reliqua;' the Dioptrics, and the 'Commentarii de Vitris Figurandis,' both first given in the posthumous works. The first treatise was reprinted by Baron Maseres, in his 'Scriptores Optici,' London, 1823. It was written in 1678, and must now be considered as the *Principia* of optics. Huyghens took up the theory of undulations in opposition to that of emanation, which was adopted by Newton. By this theory he gave a sufficient explanation of the phenomena of reflexion and refraction, and also of that of double refraction, in which Newton could not succeed; that is, he gave an explanation of all the prominent phenomena of optics. The undulatory theory is now almost universally received, and Huyghens must be considered as the founder of it; for though Hooke had previously advanced the notion, yet he made no application of it to the explanation of phenomena.

It remains to mention the treatise, 'De Ratiociniis in Ludo Aleæ,' which was printed at the end of Schooten's 'Exercitationes Mathematicæ,' Leyden, 1657. It is the earliest regular treatise on questions of chances, and first points out the manner in which the expectation of a player is determined.

We leave some minor writings unnoticed (referring to the collections of Huyghens's works), and proceed to make some remarks on the character of Huyghens as a philosopher. He is distinguished by correctness, penetration, and a freshness of intellect which never left him. Before he was in possession of the formal differential calculus he was able to supply its place. His power of acquisition lasted to the end of his life. He was near sixty when he read the 'Principia,' and past that age when he began to study the Calculus of Leibnitz. At that time of life persons seldom change old opinions; but Huyghens admitted the theory of Newton instantaneously. As he was probably the first continental philosopher who published his adhesion to the theory of gravitation, not generally, but after minute examination, (for in the correspondence of Leibnitz and Bernoulli it is noted that a manuscript of Huyghens's was sold at the auction of his books, of which the title was, 'On the Errors of Newton,') it will be worth while to quote what Huyghens says on the subject in his 'Discourse on the Cause of Gravitation,' or rather in the appendix which he added after the receipt and perusal of Newton's work. It is to be remembered that the 'Principia' was published in 1687, and what follows in 1690; and also that Huyghens had explained the spheroidal figure of the earth upon the supposition of a central attraction, but without supposing the particles of the spheroid to attract each other. This mutual attraction of the smaller parts he cannot admit, and it is clear from his expressions that he has the old notion of a natural tendency of bodies towards a centre. But notwithstanding this, his ready apprehension of the manner in which Newton's hypothesis explains facts, and his disposition to yield to that species of evidence, were not common in his day. We give then the following extract, remarkable as the first published assent to the doctrines of the 'Principia' from a continental philosopher:—'I have then nothing to say against the *Vis Centripeta*, as Mr. Newton calls it, by which he gives the planets weight towards the sun, and the moon towards the earth, but I agree to it without difficulty; because not only do we know by experience that there is some such sort of attraction or impulsion in nature, but also because it is explicable in accordance with the laws of motion, as appears in what I have written on gravity. For there is no reason why the cause of this *Vis Centripeta* towards the sun should not be the same as that by which bodies which we call heavy are forced to descend towards the earth. I had long ago imagined that the spherical figure of the sun might be produced in the same way as, in my opinion, is that of the earth; but I did not extend the action of gravity to distances so great as from the sun to the earth, or from the earth to the moon, because the vortices of M. Des Cartes (which I once thought extremely likely, and had then in my head) came in the way. Neither did I think on the law of diminution of gravity, namely, in the reciprocal proportion of the squares of the distances from the centre, which is a new and very remarkable property of gravitation, the reason of which is well worth examination. But seeing now by the demonstration of Mr. Newton, that in supposing such a gravitation towards the sun, diminishing according to such a law, it so well counterbalances the centrifugal forces of the planets, and produces exactly the effect of the elliptic motion which Kepler imagined and verified by observations, I can hardly doubt that those hypotheses concerning gravitation are true, and also the system of Mr. Newton, so far as it is founded upon them; which appears the more probable, because in it is found the solution of several difficulties which embarrass the vortices of M. Des Cartes. We see now how the excentricities of the planets remain the same, why the planes of their orbits do not coincide, but retain their inclinations, and why the planes of the orbits necessarily pass through the sun. We see how the motions of the planets can be accelerated and retarded in the manner which they really are, and which it is difficult to see how they could be if they swam in a vortex round the sun. Lastly, we see how comets can traverse our system. For as soon as it was known that they often come within the region of the planets it was difficult to see how they could sometimes be carried in a direction contrary to that of a vortex strong enough to carry the planets. But in the doctrine of Mr. Newton this difficulty entirely disappears; since there is no reason why the comets should not describe elliptic orbits round the sun like those of the planets, only more extended and differing more from a circle; and thus there is no reason why these bodies should not have their periodic returns, as some philosophers, antient and modern, have imagined.'

HUYSUM, JOHN VAN, born at Amsterdam, in 1682, was the most eminent painter of flowers and fruit in the eighteenth century. His father, a picture dealer and painter, was the instructor of his son, who at an early period resolved to devote himself entirely to that branch of the art in which he attained such unrivalled eminence. Every term of panegyric that language can furnish has been lavished, and with justice, on his productions; he seems to have dived into the mysteries of nature to represent the loveliest and most brilliant of her creations with all the magic of her own pencil. His flowers are more beautiful and true to nature than his fruits. He is equally successful in the accessories; the drops of dew, the insects, birds' nests, with their eggs and feathers, are all painted so as almost to deceive the eye. The vases in which he puts his flowers are always from some elegant model, and the bas-reliefs are finished with the same exquisite care. He was the first that painted flowers on a light ground. He is supposed to have possessed some secret in the mixing of his colours and preserving their lustre. His pictures sold at very high prices during his life, and are still held in the highest estimation. He died in England, in 1749.

HYACINTH, a favourite flower in gardens, is the Hyacinthus orientalis of botanists, a bulbous plant, found wild on the mountains of Persia, and remarkable both for its fragrance and the facility with which it varies in the colour, size, and construction of its flowers when raised from seed.

Few spring flowers are more worthy of cultivation than the hyacinth, whether we regard its varied shades of rich colour or the sweetness of its perfume. The Dutch gardeners have been celebrated for the high state of perfection to which they grow it, and for the monopoly they have secured in the sale of the bulbs, which have even acquired in the shops the familiar name of Dutch roots. The soil and climate of Holland seem to be peculiarly adapted to the plant, for however well imported roots may flower in England for the first season, they soon degenerate and become worthless. It is however probable that this arises from want of skill in our cultivation, rather than from anything unfavourable in our climate: for some gardeners have been successful in growing the same roots for several years in succession. Mr. Herbert says, 'I produced for several years successively, at my villa in Surrey, where I had the advantage of the vicinity of the fine sand of Shirley Common, hyacinth flowers fully equal, if not superior, to those obtained from the best Dutch bulbs.' As experience is in all respects the surest guide, the more nearly we approach the Dutch method of cultivation, the more likely we are to be successful. According to Mr. Herbert, the compost used at Haarlem is rotten cow-dung, rotten leaves, and fine sand. In making this compost the Dutch gardeners prefer the softer leaves of elm, limo, and birch, and reject those of oak, chesnut, walnut, beech, plane, &c., which do not rot so quickly. The cow-dung which they use is also of a peculiar quality, being collected in the winter when the cattle are stall-fed upon dry food, without any mixture of straw or other litter. The sand is procured in the neighbourhood of Haarlem, where the soil is a deposit of sea-sand upon a compact layer of hard undecayed timber, the remains of an antient forest which has been overwhelmed by the sea. Having all these substances in a proper state, they are prepared in the following manner:—First, a layer of sand is placed, then one of dung, and then one of rotten leaves, each being eight or ten inches thick. These layers are repeated till the heap is six or seven feet high, a layer of dung being uppermost, sprinkled over with a little sand to prevent the too powerful action of the sun upon it. After the heap has lain for six months or more it is mixed, and thrown up afresh, in which state it remains some weeks, to settle before it is carried into the flower beds. (*Hort. Trans.*, vol. iv., p. 163.)

The bed into which this compost is to be put must be taken out to the depth of three feet, its bottom made firm, and a few stones thrown into it in order to keep it dry. It must then be raised considerably above the level of the surrounding soil with the compost already prepared. The best season for planting is from October to the beginning of November, and the early sorts planted at this time will begin to show their flowers in the beginning of April.

Hyacinths are sometimes planted in rows or patches, but the most common and best way is to plant them in beds, because a greater mass of bloom is presented at once to the eye, and because it is easier to protect and shade them in this way. In planting them in beds a great part of the effect is produced by a judicious arrangement. The different colours are either blended together in the bed, or collected into masses. A mass of one colour is more pleasing to the eye than a mixture of several, and therefore each tint should be planted by itself in the bed; or if there are more beds than one, the first may be planted with white, the second with blue, the third with red varieties, and so on. The distance between each plant should be eight or nine inches.

As hyacinths are planted in autumn, and bloom early in the season, they never require any water, and as soon as the flowering is over, the more dry the ground can be kept the better it is for the bulbs. When the leaves turn yellow and are withered, which will take place in about a month after the plants have gone out of flower, the bulbs must be carefully taken up and dried. The practice at Haarlem is this. 'The leaves should be cut off, and each bulb laid on its side, covering it lightly with the compost, about two inches thick: in this state it should be left about a month, and then taken up in dry weather and exposed to the open air for some hours, but not to a powerful sun, which would be very injurious to it; it should after this be carefully examined, and all the decayed parts removed; afterwards it should be laid up in an airy storeroom. (Herbert, *Hort. Trans.*) Florists who have a valuable bed of hyacinths generally use an awning of some kind, to shade them from a bright sun, and protect them from heavy rains. This shade, of whatever material it is made, should be so constructed as to move up and down in favourable weather; in bright sunshine the bed may be exposed from four o'clock in the afternoon, or for a few hours in the morning. If the bed is not shaded, the colours very soon spoil, and will not bear a close examination.

Forcing of hyacinths is carried to a considerable extent, both in England and also on the Continent. When they are bloomed in this way, they are either used as ornaments to the greenhouse, or placed in the lobby or drawing-room, where the sweetness of their perfume renders them general favourites. The method of forcing them is the following: —Good Dutch bulbs, which are annually imported, are selected for this purpose. To save troublo, all which are intended to be forced may he potted at the same time, and placed in a cool greenhouse or frame; then as many as are intended to bloom at once must be placed in a gentle heat; when their flower-stems appear, others can be brought in which will succeed them, and by going on in this way a regular succession will be kept up. The pots into which they are put need not be largo, but rather deep. The soil used for potting may either be the same as is recommended above, or a good loam will answer equally well. In potting, the hulbs must not he firmly pressed into the soil, hut lie rather loose, and be only about half covered with it.

Hyacinths are frequently grown and flowered in water-glasses. Sometimes before they are put into the glasses they are planted in pots, and when the roots have grown a littlo they are taken up and washed, and placed in the glasses, or they are placed in the glasses at first. The water must be frequently renewed, or it will soon become fetid and offensive. By far the most curious system of treating forced hyacinths is to invert them in large glass jars filled with water. This must be done when the flowers are nearly expanded; and by placing one above the glass, of the same size and colour with the inverted one, the latter presents an appearance of being tho shadow of the former. Tho flowers retain their freshness much longer in the water than when exposed in the common way; but this circumstance, and the curious appearance presented, is all which can recommend the system; of course the fragrance of the hyacinth is in this way entirely lost. The principal difficulty that is experienced by those who force hyacinths in water in sitting rooms is to prevent their growing long, weak, and pale, so as to flower badly, and be in constant danger of upsetting. This is remedied by keeping them close to a window, where they can be constantly exposed to bright light all day long. It may also be added, that in order to secure their pushing out their roots before the leaves lengthen, they should always be kept in the dark for a fortnight or three weeks after they are first placed in the water-glasses, care being taken at that time that the water and the bulbs are not in contact. The moisture that rises into the air will be sufficiont to induce the bulbs to put forth roots; and the total absence of light will prevent the leaves from being stimulated into growth.

Varieties are obtained from seed, and particular kinds aro propagated by offsets. With the greatest caro in gathering the seed, it is very uncertain whether or not the young plants raised from it will turn out well; however, the best sorts to gather seed from are those with strong upright stems, semi-double flowers, and brilliant and distinct colours. The seed must be well ripened, and then sown in good sandy soil, rather lighter than what is recommended for hyacinth compost. The young plants so obtained must not be disturbed or taken up until the end of the second, or, if they are weak, the third year; all that they require during that period is a little top-dressing. They may then be taken up and planted in the hed, where they will require the same treatment as old roots; they will flower in the third spring, but it is better to destroy all the flowers of the first season, in order to strengthen the bulbs.

HYACINTH. [Zirconium.]

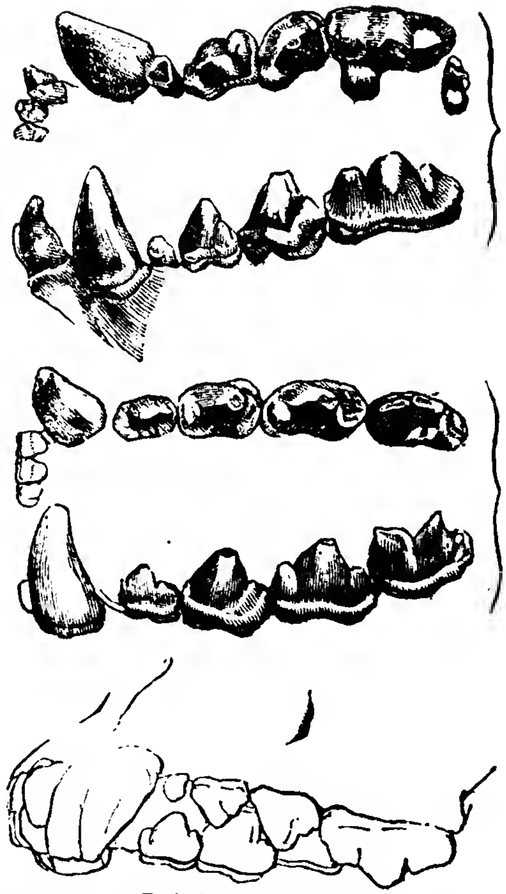
HY'ADES. [Taurus.]

HYÆNA, the name of a family of digitigrade, carnivorous quadrupeds, distinguished by having their fore legs longer than their hind legs, by their rough tongue, great and conical molar, or rather cutting-and-crushing teeth, projecting eyes, large ears, and a deep and glandular pouch beneath the anus.

Dental Formula.—Incisors $\frac{6}{6}$; canines $\frac{1-1}{1-1}$; molars $\frac{5-5}{4-4} = 34$.

The false molars, three above and four below, are conical, blunt, and very large. The upper flesh-tooth (carnassière) has a small tubercle within and in front, but the lower one has none, and presents only two trenchant points. The whole of the dental and molar organization, and indeed the whole cranial structure, appears to have been formed with a view to the bringing into the most available action the formidable natural instruments which enable the Hyænas to break the hardest bones.

Dr. Buckland gives the following account of the feats of a Cape Hyæna (the spotted species, we presume) which he

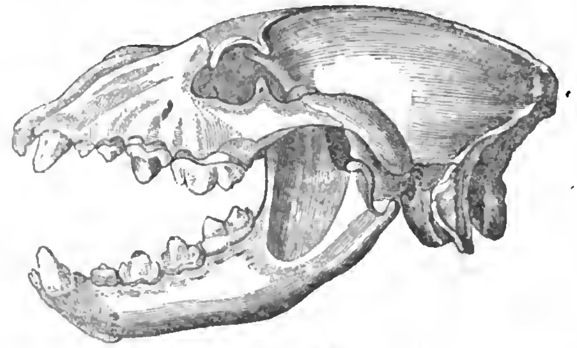


Teeth of Hyæna. (F. Cuvier.)

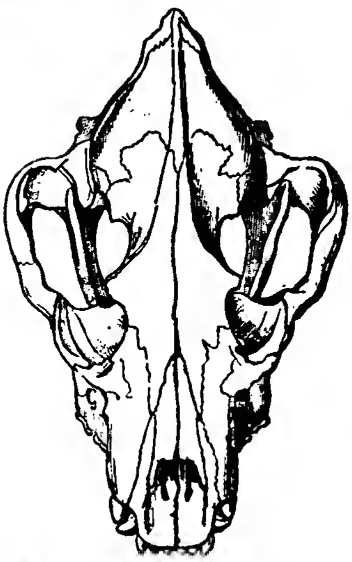
saw at Oxford in tho travelling collection of Mr. Wombwell, the keeper of which confirmed in every particular the evidence given to Dr. Wollaston by the keeper of Exeter 'Change, and noticed in 'Reliquiæ Diluvianæ,' p. 20. 'I was enabled,' says Dr. Buckland, 'to observe the animal's mode of proceeding in the destruction of hones. The shin-bone of an ox heing presented to this Hyæna, he began to bite off with his molar teeth large fragments from its upper extremity, and swallowed them whole as fast as they were broken off. On his reaching the medullary cavity the bone split into angular fragments, many of which he caught up greedily, and swallowed entire. He went on cracking it till he had extracted all the marrow, licking out the lowest portion of it with his tongue: this done, he left untouched the lower condyle, which contains no marrow, and is very hard. . . . I gave the animal successively three shin-hones of a sheep; be snapped them asunder in a moment, dividing each in two parts only, which he swallowed entire, without the smallest mastication. On the keeper putting a spar of wood two inches in diameter into his den, be cracked it in pieces as if it had been touchwood, and in a minute the whole was reduced to a mass of splinters. The power of his jaws far exceeded any animal force of the kind I ever

Skull of Striped Hyæna: profile. (Cuvier.)

saw exerted, and reminded me of nothing so much as a miner's crushing-mill, or the scissors with which they cut off bars of iron and copper in the metal founderies.' (*Reliquiæ Diluvianæ.*)



Skull of Spotted Hyæna: profile. (Cuvier.)



Skull of Spotted Hyæna, seen from above.*

These cuts will give the reader some idea of the area and space devoted to the attachment and development of the muscles destined to move the jaws. These muscles, aided by the powerful muscles of the neck, are so robust, that it is almost impossible to drag from their vice-like gripe that which the animal has once seized. Cuvier remarks that their efforts in this way sometimes produce anchylosis of the cervical vertebræ, and that this has given rise to the assertion that Hyænas have but a single bone in the neck. He also states that their name among the Arabs is the symbol of stubbornness. The tongue is rough. The feet have four toes each, like those of the surieates. The same author sums up their character by saying that they are voracious nocturnal animals, inhabiting caverns, living for the most part on carcasses, for which they ransack the tombs, and that they are the subjects of an infinity of superstitious traditions.

The strength of these animals and their power of dragging away large bodies is strikingly exemplified in Colonel Denham's narrative. At Kouka he relates that the Hyænas (*Dhubba*), which were everywhere in legions, grew so extremely ravenous, that a good large village, where he sometimes procured a draught of sour milk on his duck-shooting excursions, had been attacked the night before his last visit, the town absolutely carried by storm, notwithstanding defences nearly six feet high of branches of the prickly tulloh, and two donkeys, whose flesh these animals are, according to our author, particularly fond of, carried off, in spite of the efforts of the people. 'We constantly,' continues Colonel Denham, 'heard them close to the walls of our own town at nights, and on a gate being left partly open, they would enter and carry off any unfortunate animal that they could find in the streets.' From the same narrative it appears that it was necessary to protect the graves from the attacks of these rapacious brutes. Mr. Toole's grave had a pile of thorns and branches of the prickly tulloh, several feet high, raised over it as a protection against the flocks of hyænas which nightly infested the burying-places in that country.

* From a skull in the Royal College of Surgeons.

Systematic Arrangement.

Linnæus, in his last edition of the 'Systema Naturæ (12th), places the *Hyæna* under the genus *Canis*, between the Wolf and the Fox, and describes the *Striped Hyæna* only, as *Canis Hyæna*, with sufficient accuracy. Brisson had already given the form a generic distinction under the name of *Hyæna*.

Gmelin, in his edition, adds the spotted species under the name of *Canis Crocuta*, and places these Hyænas between the *Canes Thous* and *aureus*, the latter being the Jackal; but Pennant had previously described both species in his synopsis under the title of 'Hyæna,' and as the *Striped* and *Spotted Hyænas*, arranging the form between the 'Dog' and the 'Cat,' names which he uses as generic distinctions for those carnivorous types, in the largest sense.

Cuvier makes the Hyænas the last subdivision of the digitigrades following his 'Civets' (*Viverra*), and immediately preceding the 'Cats' (*Felis*). He describes the subdivision as containing the most cruel and most carnivorous animals of the class, and as comprising two genera (which he does not distinguish), adding that three species are known, namely, *L'Hyène rayée* (*Canis Hyæna*, Linn.); *L'Hyène brune* (*Hyæna brunnea*, Thunberg; *H. Villosa* Smith); and *L'Hyène tachetée* (*Canis Crocuta*, not of Linnæus, as Cuvier quotes it, but of Gmelin).

Mr. Gray, in his method (*Annals of Philosophy*, 1825), brings the Hyænas under the family *Felidæ*, which he divides into two sections; the first consisting of those genera which have no tubercular grinders in the lower jaws; the second consisting of those which have tubercular grinders in both jaws. The first subfamily of the first section (which also includes *Felina*) is *Hyenina*, consisting of the genera *Hyæna*, Brisson, and *Proteles*, Geoffroy. [Aard-Wolf, vol. i.]

M. Lesson arranges the genus *Hyæna* under his third section of the tribe of Digitigrades, which section consists of those genera which are without a small tooth behind the great molar of the lower jaw. Its situation is between *Proteles* and the Cats (*Felis*), and three species are recorded, the same as those mentioned by Cuvier, but two of them with different names: thus, the Spotted Hyæna is termed *Hyæna Capensis*, Desm., and the Brown Hyæna, or *Hyène brune*, is named *Hyæna rufa*, G. Cuv.

Geographical Distribution of the Genus.—Entirely confined to the Old World, Africa and Asia.

Species.

Striped Hyæna.—Before we proceed to the synonyms of this animal among modern zoologists, we must inquire into its history, as it was current among the antients. It seems uncertain whether this is the animal alluded to in the Bible. Some translate the words rendered in our copies of the Holy Scriptures, 'the valley of *Zeboim*' (1 *Sam.* xiii. 18; *Nehem.* xi. 34) as 'the valley of Hyænas;' and the Seventy render the words given by the English translators as 'a speckled bird,' and 'a bird of divers colours' (*Jer.* xii. 9), as 'the cave of the Hyæna,' σπήλαιον ὑαίνης, while others would substitute one of the Hebrew letters composing the word in Samuel for another, and make the reading *vipers*, as if certain streaked serpents were meant. Bochart, and Scheuchzer seems to agree with him, shows that by the Tsabhua, or Tsehoa, the word occurring in the ninth verse of the twelfth chapter of *Jeremiah*, the Hyæna was intended, and, if this opinion be correct, there can be little doubt that 'the valley of Zeboim' means 'the valley of Hyænas.' *Dzuba* and *Dubba* are, it appears, Arabic names for this species.

Whatever may be the opinions as to the Striped Hyæna being alluded to in those passages of Scripture which we have quoted, there can be no doubt that it is the ὕαινα of Aristotle (*Hist. Anim.*, vi. 32; viii. 5) and the Greeks. The most monstrous fables were rife respecting this animal, and the extent to which they had reached may be supposed when we find Aristotle (vi. 32) taking pains to demonstrate the absurdity of the assertion that the animal was bisexual, or a true hermaphrodite. He declares that the genital parts of the male resemble those of the wolf and dog, and that the part which had been taken for the female organ is an opening with an imperforate bottom placed under the tail. This, as we have seen, is characteristic of the genus. Aristotle describes the parts with great minuteness; but notwithstanding his accuracy, we find Pliny (viii. 30, and xxviii. 8), and Ælian (i. 25, and vi. 14), stating not only that the Hyæna is bisexual, but that it changes the sex, being a male one year, and a female another. It is true that Pliny, in the passage first quoted, after stating—'Hyænis utramque esse naturam, et alternis annis mares, alternis fœminas fieri, parere sine mare, vulgus credit'—adds, 'Aristoteles negat.' But he leaves the subject there; and continues in such a strain, in both the books quoted, that his authority has been cited in support of these and other absurdities. Thus we are told that magicians looked on it with the greatest admiration, as possessing the magical power of alluring men.

It would be a waste of time and space to enumerate all the wonderful powers that were attributed to it; but among other accomplishments it was said to imitate the language of men, in order to draw to it shepherds whom it devoured at leisure, and to have the power of charming dogs so that they became dumb.

The animal does not seem to have made a part of the Roman shows till a comparatively late period. The third Gordian appears to have been the first who so introduced it: ten are said to have made their appearance at the games given by the emperor Philip, about A.D. 247.

The early modern naturalists repeated the fables of the antients. Even Belon, who was a good observer, gives 'Le Portrait de la Civette, qu'on nommoit anciennement Hyæna.' This figure is by no means bad for the time, and beneath in the small quarto 'Portraits D'Oyseaux, Animaux, &c., &c.,' is the following quatrain:—

'Voyant cecy, tu voy de la Civette
Le vray portrait: qui rend abondamment
Par son conduit le musc, pour excrement,
Odeur, que plus à sentir on souhaite.'

And this is the more curious when we find the same author (*Aquat.*) giving a very fair cut of the Striped Hyæna (which Gesner, Aldrovandus, and Jonston copied) as the sea-wolf, an amphibious animal, satiating itself with fish, and seen on the shore of the British Ocean.

This ὕαινα and Hyæna of the antients is the *Canis Hyæna* of Linnæus; *Hyæna striata* of Zimmerman; *H. vulgaris* of Desmarest; and *H. antiquorum* of Temminck.

Description.—Ground colour uniform, brownish-grey, rather darker above than beneath. Sides marked by several irregular, distant, transverse, blackish stripes or bands, which are more distinct on the lower part. Towards the shoulders and haunches these stripes become oblique, and they are continued in regular transverse lines on the outside of the legs. Front of the neck, muzzle, and outsides of the ears black; the latter broad, moderately long, and nearly destitute of hairs, especially on the inside. Hairs of the body long, particularly on the back of the neck, and on the spine, where it forms a full and thick mane, which may be said to be continued even upon the tail, the latter being furnished with strong tufted hairs of considerable length. Mane and tail both marked with blackish spots or stripes, variously and irregularly placed. Individuals vary much in colour and markings. (Bennett.)

Food, Habits, &c.—Pennant notices the propensity of this species to violate the repositories of the dead, and greedily devour the putrid contents of the grave. He also states, that it preys on the herds and flocks; but adds, on the authority of Shaw (*Travels*), that for want of other food it will eat the roots of plants, and that it will feed on the tender shoots of palms. He speaks of it as an unsociable animal, solitary, and inhabiting the chasms of the rocks, and says (also on the authority of Shaw), that the superstitious Arabs, when they kill one, carefully bury the head, least it should be applied to magical purposes; as the neck was of old by the Thessalian sorceress—

'Viscera non Lyncis, non diræ nodus Hyænæ
Defuit.'*

'Nor entrails of the spotted Lynx she lacks,
Nor bony joints from fell Hyænas' backs.'*

After referring to the wild opinions of the antients on this subject, he remarks, that it is no wonder that an ignorant Arab should attribute to its remains preternatural powers.

'They are,' continues Pennant, 'cruel, fierce, and untameable animals, with a most malevolent aspect; have a sort of obstinate courage, which will make them face stronger quadrupeds than themselves. Kæmpfer relates that he saw one which had put two lions to flight, regarding them with the utmost coolness.' (*Synopsis Quadr.*) This is a somewhat extraordinary translation of a passage in the second fasciculus of Kæmpfer's 'Amœnitates Exoticæ,' where he relates that he went to see a male Hyæna (*Kaftaar*), which a certain rich *Gabr*, or fireworshipper, kept as a curiosity, the animal having been taken when a suckling. It was muzzled by means of a rope fastened round its jaws, led out, and the rope lengthened so as to enable the animal to run more freely; and Kæmpfer goes on to say, 'Narrabant *Gabri*, sic frænatum nuper se opposuisse duobus leonibus, quos, *adspectante serenissimo*,* in fugam verterit.' Kæmpfer gives a figure which, though rude, cannot be mistaken for any animal but a striped Hyæna. Pennant seems to have been aware of his misconstruction, for afterwards, in his 'History of Quadrupeds,' he stops at 'put two lions to flight,' omitting 'regarding them with the utmost coolness.'

In the last-mentioned work Pennant remarks, that i will venture near towns; and quotes Niebuhr as authority that it will, about Gambron, in the season when the inhabitants sleep in the open air, snatch away children from the sides of their parents.

It has been the custom, among other fabulous assertions, to state that the Hyæna is not to be tamed: now, as Mr Bennett observes in the 'Tower Menagerie,' there is scarcely any animal that submits with greater facility to the control of man. He speaks of the docility and attachment to his keepers manifested by the Striped Hyæna, especially when allowed a certain degree of liberty, which the animal shows no disposition to abuse, though those which are carried about from fair to fair in close caravans are surly and dangerous from irritation and ill treatment. The individual which Mr. Bennett figures was remarkably tame, and confined in the same den with one of the American bears. [BEAR, vol. iv., p. 87.] Col. Sykes (*Proc. Zool. Soc.*, 1830—31) remarks, that this species, Turrus of the Mahrattas, is numerous in Dukhun (Deccan), and susceptible of the same domestication as a dog.

Locality.—Asia, and Northern and Central Africa, the mountains of Caucasus, and the Altaic chain, Asiatic Turkey, Syria, Persia, Barbary, and Senegal, and even as low as the Cape. (Pennant, but see post, p. 370.) There are three living specimens (1838) in the gardens of the Zoological Society at the Regent's Park. The locality of one is marked Asia and Africa, of another North Africa, and of the third Asia.

Striped Hyæna.

Spotted Hyæna.—This species is the *Tiger-wolf* of the colonists at the Cape; *Canis Crocuta* of Erxleben and Gmelin; *Hyæna Crocuta* of Zimmerman; *Hyæna Capensis* of Desmarest. Gesner has a figure of this species devouring a dog; and the spotted *Zilio Hyæna* of Jonston appears to owe its origin to the same animal.

Description.—Cuvier remarks that this and the preceding Hyæna are entirely distinct specifically, notwithstanding their generic resemblance, both externally and in the skeleton. The *Spotted Hyæna* has, he observes, no mane on the back, and instead of stripes has only round

* Lucan; Rowe.

* The king of Persia, apparently.

or black spots more or less scattered. He states that the last lower molar in the *Spotted Hyæna* is simply compressed and bilobated with a heel or process behind, whilst the *Striped Hyæna* has in addition a particular tubercle on the internal surface of its posterior lobe; there are also other osteological differences, which the reader will find pointed out in the 'Ossemens Fossiles.'

Size rather less than that of the *Striped Hyæna.* Muzzle short, but not so abruptly truncated. Ears short and broad, nearly quadrilateral. Colour yellowish-brown, the whole body covered with numerous spots of a deeper brown, tolerably uniform in size, but sometimes not very distinctly marked, and occasionally arranged in longitudinal rows. Hair shorter than in the Striped Hyæna; and though longer on the neck and in the central line of the back than elsewhere, it does not form so distinct and well furnished a mane as that of the Striped Hyæna. Tail blackish-brown, covered with long bushy hair. (Bennett.)

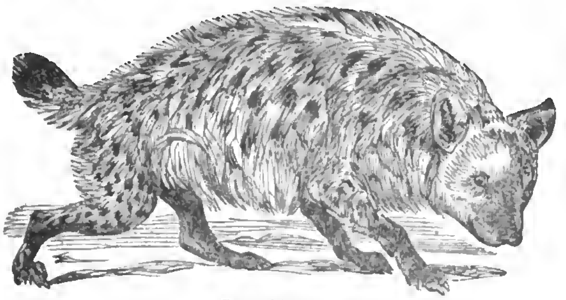
Locality.—Southern Africa, and especially the neighbourhood of the Cape of Good Hope. Lesson and others say that it is found even as high as Barbary: *quære tamen.* Ludolf, in his 'Ethiopia,' or rather the translator (i. 10), says, 'The *Hyæna*, or the *Crocuta*, near akin to the Wolfe, is the most voracious of their wild beasts: for she not only by night and by stealth, but openly and in the daytime, preys upon all she meets with, men or cattle; and rather than fail, digs down the walls of houses and stables. Gregory described her to be speckled with black and white spots.' To this is appended the following note:—'Begot between a Hyæna and a Lioness: familiar to Ethiopia. See *Solinus*, l. 65, and Salmatius upon him.' There is a living specimen in the gardens of the Zoological Society, at the Regent's Park, with 'South Africa' on the label.

Food, Habits, &c.—Numerous are the writers who have treated of the habits of this destructive animal. Le Vaillant, Sparrman, and other travellers give very interesting accounts of its manners; but we select the statement made in the first catalogue of the African Museum (where it is named *Hyæna Maculata*), which has lately (1838) been dispersed, because we think that the statement carries internal evidence of its having proceeded from the pen of the eminent and accurate zoologist under whose zealous superintendence that collection was made. The catalogue, then, states that there are two species of Hyæna in South Africa, and that the Spotted Hyæna, or Tiger-Wolf of the colonists, is more numerous and more widely diffused than the other species, which has the name of the Strand or Coast Wolf, and is also more voracious and destructive, not only devouring such animals as it chances to find dead, but also carrying off the smaller ones from the pens of the farmers during the night, and often succeeding in killing or mutilating such of the larger kinds as have not been secured before dusk. Sickly animals, it appears, are less liable to suffer from the voracity of this creature than those that are in full health; the latter, by their rapid flight, inspiring their enemy with a courage of which by nature he is destitute; whereas the sickly face him, and thus intimidate him from attacks which might be successful if made. So anxious is he for the flight of the animals, as a preliminary to his attack, that he uses all the grimace and threatening he can command to induce them to run, and never dares to attack them unless they do so. 'The character of this Hyæna,' continues the author, 'makes his destruction an object of no small importance to the farmers, whose ingenious snares for him call forth amazing cunning and dexterity on the part of the animal to render them of no avail. The more common methods employed against beasts of prey, such as spring-guns, traps, &c., do not succeed in his case. During his nocturnal wanderings he minutely examines every object that presents itself to his notice with which he is not perfectly familiar; and if he see reason to suspect that it can injure him, he will turn back and make his way in an opposite direction. Thus cords or leather thongs, which are often laid across the footpaths the Hyæna is accustomed to travel upon, and which are attached to the triggers of loaded guns, with the design that his contact with the thong may cause the discharge of the gun in his direction, are very carefully examined by him, and the usual result of his examination is his deciding against trusting himself in contact with them. The farmers have so often observed this result, that they now very rarely attempt his destruction by this means, but occasionally succeed by substituting for cords the delicate stems of creeping plants, which are regarded by him without suspicion until he has actually suffered through them. Many other ingenious methods, suggested by the necessity of the case, have been adopted by the farmers for the destruction of Hyænas; but a description of them, though elsewhere desirable, would here be out of place. This species seldom, if ever, moves abroad during the day, but passes that period in a state of repose, either in holes in the ground, or in retired situations densely covered with bush. Night is his favourite season for seeking his food; and towards nightfall his howlings are regularly heard, announcing to the various animals the approach of their voracious enemy, and thus enabling many of them to escape his wiles. The propensity this beast has for howling seems therefore to be disadvantageous to him; and if his almost continuous noise be not intended to put the animals upon which he preys upon their guard, its actual purpose is scarcely conceivable. Some have surmised it to be his call to creatures of his own species; but that this is not the case is certain from the fact that Hyænas are heard to utter their supposed call even while separating from each other farther and farther as each cry is uttered; in addition to which it may be remarked that it is contrary to the habit of this animal to hunt in company, or even to congregate in large numbers, save when assembled by the temptation of an abundance of carrion. A still further proof that the Hyæna's cry is not a friendly call to his own species may be found in the fact that when individual Hyænas have found a dead animal they cease to utter their melancholy howl, as if in fear of calling participators of their feast.'

It appears from the above interesting account that the Spotted Hyæna puts in practice 'all the grimace and threatening he can command' to induce the objects of his attack to run: in other words, his plan of attack is founded upon intimidation. May not his howls be intended to inspire terror and shake the nerves of the animals within hearing of the doleful nocturnal sounds?

'Till lately,' adds the author in conclusion, 'Hyænas were in the habit of paying nightly visits to the streets of Cape Town, and were regarded as very useful in carrying away the animal refuse, which might otherwise have been disagreeable. This however no longer occurs, partly perhaps from better regulations now existing in the town, and partly from the number of these animals having very greatly decreased. Even now however individual Hyænas occasionally approach the town, and their howlings are sometimes heard under Table Mountain, and in other directions, during the nights. In the countries inhabited by the Caffres they are very numerous and daring, generally approaching the villages during the night, and attempting, either by strength or stratagem, to pass the wattles by which the houses are defended. If they be thus far successful, they next endeavour to enter the houses, which they sometimes accomplish, in which case they not unfrequently carry off some young child of the family. Scars and marks on various parts of the body often testify to the traveller how dangerous a foe the natives have in this animal.'

Mr. Steedman, in his 'Wanderings and Adventures in the Interior of Southern Africa,' gives most appalling accounts of the rapacity of the Spotted Hyæna. He states that Mr. Shepstone, in a letter from Mamboland, relates that the nightly attacks of wolves, as the Hyænas are generally called, have been very destructive amongst the children and youth; for within a few months not fewer than forty instances came to his knowledge wherein that beast had made a most dreadful havoc. 'To show clearly,' says that gentleman, 'the preference of the wolf (Spotted Hyæna) for human flesh, it will be necessary to notice that when the Mamhookies build their houses, which are in form like beehives, and tolerably large, often eighteen or twenty feet in diameter, the floor is raised at the higher or back part of the house, until within three or four feet of the front, where it suddenly terminates, leaving an area from thence to the wall, in which every night the calves are tied to protect them from the storms or from wild beasts. Now it would be natural to suppose, that should the wolf enter, he would seize the first object for his prey, especially as the natives always lie with the fire at their feet; but notwithstanding this, the constant practice of this animal has been in every instance to pass by the calves in the area, and even by the fire, and to take the children from under the mother's kaross, and this in such a gentle and cautious manner, that the poor parent has been unconscious of her loss until the cries of her little innocent have reached her from without when a close prisoner in the jaws of the monster.' Mr. Shepstone then particularizes two instances within his own knowledge, one of a boy about ten years of age, and the other of a little girl about eight, who had been carried off by this species, and wretchedly mangled, but recovered by the attention of Mr. Shepstone and his friends. Notwithstanding this ferocity, the *Spotted Hyæna* has, it is stated, been domiciliated in the houses of the peasantry, 'among whom,' says Mr. Bennett, 'he is preferred to the dog himself for attachment to his master, for general sagacity, and even, it is said, for his qualifications for the chase.'



Spotted Hyæna.

Hyæna villosa.—In a letter read to the Zoological Society of London (April 9, 1833, 'Zool. Proc.'), Dr. Andrew Smith, so well known for his enterprising character and the additions which he is making to our knowledge of the zoology of Southern Africa, stated his belief that the *Striped Hyæna* does not inhabit South Africa; its place being occupied by the *Hyæna villosa*, which bears, when young, considerable resemblance to that species. *Hyæna villosa* was first described by Dr. Smith in the 'Transactions of the Linnæan Society.' This animal is considered by Cuvier as identical with *L'Hyène brune* (*Hyæna brunnea* of Thunberg), which is quoted by M. Lesson as *Hyène rousse, Hyæna rufa*, of Cuvier. The following are the dimensions of a specimen in Mr. Steedman's collection:—

	Ft.	In.
From the nose to the root of the tail	4	4
Height at the shoulder	2	4
" croup	2	0
Breadth of head between the ears	0	5½
Length of head from nose to occiput	0	10
Length of the ear	0	5
Length of the tail to the extremity of the vertebræ	0	9½
with hair	1	2

The hair is described as remarkably long, coarse, and shaggy over the whole body of the animal; whilst on the head, ears, and extremities alone it is short and crisp. Its length on the back and sides is eight or ten inches, and it does not form a long mane on the spine, as is the case with the common Striped Hyæna. The general colour of the head, body, and extremities is grizzled brown, from the long hairs being greyish at the roots and brown at the points, marked on the sides and hips with large but rather indistinct transverse bands of a deep vinous brown colour. The legs, particularly those before, which, as in other Hyænas, are much longer than those behind, are marked with transverse black bands much more distinct and apparent than those on the body. The upper lip is furnished with remarkably long, bristly, black moustaches, and the tail, which is thickly covered with long hair, and of greater length than in the common Hyæna, is uniform dark brown. The fore-arms and thighs are darker than other parts of the animal, and a large collar of dirty yellowish white surrounds the throat and extends up the sides of the neck, occupying the entire space between the setting on of the head and shoulders. Under each eye is a large irregular black patch; the chin is black also, and a narrow band of the same colour marks the junction of the head and neck, bordered by the dirty white collar above mentioned. The ears are large, erect, and rather pointed. The individual was aged, all the teeth being much worn: the two exterior incisors were much larger than the others, and had the form and size of small canines. A young one, nineteen inches in length, also in Mr. Steedman's collection, exhibited all the general characters of the aged specimen, excepting that the hair was shorter and more woolly. (Steedman.)

Locality.—The sea-coast throughout the whole extent of Southern Africa, but by no means so common as the *Spotted Hyæna*. The young specimen mentioned above was obtained alive with two others in the neighbourhood of the Nieuveld Mountains, a considerable distance in the interior of the country, which shows, as Mr. Steedman observes, that the species is not so strictly confined to the vicinity of the sea-coast, as its name '*Straand Wolf*' would imply, or as the accounts of travellers would lead us to imagine.

Food, Habits, &c.—The *Straand Wolf* devours carrion and such dead animal substances, whales for instance, as the sea casts up: but when pressed by hunger its habits seem to resemble those of the other species, for it then commits serious depredations on the flocks and herds of the colonists, who hold its incursions in great dread. Mr. Steedman, who states this, says that he saw a very fine specimen, which had been shot by a farmer residing in the vicinity of Blauwberg, and was informed that it had destroyed three large calves belonging to the farmer. He adds, that it is said to be a remarkably cunning animal, retiring to a considerable distance from the scene of its depredations to elude pursuit, and concealing itself during the day-time in the mountains, or in the thick bush, which extends in large patches throughout the sandy district in which it is usually found.

Hyæna Villosa.

Fossil Hyænas.

Fossil *Hyænas* occur abundantly in the third period of the tertiary deposits (Pliocene of Lyell), especially in the ossiferous caverns. Dr. Buckland's *Reliquiæ Diluvianæ*, in particular, should be referred to by the student for the history of these extinct species and the bones collected by them in the caves of Kirkdale, Kent's Hole, &c., but particularly the former. He also in the same most interesting and well illustrated work gives the following localities for the remains of Hyænas in caves or fissures:—Kirkdale, Plymouth, Crawley rocks near Swansea, Paviland caves near Swansea, district of Muggendorf, district of the Harz, Fouvent in France, Sundwick in Westphalia, and Köstritz near Leipzig. Those found in the superficial loam or gravel are stated to have occurred at Lawford near Rugby, at Herzberg, and Osterode, Canstadt near Stutgard, Eichstadt in Bavaria, and the Val d'Arno near Florence. The student should also consult the works of Sömmering, Schlotheim, Rosenmüller, Blumenbach, Cuvier, M. de Serres, Christol and Bravard, Croizet and Jobert, Goldfuss, &c. The fossil species named are *Hyæna spelæa*, Goldf.; *Hyæna spelæa major*, Goldf.; *Hyæna prisca* (*Hyène rayée* fossile), M. de Serres; *Hyæna intermedia*, M. de Serres; *Hyæna Perrierii*, Brav., Croiz., and Job.; *Hyæna Arvernensis*, Brav., Croiz., and Job.; and *Hyæna dubia*, Brav., Croiz., and Job.

Captain Mudge found the remains of *Hyæna* in the ossiferous cavern of Yealm Bridge, six miles south-east from Plymouth, among those of other animals, several of whose bones were splintered, chipped, and gnawed. (*Geol. Proc.* 1836.)

HYÆNA-DOG. This quadruped, which in size and form is smaller and more slender than either the Hyæna or the Wolf, is the Wild Dog of the settlers at the Cape. M. Temminck first described it as a Hyæna (*Hyæna picta*), but subsequently regarded it as a species of dog. Desmarest considered it a species of *Canis*, and recorded it as *Canis pictus*. Brookes gave it the generic appellation of *Lycaon*; and Fischer, in his 'Addenda et Emendanda,' quotes it as *Canis Lycaon*, and in his 'Index Nominum' refers to it as *Lycaon tricolor* of Brookes. Cuvier places it among the dogs.

In the number and form of its teeth the Hyæna-Dog agrees with the dogs, as well as in its general osteological structure, which presents a remarkable difference from that of the Hyæna. Externally it is distinguishable from both the Hyænas and Dogs in the proportional length of its legs and the form and proportions of the body. There is no mane as in the Hyænas, and the tail resembles that of some dogs. The head is Hyæna-like, and, like the Hyænas, it has only four toes to each foot.

Description.—Colour reddish or yellowish-brown, variously mottled in large patches along the sides of the body and on the legs, with black and white intermixed. Nose and muzzle black, with a strong black line passing from them up the centre of the forehead to between the ears, which are very large, black within and without, and furnished with a broad and expanded tuft of long whitish hairs arising from their anterior margin and filling up a considerable part of their concavity. Beneath each of the eyes a lighter patch. Tail moderate, covered with long bushy hair, and divided in the middle by a ring of black, below which it is nearly white, as are also the fore parts of the legs below the joint. Mr. Bennett, who thus describes the animal, had an opportunity of seeing a living specimen in the Tower of London; but he observes that their colours and markings are subject to variation in different individuals, though their general disposition and appearance are similar.

Locality, South Africa: troublesome at the frontier settlements near the Cape.

Habits.—Mr. Burchell, who brought to this country the first specimen and pointed out the distinguishing characters, describing it under the name of *Hyæna venatica*, states that it hunts in packs, at night by preference, but frequently in the day. He describes it as swift, fierce, and active, so that only those animals which are gifted with great fleetness can escape from it. It attacks sheep openly and fearlessly: it approaches oxen and horses more cautiously, advancing upon them by stealth, biting off the tails of the oxen, and injuring the horses, especially young colts, so severely that they rarely survive.

Mr. Burchell's specimen continued ferocious though he kept it chained up in his stable-yard for more than a year, and the man who fed it 'dared never to venture his hand upon it.' It however became familiar with a dog, its companion. The Tower specimen arrived with a young Cape Lion, with which it agreed perfectly till the lion became too strong and rough in his play, when the Hyæna-Dog was associated with a Striped Hyæna and two Spotted Hyænas, and all lived tolerably well together in the same den.

Mr. Swainson gives the name of *Hyæna-Dog* as the English synonym of *Proteles*. [AARD-WOLF.] The animal which is the subject of this article he describes under the name of *Lycaon, the Hunting Dog*. He arranges both under the family *Felidæ*, where they had been previously placed by Mr. Gray, who makes *Proteles* a genus of his subfamily *Hyenina*, and *Lycaon* a genus of his subfamily *Canina*.

HYALÆ'IDÆ, a family of *Pteropoda* according to the systems of Lamarck and Cuvier, but belonging to the family *Thecosomata* (order *Aporobranchiata*) of De Blainville. M. Rang, in his *Tableau Méthodique*, follows De Férussac in making the *Hyalæidæ* a family, and enumerates the following genera as composing it: *Cymbulia, Limacina, Hyalæa, Cleodora, Cuvieria, Euribia*, and *Psyche*.

Definition of the Family.—*Animal* furnished with a head, but it is not distinct, with a third natatory membrane smaller and intermediate at the ventral part; *mouth* situated at the bottom of a cavity formed by the union of the locomotive organs.

Shell nearly always present, and very variable in form.

Genera.

† *A Shell.*

Cymbulia.

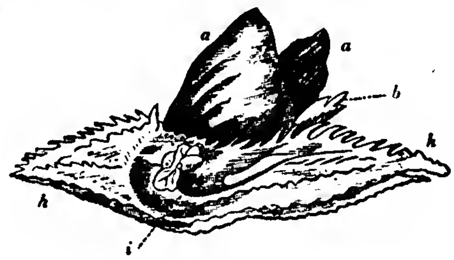
Cuvier describes the *Cymbuliæ* as having a cartilaginous or gelatinous envelope in the form of a boat or slipper, beset with points in longitudinal rows; and the animal itself as possessing two great wings of a vascular tissue, which are at once branchiæ and fins, and between them on the open side a third smaller lobe, which is three-pointed. The mouth with two small tentacula is placed between the wings, towards the shut side of the shell, and above two small eyes and the orifice of generation, whence issues an intromissive male organ in the form of a small proboscis (trompe). The transparency of the texture permits the observer to distinguish the heart, the brain, and the viscera through the envelopes.

M. Rang gives the following *Generic Character*:—

Animal oblong, gelatinous, transparent, furnished with two eyes? two tentacles? and a mouth in the form of a proboscis (trompe)? Two lateral fins, which are large and rounded, carry the vascular net of the branchiæ; they are united at their base, on the posterior side, by an intermediate appendage in form of an elongated lobe.

Shell gelatinoso-cartilaginous, oblong, in the form of a slipper, entirely covered with a delicate and hardly visible membrane, with a superior opening, long and truncated at one of its extremities.

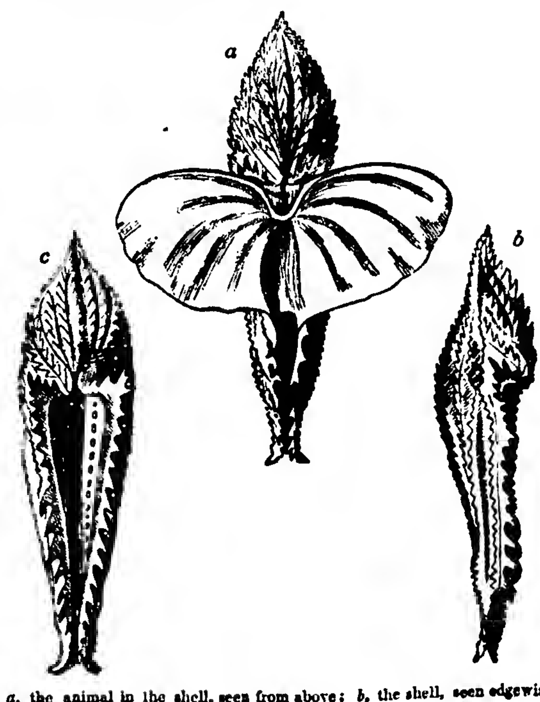
M. Rang further observes that this curious and very incompletely known genus only contains a single species, which is found in the Mediterranean sea; and he adds that be only knows it by a drawing communicated to him by Cuvier, who remarks (*Règne Animal*) that in the figure given by M. de Blainville (*Malacologie*, xlvi. 3) the animal is placed in the shell the wrong way ('en sens contraire du veritable'), and that his (Cuvier's) description rests on recent and repeated observations made by M. Laurillard. M. Deshayes confirms this remark as to the inverse position of the animal, and says that he has had occasion to verify it often. The following is a copy of the figure given by M. Rang in his *Tableau*.



Cymbulia.

a, a, fins; *b*, the intermediate lobe; *i*, the viscera, seen through the shell; *h*, the shell.

The following is Mr. G. B. Sowerby's representation of Cymbulia (Genera, No. 39).



a, the animal in the shell, seen from above; *b*, the shell, seen edgewise; *c*, the shell, seen from above.

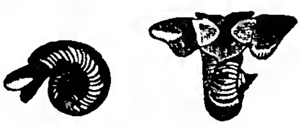
M. Rang, as we have seen, states (1829) that there is but one species. M. Deshayes, in his edition of Lamarck (1836), enumerates five. The species known to M. Rang must have been *Cymbulia Peronii*.

Limacina. (Spiratella, De Bl.)

Animal elongated anteriorly, turned into a spiral form behind; branchiæ in the form of plaits on the back; mouth furnished with two small appendages, which are united by one of their extremities to the anterior border.

Shell very delicate, fragile, vitreous, spiral, not carinated, turning rather obliquely on itself, with a circular aperture and simple borders. (Rang.)

Cuvier is of opinion that the *Limacinæ* ought, according to the description of Fabricius, to bear a strong relationship to *Pneumodermon;* but their body is terminated by a tail, which is twisted spirally ('coutournée en spirale'), and is lodged in a very delicate shell, of one whorl and a half, umbilicated on one side and flattened on the other. Cuvier adds that the animal uses its shell as a boat and its wings as oars when it would swim on the surface of the sea. The same author remarks, that the only species, *Clio helicina* of Phipps and Gmelin, is scarcely less abundant in the icy sea than *Clio borealis* [CLIO], and is considered as one of the principal aliments of the whale. He observes that he does not know whether the animal figured by Mr. Scoresby, of which M. de Blainville (*Malacologie*, pl. xlviii. bis, f. 5) makes his genus *Spiratella*, is in reality, as M. de Blainville believes, the same animal with that of Phipps and Fabricius. M. Rang considers *Spiratella* of De Blainville as synonymous with *Limacina*, of which M. Rang states that but one species is known, and says that it would be interesting to have new accounts of it. He speaks of its inhabiting the North Sea, its prodigious abundance, and the possibility of its serving as food for the whales. Phipps mentions it as being found in innumerable quantities in the Arctic seas, and describes its body as of the size of a pea, rolled up into a spire like a *helix*, and its ovate, obtuse, expanded wings as being greater than the body. The following cut is taken from the figure of M. de Blainville, who founds his genus (which he places under *his* family of *Pteropoda*, between *Atlanta* and *Argonauta*) on the materials furnished by Mr. Scoresby, and considers his *Spiratella* as synonymous with Cuvier's *Limacina*.



Spiratella Limacina of De Blainville.

Mr. G. B. Sowerby figures a *Limacina* (in his 'Genera of Recent and Fossil Shells,' and in the same number as that which contains *Cymbulia*) from Messina. He describes it as a thin, fragile, spiral, discoid shell, umbilicated on both sides, and carinated on the back and below, with a membranaceous lamellar keel, and he says that it has externally much the appearance of a very diminutive umbilicated *Nautilus*.

M. Deshayes, in his edition of Lamarck, remarks that the *Limacinæ*, of which M. de Blainville formed his genus *Spiratella*, have in fact much analogy with the *Cleodoræ;* and that they are *Cleodoræ* whose shell is spiral, and not swimming gastropods, like the *Carinariæ* and *Atlantæ*. M. Deshayes goes on to state that he has many individuals preserved in spirit, which he owes to the generosity of Dr. Fleming, that he has examined them with attention, and that they have not the projecting foot of *Atlanta*, nor a fin-like foot, but two lateral fins of the form of those of the *Cleodoræ*. He adds that they have no tentacles, and no eyes, but a mouth in the shape of a triangular slit at the summit of the angle which forms the fins. The shell is not closed by an operculum as that of *Atlanta* is. The anus and the organs of generation have their issue from the right side, below the fin and at its base. M. Deshayes is of opinion that the genus ought to remain among the *Pteropods*, where it was placed by Cuvier and Lamarck.

Hyalæa.

Animal globular or oblong, furnished with two lateral expansions more or less elongated backwards; the intermediate lobe of a demicircular form; two very short tentacles, hardly distinct, contained in a cylindrical sheath; the aperture of the mouth provided with two labial appendages; orifice of the anus at the right side of the mantle; that of the male organ in front and within the right tentacle; that of the female organ on the same side, at the point of separation of the two parts of the body; branchiæ pectinated, on each side, in a particular cavity.

Shell horny or vitreous, transparent, and fragile, in form of a slipper, straight or recurved, with an anterior opening, and split laterally, tricuspidated backwards. (Rang.)

M. Rang remarks that this beautiful and interesting genus, the anatomy of which has been made known by M. Cuvier and M. de Blainville, is perfectly distinct from those which approach it. He speaks of the *Hyalææ* as very small animals, spread over all the seas of the torrid zone and a great part of those of the temperate zones, and of the occurrence of the same species on the most opposite points of the globe. He adds that the discovery which he had made of many species, one in a fossil state, had caused him to divide the *Hyalææ* into the two following groups:—

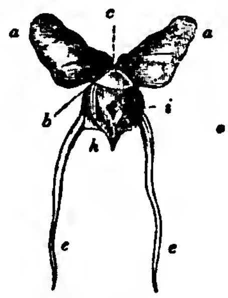
1. *Globulosæ.*

Shell subglobular, having the lateral slits nearly as long as itself, and the appendages placed very much backward. *H. uncinata*, &c. This group, he says, is the most numerous.

2. *Elongatæ.*

Shell elongated, having the lateral slits short and the appendages advanced. *H. trispinosa*, &c.

He states that, at the time he wrote, five species completed the group, and gives the following figure of a *Hyalæa*.



Hyalæa.

a, fins; *b*, intermediate lobe; *c*, mouth; *e*, lateral expansions of the mantle; *i*, viscera, seen through the shell; *h*, the shell.

Cuvier describes *Hyalæa* as having two great wings, no tentacles, a mantle slit at the sides, lodging the branchiæ in the bottom of the fissures, and covered by a shell equally slit at the sides, the ventral surface of which is very convex, the dorsal flat and longer than the other, and the transversal line, which unites them behind, furnished with three pointed dentilations. In the living state, the animal projects by the lateral slits of the shell filaments more or less long, which are productions of the mantle. Cuvier concludes by observing that the species most known (*Anomia tridentata*, Forskahl; *Cavolina natans*, Abildgaardt; *Hyalæa cornea* (*tridentata*), Lamarck) has a small yellowish demitransparent shell, which is found in the Mediterranean Sea and in the ocean.

M. de Blainville, who has published a monograph of this genus in the 'Journal de Physique,' and in the 'Dictionnaire des Sciences Naturelles,' states, that it contains already (1825) from five to six species, all of which appear to be the inhabitants of warm climates. He considers the genus *Glandiolus* of De Montfort as belonging to the *Hyalææ*, and quotes the observation of M. Defrance to that effect with approbation.

M. Deshayes, in his edition of Lamarck (1836), observes, that in the comparison which the latter makes of the *Hyalææ* with the conchifers, he had remarked, that they approached so closely that he had found it proper to place the *Hyalææ* at the head of the mollusks. Lamarck had suffered himself to be seduced by an analogy rather apparent than real. It is not with the lamellibranchiate conchifers, continues M. Deshayes, that the *Hyalææ* should be compared, but with the brachiopods, an inferior class of animals [BRACHIOPODA, vol. v.]; for the *Hyalææ* and the brachiopods are placed in the shell in the same way. We find, he observes, in the *Hyalææ* the two valves of the *Terebratulæ* soldered together; and, in becoming free, the animal has closed the umbo of the great valve, and the shell has left a passage always open for the ciliated appendages, changed into locomotive organs. This comparison, says M. Deshayes, would appear sufficiently just, and yet it is not. Upon the examination of the two groups, we are soon convinced of their dissemblance in all the essential parts of their organization. To this we beg to add, that it will be probably difficult to establish any essential difference in the organization of the two groups, except upon the higher development of the nervous system, and the presence of a head in *Hyalæa*. M. Deshayes enumerates siteexn recent species, exclusive of *Hyalæa cuspidata*, which, he says, is not a true *Hyalæa*, as Bosc, De Roissy, and Lamarck believed, but a *Cleodora*. MM. Rang, D'Orbigny, Lesueur, and Quoy and Gaimard, have principally contributed to the number of species.

Hyalæa tridentata.
a, the anterior border, showing the mouth.

This is the *Anomia tridentata* of Forskahl, Gmelin, and Dillwyn; *Hyalæa papilionacea* of Bory de St. Vincent; *Hyalæa cornea* of De Roissy. M. Deshayes keeps Lamarck's synonym with a query—*Monoculus telemus ?* Lin.

Locality, Mediterranean, and the seas of warm climates. The size scarcely reaches that of a small hazel-nut.

Cleodora.

Cuvier remarks, that the *Cleodoræ*, for which Brown originally founded the genus *Clio*, appear analogous to the *Hyalææ*, in the simplicity of their wings and the absence of tentacles between them: their conic or pyramidal shell, he adds, is not slit on the sides; and he quotes M. Rang's genera and subgenera.

M. Deshayes, in his edition of Lamarck, states, that the *Cleodoræ* are much more allied to the *Hyalææ* than the *Clios*, approaching the former not only in having a shell, but also in the form of the animal, which bears a great resemblance to that of *Hyalæa*. It is not astonishing, proceeds M. Deshayes, to see Lamarck, who had approximated the *Cleodoræ* to the *Clios*, indicate not very natural relations to the former; for, when he wrote, but a very small number of species were known, and he could hardly foresee that the assiduous researches of MM. Quoy and Gaimard, Rang and D'Orbigny, should have contributed to throw so much light on the Pteropods in general, and the *Hyalææ* and *Cleodoræ* in particular. If we have before us a sufficient number of species belonging to the two last-named genera, we shall see them blend into each other so as to make it impossible to draw the line between them. It is thus, continues M. Deshayes, that we proceed by insensible degrees from the globular to the lanceolate species. A globular *Hyalæa* seems formed of two unequal valves soldered together, leaving between them a principal anterior slit, and also lateral slits, sometimes without communication with the aperture, and sometimes forming the prolongation of this part. The posterior extremity is prolonged into a spine, which is ordinarily short, sometimes straight, and sometimes curved. Taking these species of *Hyalæa* as the commencement of the genus, M. Deshayes points out the following alterations of their characters in the rest of the series. At first the posterior extremity is seen to be elongated, and, in this case, the two parts of the shell are flattened, become nearly equal, and, if in some of the species there remains the trace of posterior lateral slits, for the most part these slits rise sufficiently to be in continuation of the aperture. This aperture is always transverse and narrow, as in the *Hyalææ* properly so called. When the shells are thus elongated, some have their posterior extremity curved; others have it straight, as in the *Cleodoræ*. These last are elongated more and more, and in proportion as this elongation exists the aperture is enlarged, and the lateral slits progressively diminish, are reduced to simple inflexions, and at last entirely disappear. These changes in the form of these shells are not, M. Deshayes observes, more extraordinary than those to which he has drawn attention in other groups, and principally in the acephalous mollusks. If, continues the same author, the animals coincide with these modifications in their external form, their internal organization offers but little alteration; and he cites the authority of MM. Quoy and Gaimard, who assert positively that the lanceolate *Cleodoræ* differ in nothing essentially from the *Hyalææ* properly so called. This M. Deshayes considers as the more important to him, inasmuch as he is thereby confirmed in the opinion which he had long entertained as to the analogy of the *Hyalææ* and *Cleodoræ*.

The following is M. Rang's definition of *Cleodora*:—

Animal of an oblong or elongated form, furnished with an intermediate demicircular lobe, but having no lateral expansions; mantle open in front; branchiæ and organs of generation incompletely known.

Shell fragile, vitreous, in form of a sheath or case (gaîne ou cornet), more or less pointed posteriorly; aperture very large, nearly always without a slit, and without lateral appendages.

The same zoologist having, as he states, obtained many new species, and studied their organization, divides the genus into the following subgenera:—

1. Cleodoræ properly so called.

Animal of an oblong form, having the mantle very much dilated and advanced on each side.

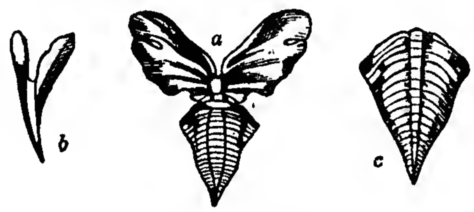
Shell pyramidal, angular, very much dilated anteriorly, with a very large aperture, canaliculated on each side, and rarely slit.

M. Rang makes this subgenus comprise (1829) five species only, two of which he considers as very doubtful. Type *Cleodora lanceolata*.

Description.—Shell compressed, elongated, lanceolate; aperture dilated.

Locality, the seas of warm climates.

The following figure will convey a general idea of the form of the animal and shell.

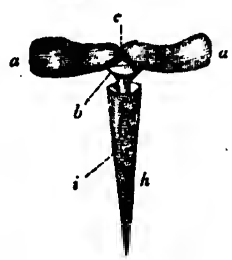


Cleodora pyramidata.
a, animal and shell; *b*, shell, seen edgewise; *c*, shell, seen from above.

M. Deshayes, in his edition of Lamarck, records thirteen species, besides *Hyalæa cuspidata*.

2. Cresis. (Rang.)

Animal very slender; the mantle not dilated on its sides; fins generally rather small.



Cresis.
a, fins; *b*, intermediate lobe; *c*, mouth; *i*, viscera, seen through the shell; *h*, the shell.

Shell very slender, fragile, and diaphanous, in the form of a straight or curved case (cornet), with an aperture almost always as large as the shell itself, and generally without a canal; no lateral appendages. M. Rang, who gives this description, says, that he formed this subgenus for some very small new mollusks, which he frequently met with in the middle of the ocean, and to which he unites, by analogy, the genera *Vaginella* of Daudin, and the *Gadus* of Mon tagu, known in the fossil state; and M. Rang reckons nine species.

3 Tripter. (Quoy and Gaimard.)

Animal oblong, fleshy, contractile, furnished with two small lateral fins, and surmounted by a membranous veil of the same form and size as they are.

Shell diaphanous, vitreous, in form of a cylindrical sheath, rounded posteriorly, with a circular opening, horizontal and dentilated on its borders.

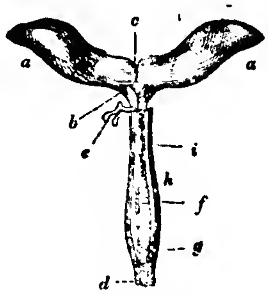
M. Rang observes that this genus is established on a single species, and that he is inclined to believe that the membranous veil described by MM. Quoy and Gaimard is nothing more than the intermediate lobe common to all the Pteropods of the family of *Hyalæidæ*, and he thinks that this subgenus should be united to the preceding.

Cuvieria.* (Rang.)

Animal elongated, furnished with two rather large fins and with an intermediate demicircular lobe; the exterior branchiæ situated at the ventral part, and at the base of the intermediate lobe; organ of generation incompletely known; the mouth furnished with dentiform pieces proper for mastication.

Shell in form of a cylindrical case, rather flattened near its aperture, which is heart-shaped with sharp edges; the side opposite to the aperture shut by a diaphragm which is convex externally, but not terminal, being surpassed by the walls of the cylinder.

M. Rang remarks that he established this curious genus on a species equally common in the Indian Sea, the ocean, and the South Sea.



Cuvieria.

a, fins; *b*, intermediate lobe; *c*, mouth; *e*, gills; *i*, viscera, seen through the shell; *f*, ovaries; *g*, heart; *h*, shell; *d*, posterior cavity of the shell.

Euribia. (Rang.)

Animal furnished with two horizontal fins, at the base of which is the mouth; the intermediate lobe is very small and of a triangular form; body globular, short; gills and organs of generation unknown.

Shell cartilagino-membranous, delicate, transparent, regular, and in form of a reversed cap (calotte).

M. Rang states that there is only a single species which he has not been able to observe sufficiently, but which presented well-defined generic characters.

†† No Shell.

Psyche. (Rang.)

Animal enveloped in a membranous mantle, furnished with two rather long fins, but which do not appear united on the ventral side by an intermediate lobe; branchiæ overspreading the fins.

M. Rang established this genus on a species from the seas of Newfoundland (Terre-Neuve); he adds that M. Reynaud brought back from his Indian voyage some drawings of Pteropods which appear to be referrible to it.

M. Deshayes (edit. of Lamarck, 1836) says that he is led to reject many genera proposed some years since by M. Rang, in the *Annales des Sciences Naturelles* as well as in his *Manuel*, under the name of *Cresis* and *Cuvieria*. M. Deshayes observes that M. Rang has comprehended under his subgenus *Cresis* a living shell named *Gadus* by Montagu, and some other fossils placed by Lamarck in the genus *Dentalium*. [Dentalium, vol. viii., p. 406.] Although M. Deshayes is as yet uncertain as to these species, he adopts the opinion of Lamarck as preferable, because, he says, M. Rang has contested it only on the supposition that they had been defined after the mutilation of their posterior extremity, which, being naturally short, only presented itself as open by accident. This view taken by M. Rang, he continues, is not founded on any good observation, and he says that he has seen a sufficiently large number of individuals perfectly preserved, to be able to affirm that their posterior extremity was open when the animal was alive. These shells then, he states in conclusion, do not belong to the Pteropods, and are more probably Dentalia. This opinion is a very strong one, and, coming from the quarter it does, is deserving of all respect: but as M. Rang has justly the reputation of a good observer in this department of natural history, we have thought it right to lay before the reader the descriptions and figures given by him.

* This name has been pre-occupied for a genus of Holothuridæ. [Holothuria, vol. xii., p. 269, &c.]

Fossil Hyalæidæ.

M. Rang, as we have seen, mentions one fossil species of *Hyalæa*, and Mr. G. B. Sowerby states that the genus occurs in a fossil state in Sicily. M. Rang notices the fossil analogue of *Cleodora* from Piedmont: if *Vaginella* and *Gadus* are to be considered as belonging to this family, they must be added. The last-mentioned author says that he has detected a fossil species of *Cuvieria* in the shell sand of Piedmont, where it had been collected by the elder De Luc. M. Deshayes, in his tables, enumerates two fossil (tertiary) of *Hyalæa* and three of *Cleodora*,* tertiary also; of the latter he records *Cleodora lanceolata* as a species found both living and fossil (tertiary).

HYALITE. [Silicium.]

HYAS, a genus of brachyurous crustaceans belonging to the *Maia* family. [Maiadæ.]

HY'BODUS, a genus of fossil fishes placed in the order of Placoïdians by M. Agassiz (*Recherches sur les Poissons Fossiles*, vol. iii., tab. 8, 9, 10). The information which M. Agassiz has collected concerning this extinct group of fishes appears to be considerable, yet only in a few instances (from the lias of Lyme Regis and Bristol) has he been able to reconstruct the whole skeleton. In consequence, the spinous rays and the teeth of one species may be, and probably are, described under different specific names. The species of Hybodus are supposed to amount to twenty-two, and extend from the new red sandstone (grès bigarré) to the chalk inclusive. They present analogies to the genus Squalus of Linnæus, in the teeth and spinous rays; it appears that there were two dorsal fins, each having spinous rays, not differing more than in recent species of fishes with two spinous dorsal fins. (Agassiz, vol. iii.)

HYBRID. [Mule: and see, as far as Zoology is concerned, the different articles where Hybrids are noticed; Canary Bird, and Horse, for instance.]

HYDA'TIDS (ὑδατίς, a vesicle, from ὕδωρ, water). This name has been applied to various cyst-like productions, which are sometimes found in the bodies of men and animals.

The term hydatid is of the most indefinite application, for under this common denomination are included objects of the most dissimilar nature. In the first place, the term comprehends several species of entozoa, or parasitic animals, which have a distinct independent vitality; secondly, the simple unattached cysts which are frequently met with; and lastly, what have been called false hydatids, which are vesicular bodies, either entirely or partially connected with the tissues by which they are surrounded.

Hartmann in 1686 (*Ephem. Nat. Curios.*, Ann. iv. dec. 2, obs. 73), and Tyson in 1691 (*Philos. Trans.*, No. 193), first clearly observed that many of the bodies, or cyst-like tumours, called hydatids, were distinct living beings, or parasitic animals. They arrived at this conclusion from observing that they had no connection with the organs in which they were found, that some of them distinctly moved when placed in warm water, and were also furnished with projecting processes or heads, having an orifice or mouth at their extremity. Morgagni and others have thought that some of the antient medical writers, particularly Aretæus and Galen, were acquainted with the true nature of these bodies; but nothing of the kind is clearly stated in their writings, though they often mention the occurrence of hydatids.

The discovery of Hartmann and Tyson was taken little notice of before the time of Linnæus and Pallas, who pursued the investigation; since which time these beings have occupied the attention of many naturalists, among whom may be mentioned Hunter, Müller, Goeze, Cuvier, Laennec,

* Including, probably, Cresis and Vaginula.

and Rudolphi, who have all admitted the animal existence of the greater part, if not the whole of them. Pallas arranged all the cystic entozoa, except the common globular hydatid, or acephalocyst (which was only considered as a simple serous cyst before the time of Laennec), under the genus 'Tænia,' on account of tho similarity of structure between their mouths and those of the tape-worm. In this classification he was followed by Goeze. Cuvier and other French naturalists gave all these entozoa the generic name of 'Hydatis,' but Rudolphi (*Ent.*) has since shown that they cannot be all placed in one genus, bnt should be divided into several, as 'Cænurus,' 'Cysticercus,' &c., which together form the order Cystica. [ENTOZOA.]

Hydatids are found principally in the bodies of mammalia; rarely in those of the lower orders of animals. They may occur in any part of the body, but are very seldom seen in the mucous cavities and passages, except when they have been discharged into them by tho rupture of their containing cyst. This external sac, by which they are mostly surrounded, is generally attached to the tissue of the organ in which it is seated; it is frequently common to many hydatids, but each individual may have a distinct envelope, in the interior of which it floats, and to which it never contracts any adhesion. The fluid which fills the proper cyst of a hydatid is almost always colourless and limpid. The liquid of the common cyst in which they float may present various appearances: sometimes it is quite limpid; at others it may be coloured. When formed in the liver it is often yellow.

Though these beings possess an independent existence, their life is connected with that of the body in which they are found; for if not removed immediately after the death of the parent animal, they can never be seen to move. The form of Hydatids varies according to the genus and species of Entozoa to which they belong; and they have been divided into two classes, Cephalocysts and Acephalocysts. The latter consists of a simple bladder without any appendix: the former of a cyst to which are attached one or more bodies or heads. When there is only one appendix, as in the cysticercus, it has been called a monocephalocyst; when several heads or processes are attached to one terminal cyst, as in the cænurus, the name of polycephalocyst has been applied.

The origin and mode of development of Hydatids are involved in the same obscurity as the production of all the other forms of entozoa; but though first formed in an unknown manner, they are capable of reproducing their species, which, as no traces of organs of generation have been detected, probably takes place in all the genera by gemmation. In the acephalocyst, the reproductive power is spread over the whole surface of the cyst.

The principal genera of cystic entozoa, or true hydatids, are Cysticercus, Cænurus, and Echinococcus; to which may be added Acephalocystis. For the characters by which these genera are distinguished see ENTOZOA. Several species of Cysticercus are enumerated, but the most common are C. tenuicollis, and C. cellulosus. The former (Tænia hydatigena, *Pallas;* Hydatis globosa, *Lamarck*) is met with frequently in the peritoneum and pleura of ruminating animals and pigs. It is often generated in the disease of sheep called the rot, where another entozoon, the 'distoma,' or fluke-worm, is met with in the ducts of the liver. The C. cellulosus (Tænia cellulosa et T. finna, *Gm.;* Hydatis finna, *Blum.*) is found generally lodged in the tissue of the muscles between the fibres; it occurs sometimes in man, but more frequently in animals, particularly in the hog, where it causes the disease called measles or leprosy. Of the genus Cænurus (Hydatis polycephalus, *Zeder*), the species C. cerebralis (Tænia vesicularis, *Goeze;* T. cerebralis, *Gom.;* Polycephalus ovinus, *Zeder*) is found in the brain of sheep, oxen, and other ruminating animals. These hydatids occur in various parts of the brain of sheep, but most frequently in one of the lateral ventricles, where they occasion a kind of giddiness, in which the animal turns round and round in one direction; this affection is denominated by the German farmers 'das Drehen,' by the French 'le Tournis,' and in England the sheep are said to be 'giddy,' or to have the 'staggers.'

Sometimes the hydatid is situated in the fourth ventricle, when it is said to cause a variation in the affection, called in German 'das Springen,' from the animal springing up. Rudolphi says that he has seen the latter variety occur when one large hydatid has occupied the middle part of the brain. In the first case one-half of the body is rendered partially paralytic from the pressure of the hydatid on the side of the brain, and the opposite muscles by their action turn the body round towards the unaffected side. In the latter form of the disease, Rudolphi says that the equilibrium between the anterior and posterior muscles of the body is destroyed, which causes tho animal to spring up. Sometimes two hydatids are found in the same ventricle, and occasionally as many as five or six have been met with. The internal surface of the ventricles is always smooth, and never contracts any adhesion to the cysts. This hydatid is sometimes found as large as a hen's egg; the walls of the bladder are very thin and fibrous, and may be seen clearly to contract. The little worm-like bodies attached to it are scarcely half a line in length, and have the power of retracting themselves within the cyst. These hydatids are most generally met with in yearling cattle and sheep, and their production, or that of the state of health which gives rise to them, seems owing principally to the effects of cold and damp, and watery pasturage, which also occasions the rot in sheep. The best treatment is removal to a dry and sheltered pasturage. In some cases sheep have been cured by the extraction of the hydatids by the operation of trepanning.

The hydatids belonging to the genus Echinococcus are not very well understood. They are considered by some as mere varieties of the Acephalocyst. They are commonly called granular hydatids, from the presence of numerous granules or minute particles which float in the fluid of the cyst or adhere to its walls. Two species of Echinococcus have been particularly described: one, called E. hominis, has been met with in the brain and abdomen of man in a few instances; the other, E. veterinorum, occurs more frequently in the hog and other animals.

The Acephalocyst, or common globular hydatid, to which it is thought by some that tho name of hydatid should be restricted, is a simple unattached vesicle, varying in size from a millet-seed to a child's head, filled with pellucid fluid, furnished with no kind of appendix or head, generally associated with numerous others, and contained in a common cyst, which is also filled with fluid. These bodies seem to possess a proper vitality, though dependent for existence on the body of the animal in which they live. The coat of the proper cyst is composed of several laminæ or membranes, which consist of white semiopaque pulpy matter. The common cyst enclosing the hydatids is supposed to be formed by the condensation of the cellular tissue of the surrounding parts, but frequently it is but very loosely attached to the adjoining tissues, and the texture of the organ in which it is situated is unchanged, unless when the cyst is of sufficient size to cause considerable pressure around. The coats of these common cysts are of a fibrous texture, and possess considerablo contractile power. These hydatids have been divided into the solitary and the multiplied: the former is found in the viscera of ruminating animals; it has been called the Acephalocystis exogena, because it is said that the young in this species are formed by gemmation from the outside of the parent cyst. The multiplied hydatids have been found in most of the structures of the human body, particularly the brain, the viscera of the thorax and abdomen. This species has been named A. endogena, because the young cysts are developed within the older ones; thus one large hydatid is frequently found to contain numerous smaller ones within it. In fact, the common containing cyst has been supposod to be only the original parent hydatid of all the others within it.

Hydatids may be developed slowly, and occasion so little inconvenience, that persons in whom they have been discovered after death may not have suspected disease of the organ in which they existed during life. Occasionally they cause so much irritation that suppuration may take place either around or within the common sac, which may burst externally or into a serous or mucous cavity. In either the first or last case the hydatids will be discharged, and the patient may recover; but if the cyst should communicate with a serous cavity, as the peritoneum or pleura, fatal inflammation will occur.

With respect to the treatment for the prevention or removal of hydatids, it is very imperfect. As they generally occur in a cachectic or disordered state of health, those remedies may be given which are most likely to remove that state and improve the general health. When a hydatid cyst is situated so near the surface of the body that it may be easily evacuated without risk of effusion into the internal serous cavities, it may sometimes he punctured with propriety, which operation will cause obliteration of the sac.

Pseudo or false hydatids are simple serous cysts or vesicles, either occurring singly or aggregated in clusters, hut in both cases having a more or less close connection with the subjacent tissues, from which in fact they grow. The vesicles often found in the choroid plexuses belong to this class; also the cysts which contain the fluid in ovarian dropsy, which may grow to an enormous size. Lastly, one of the most common situations for these false hydatids is in the uterus, where they are described as 'vesicles of a round or oval shape, with a narrow stalk to each, hy which they adhere on the outside to one another.' They may here increase in such numbers as to distend the uterus till it is too large to be contained in the pelvis, and rises into the ahdomen. These cysts may be developed in many other situations, and contain fluids of various characters. For further information respecting them we must refer to a paper by Dr. Hodgkin, in *Med. Chirur. Trans.*, vol. xv., p. 266.

HYDE, EDWARD, EARL OF CLARENDON, the third son of Henry Hyde, of Dinton, in Wiltshire, near Salishury, and Mary, one of the daughters and co-heiresses of Edward Langford, of Trowhridge, in the same county, was born at Dinton on the 18th February, 1608. He was first instructed hy the clergyman of the parish, who was also a schoolmaster, and afterwards at Magdalen College, Oxford, where he was entered in 1621. It was his father's desire to make him a clergyman, hut by the death of his two elder sons he was induced to alter his intention: the law, under these circumstances, was thought a more desirahle profession; and Edward, under the auspices of his uncle Nicholas Hyde, who was treasurer of the Middle Temple, was entered as a student in that Society. Three several impediments obstructed his early legal studies; the weakness of his health, the hahits of his companions, and an attachment which he entertained towards the daughter of Sir George Ayliffe, of Gretenham, in Wiltshire, whom he married in 1629. The death of this lady six months after their marriage hlighted the happy prospects he had enjoyed. In 1632, having heen three years a widower, he was again married. His second wife was Frances, daughter of Sir Thomas Aylesbury.

After his father's death Hyde found himself in possession of such a competent fortune as to render exertion in his profession, in a pecuniary point of view, unnecessary. His studies however were not neglected: he devoted the forenoon to the husiness of the courts, and the evenings to taking instructions and other legal employment. It was his habit to dine, not in the Temple Hall, as most of the other students were accustomed to do, but with some of the many eminent friends whom his abilities and increasing reputation had attached to him.

In the spring of 1640 he commenced his political career: he was returned to parliament hy the constituencies hoth of Shafteshury and Wootton Basset, and made his election to serve for the latter. The question of granting the supply demanded hy the king formed the principal subject of discussion. Hyde argued in favour of a grant, hut was successfully opposed hy Hampden. The king dissolved this moderate and well-inclined parliament twenty-two days after its assemhly. Hyde was named upon seven of twenty-one committees that were appointed. The borough of Saltash returned him to the Long Parliament (Nov., 1640), and he laid aside his legal practice in order to devote himself exclusively to parliamentary business. The earl-marshal's oppressive court was aholished through his efforts; he also attacked the despotic 'Court of the North;' he was active in the condemnation of the Judges' decision respecting ship-money, and took a share in the proceedings against Strafford. Up to this time he had acted with the more moderate of the popular party; hut now he thought fit to detach himself from these friends. Within a week after the fall of Strafford a bill was passed for preventing the dissolution of parliament without its own authority and consent. The knowledge that this encroachment on the constitution would render the parliament more powerful than the crown probahly determined him to alter his political course. A conversation with Martin and Fiennes, in which these adherents of the parliamentary party expressed strongly democratic opinions, is thought to have confirmed his determination. He now gave his support to the church, and defended the prerogative of the crown. His votes and speeches soon attracted the attention of the court; he was summoned to a private conference with the king, and received his thanks for the service he had rendered him.

He daily increased in favour at court. An answer which he wrote to 'The Remonstrance' was adopted and puhlished hy the king in his own name; and so sensihle was Charles of the importance of this paper, and its author's utility to his cause, that he offered to make him his solicitor-general. The office was declined, hut a request that accompanied the offer of it was complied with, and Hyde consented to meet frequently with Lord Falkland and Sir John Colepepper to consult on the king's affairs, and to conduct them in parliament.

It may he thought that because the king had promised to take no step without the advico of these three counsellors, they are in a great degree responsible for his conduct; hut this is not the case: Charles sometimes acted without their consent and without their knowledge on the most important occasions. For instance, in the attempt to seize the five members, his advisers were wholly ignorant of his intention, and so displeased and dejected by its perfidy and rashness, that Clarendon writes (*Hist. Reb.*, vol. ii., p. 133) 'they were inclined never more to take upon them the care of anything to be transacted in the house; finding already that they could not avoid heing looked upon as the authors of those counsels to which they were so ahsolute strangers, and which they so perfectly detested.'

The queen quitted England in 1642, and Charles left London, not again to reside there until he was a prisoner. 'It appears,' says Mr. Lister (vol. i., p. 166) 'to have been the opinion of Hyde that the king would have acted wisely, if, after the departure of the queen, he had again resided at Whitehall; that if he had done so he would have heen treated with more respect; that moderate compliances would have proved efficacious; and that in the ahsence of the queen, who was the chief cause of the king's unpopularity, he would soon have regained the affections of his people.'

Although Hyde was suspected of framing the king's papers and the answers which he sent to the messages of the parliament, and danger was to he apprehended in case of discovery, he continued to write them. He used more moderation than the king would have used, and indeed more than was pleasing to many Royalists. It will be seen by comparison that his papers were drawn with an ability far superior hoth in argument and eloquence to that which was evinced in tho manifestoes of the parliament. So necessary were his services to the king that he received a summons to repair to York, whither the king had retired (1642), as soon as he could be spared from London. He escaped from the parliament with difficulty, and reached York by circuitous and unusual routes, and continued to act as the king's adviser until the civil war hroke out.

In the spring of 1643 a considerable change took place in the fortunes and condition of Hyde; instead of the secret counsellor of the king, he hecame his avowed and responsihle servant. After he had declined the office of secretary of state, the chancellorship of the exchequer was accepted hy him, and he was knighted and sworn a member of the privy council. In this disastrous year he vainly endeavoured to compromise the differences of the contending parties: neither the summons of a parliament at Oxford, nor his suhsequent negotiations with the parliamentary leaders and commissioners, could arrest the rapid decline of the royal cause. In 1645 the king thought fit to send the prince of Wales into the West, and to name Hyde one of the counsellors to attend upon and direct him. On the 5th of March he had an interview with the king, the last time that he ever saw him, and afterwards repaired to Bristol to enter on the functions which he had undertaken. Disputes and difficulties arose; the prince's army was disorganized; and his situation daily hecame more hazardous, on account of the many defeats which the king sustained during the autumn. In Decemher letters were received from the king urging the prince's speedy removal either to Denmark, France, or Holland. His advisers hesitated about his departure, because there were differences of opinion as to where he should be sent: at length danger compelled his flight; and Hyde and others of his suite sailed with him, first to Scilly, and thence to Jersey, where he landed on the 16th of April, 1646. After a short residence in this island, the prince, persuaded by the queen, who desired to have him in her power, joined her in France. Hyde remained in Jersey. His situation at this time was most painful; he could not return to England because of the enmity of the parliament; he even feared an attempt upon Jersey from the parliament; and impressed with a sense of imminent danger on that account, made his will, and wrote letters to be delivered to the king and the prince after his death. It might be expected that under such adverse circumstances his spirits would have failed, but constant occupation sustained them; he collected all the materials that he was able, and commenced his 'History of the Rebellion.'

After the seizure of the king his cause appeared to be desperate; there were however occasionally revulsions in his favour which spread a faint gleam of hope upon the minds of his adherents. Among these was the desertion of 17 ships of war from the parliament to the prince. This event had an influence upon the proceedings of Sir Edward Hyde, who received orders to join Prince Charles. After some fruitless travelling in quest of him, Hyde heard that he had sailed for the Thames, and procured a small vessel in order to join him. Ill fortune awaited him; he was becalmed, and seized by several pirates from Ostend, who took him prisoner, and plundering him of all his money and goods, landed him at Ostend. In September, 1648, Hyde rejoined the prince at the Hague; and here he heard of the execution of the king.

The disposition of the Spanish court towards the youthful Charles II. disposed him to send an embassy to Madrid. Hyde and Cottington were fixed upon for the ambassadors, and received instructions to the following purport:—'that they should endeavour to effect with Spain a league offensive and defensive; should give assurances of the king's resolutions of grace and favour towards his Catholic subjects; should offer security under the great seal of England, in as ample a manner as might be desired, for any money that might be lent by Spain; and should offer such civilities to the nuncio as might tend to procure the assistance of the pope.' In May, 1649, the two ambassadors left the Hague: Hyde established his wife and children at Antwerp, and after some delay landed in Spain. During fifteen months negotiations were carried on, until it became evident that none of the desired objects would result from the embassy. At length the ambassadors received the command of the king of Spain to retire, having suffered mortification from neglect, and inconvenience from excessive poverty. Hyde quitted Madrid in 1651, and lived at Antwerp with his family until the autumn, when the king returned to Paris. Here he conducted the principal business of the English court, collecting for their benefit such sums as he could procure to diminish their pecuniary embarrassments. That they were in extreme penury is evident from Hyde's correspondence. He says in 1652, 'I have neither clothes nor fire to preserve me from the sharpness of the season;' and in the following year, 'I have not had a livre of my own these three months.' He had also other evils to contend with; the queen was his open foe, and he had enemies striving to undermine him in the favour of the king; and though the behaviour of the king was friendly, he could not avoid being vexed at his indolence and inordinate dissipation. Thus Hyde followed the fortunes of the king, affording him during his exile all the service that he was able; conducting his affairs, advising his actions, and composing the quarrels of his supporters. He was rewarded with the appointment of lord-chancellor, an empty title, as the king was then situated, powerless and poor, yet, in all respects, the utmost that could be bestowed on him.

The death of Oliver Cromwell revived the hopes of the Royalists. During the short protectorship of his son the restoration of Charles became daily more probable. 'Hyde, Ormond, Colepepper, and Nicholas were at this time the four confidential counsellors by whose advice Charles was almost exclusively directed. Of these four Hyde bore the greatest share of business, and was believed to possess the greatest influence. The measures he recommended were tempered with sagacity, prudence, and moderation.' 'The chancellor was a witness of the Restoration: he was with Charles at Canterbury in his progress to London, followed his triumphal entry to the capital, and took his seat on the first of June (1660) as speaker of the House of Lords: he also sat on the same day in the Court of Chancery.' He retained the office of chancellor of the exchequer until the king could find a fit person to succeed him. Thus from a powerless and poverty-stricken guardian of an exiled king he suddenly rose to be the 'first in place, favour, and authority, among the ministers of a monarch, who, while invested by the public with sovereign power, still evinced towards him the deference of a pupil.'

The part that Hyde took in the principal measures that occupied the parliaments assembled after the Restoration may be learned from Lord Clarendon's 'Life,' written by himself, in Mr. Lister's 'Life of Clarendon,' and Burnet's 'History of his own Times.' We pass to the narration of an event of immediate personal importance and interest to the chancellor which occurred in the autumn of 1660. Anne Hyde, his daughter, who was in the household of the princess of Orange, during a visit to the queen at Paris had contracted an attachment to the duke of York, the result of which was a secret marriage, solemnized in September, in time to legitimatise their first child, born on the 22nd of the following month. This marriage was offensive, not only at court, but also to the chancellor, 'who broke out,' as he tells us, 'into an immoderate passion against the wickedness of his daughter.' It was at first doubtful whether this unpopular marriage might not tend to diminish the favour and power of the chancellor. These doubts however were soon removed. The king entertained no suspicions of artifice or collusion on the part of Hyde, and to prove that he entertained none, created him a baron, under the title of Lord Hyde of Hindon. On the occasion of the coronation, which took place in April, 1661, the further dignity of the earldom of Clarendon was conferred on him, and he received from the king a gift of 20,000*l.*

The principal events which now took place were, the king's marriage with Catherine of Portugal, the negotiation of a loan from the king of France, and the sale of Dunkirk. Clarendon took an active part in bringing each of these events to pass: his authority and station required that in all important matters his opinions and decision should be expressed. For his decision in each of these transactions he has not escaped censure; we think it doubtful whether censure is merited for the promotion of the king's unhappy marriage, or for the sale of Dunkirk; but his suffering Charles to become a dependent borrower from the king of France—'to have been the sanctioner of such a system is one of the gravest faults with which Clarendon is chargeable as an adviser of the crown.'

The opposition of the chancellor to the king's inclination to Catholicism, as well as to other wishes he had formed, diminished his share of royal favour, and gave opportunity to his enemies to cabal against him with a greater probability of accomplishing his overthrow, than had ever been reasonably entertained. Among these enemies was the Earl of Bristol, a bold, ambitious, intriguing man, who sought to aggrandize himself at Clarendon's expense. Bristol, who was politically embarrassed to such an extent, that he could only extricate himself by some desperate effort, thinking that Clarendon might be successfully attacked, drew up articles of impeachment, and accused him of high treason, in the House of Lords. 'The Lords referred the charges to the Judges; the Judges unanimously returned an answer that the charge had not been regularly and legally brought in, inasmuch as a charge of high treason cannot be originally exhibited to the House of Peers by any one peer against another; and that if the charges were admitted to be true, yet there is not any treason in them.' 'The Lords resolved unanimously, that they concurred with the Judges. Bristol absconded, and a proclamation was issued for his apprehension; and thus ridiculously and utterly failed this rash attempt to assail the character and power of Clarendon.'

Clarendon still continued the principal conductor of the public affairs, and such was the condition of the kingdom in politics both domestic and foreign, the poverty of the exchequer, the difficulty of raising supplies, the profligacy of the court and the king's absolute neglect of business on the one hand, the relation of England to foreign powers and the Dutch war on the other, that he had difficulties of no ordinary magnitude to contend with. Discontent was general throughout the country; the war with Holland was unpopular, and the terms of the peace which followed it were still more so. 'A succession of calamities had depressed and soured the minds of the people and had created a general impression of corruption and abuse in the administration of state affairs.' (Lister's *Life of Clarendon*, vol. ii., p. 384.) These feelings of irritation and disgust were vented upon Clarendon, and the public, without regard to justice, heaped upon him the odium of every measure and event.

'The war, which he had originally opposed,' says Mr. Lister; 'the division of the fleet, which he had not suggested; even the want of royal issue, which he could not have foreseen (the queen having lately miscarried), were all laid to his charge. Old topics of complaint were revived by the pressure of a calamity with which those topics had no connection; and in the midst of the panic and rage of the populace, at the alarming news that the Dutch were at Gravesend, they broke the windows of Clarendon's house, and painted a gibbet on his gate, accompanied with this rude rhyme,—

> 'Three sights to be seen:
> Dunkirk, Tangiers, and a barren Queen.'

The vulgar belief that he had appropriated to his own use the revenues of the state was fostered by a standing eyesore, a magnificent house that he had built, and which in derision was called Dunkirk House, Tangier Hall, and such significant nicknames. At court the king's profligate associates used all the means in their power to foster and nourish his long-conceived dislike of his principal counsellor; and by the persuasion of Lady Castlemaine, Buckingham, the chancellor's greatest enemy, was restored to office. The influence of Clarendon was successfully undermined: by the king's command he resigned the great seal on the 30th of August, 1667; and in such a manner was he held up as an object for persecution, that it became evident that some proceedings would be instituted against him. The Commons, angry with him for many causes, but more especially for his recommendation of their dissolution, met in October, when a resolution was passed, 'that it be referred to a committee to reduce into heads the charges against the Earl of Clarendon.' Seventeen articles of impeachment were drawn up (Lister's *Life*, vol. ii., p. 424), and, after some discussion, an accusation was agreed upon and forwarded to the Lords; it was rejected however, 'because the House of Commons only accused him of treason in general, and did not assign or specify any particular treason.' Upon this refusal to commit, a serious contest arose between the two houses; and great excitement prevailed. To compose these animosities by withdrawing the object of contention, the friends of Clarendon advised him to quit the kingdom. After some hesitation he consented to their proposal; and on the 29th of November, 1667, he sailed for Calais, leaving behind him an address written to the Lords, exculpating himself from the unfounded charges made against him, of which his flight might otherwise have been thought to be an acknowledgement. 'A bill for banishing and disenabling Lord Clarendon was passed by the Lords on the 12th of December, and by the Commons on the 18th. By this bill, unless he returned and surrendered himself before the 1st of February, he was to be banished for life; disabled from ever again holding any office; subjected, if he afterwards returned to England, to the penalties of high treason; and rendered incapable of pardon without the consent of the two Houses of Parliament.'

The public life of Clarendon was now at end; he was permitted somewhat reluctantly by the king of France to reside within his kingdom. At Evreux he narrowly escaped assassination at the hands of some English sailors; from Evreux he went to Bourbon, thinking to derive benefit to his health from the mineral waters; from Bourbon he removed to Montpelier; from Montpelier to Moulins, where, in the enjoyment of the society of his children, he commenced the continuation of his 'Life.' In the spring of 1674 he procured a house at Rouen, which was his last residence. Repeated attacks of gout had enfeebled his frame and constitution, and his malady continually increased: at length he expired on the 9th day of December, 1674, in the 65th year of his age. His body was brought to England, and, according to the statement of Anthony Wood, was buried on the north side of Henry VII.'s chapel in Westminster Abbey. No monument has been erected, and no inscription marks the place of interment.

By his second wife, who died in 1667, at the time that difficulties were multiplying around her husband, he had six children, four sons and two daughters. Henry, the second earl of Clarendon, died in 1709; Lawrence, created earl of Rochester, died in 1711; Edward and James died unmarried; Anne married James, duke of York, and was the mother of Queen Mary and Queen Anne; Frances was married to Thomas Keightly, of Hertingfordbury.

Clarendon's abilities were great. As a minister he was wanting more in courage and firmness than in sagacity and foresight: it was his 'disposition to be too much contented with temporary expedients and to be too little mindful of remote consequences.' He was pure according to the standard of the times. 'He had one great merit,' says Mr. Lister, in his studied and careful character of this great man, 'rare and valuable at all times, but peculiarly so at such a period as the Restoration. He was not disposed (except perhaps when the interests of the church were concerned) to govern in the spirit of a partisan. He aimed at appearing, not the leader of a political faction, but the minister of the nation—a minister to whom royalist and republican might equally look up for justice.' His industry was remarkable, and of his oratory Pepys says (vol. iii., p. 62), 'I am mad in love with my lord chancellor, for he do comprehend and speak out well, and with the greatest easiness and authority that I ever saw a man in my life.'

As a judge there are but scanty materials for the estimation of his character: the judicial functions of a chancellor were at this time very subordinate to the political: high legal attainments were not considered essential qualifications. We do not find that he was negligent of the duties and improvement of his court.*

In private life he was a warm and constant friend, and strict observer of moral duties, in an age when vice was openly countenanced and preferred. Haughtiness and irritability of temper were his principal failings. In his 'History of the Rebellion,' and in his 'Life' of himself, there are many inaccuracies. In the latter he appears to have trusted chiefly to the recollection of a somewhat fallacious memory. We must refer to Mr. Lister's 'Life of Clarendon' for an account of his writings.

(Lister's *Life of Clarendon*, *Life of Clarendon*, by himself; Burnet's *Own Times; Diaries* of Evelyn and Pepys.)

HYDE, THOMAS, D.D., was born June the 29th, 1636, at Billingsley near Bridgenorth, in Yorkshire. He received his first instruction in the Oriental languages from his father, and afterwards studied them under Wheelock, professor of Arabic in the University of Cambridge. He only remained at Cambridge about a year; and afterwards went, at the age of seventeen, to London to assist Walton in editing the Polyglott Bible. He transcribed for this work in Persian letters the Persian translation of the Pentateuch, which had previously been published at Constantinople in Hebrew characters, and also translated it into Latin. He also assisted in the correction of the Arabic and Syriac versions. In 1658 he entered Queen's College, Oxford; in 1659 was appointed under-librarian of the Bodleian, and in 1665 principal librarian. In 1660 he became a prebendary of Salisbury; in 1678 archdeacon of Gloucester; and in 1682 took the degree of D.D. On the death of Pococke, in 1691, Hyde was appointed Laudian professor of Arabic; and not long afterwards Regius professor of Hebrew, and canon of Christchurch. He resigned the librarianship of the Bodleian in 1701, and died on the 18th of January, 1703, in his sixty-eighth year. He was interpreter of Oriental languages during the reigns of Charles II., James II., and William III.

Hyde possessed an accurate knowledge of almost all the Asiatic languages which were at that time accessible to European scholars. In addition to Hebrew, Syriac, Persian, Arabic, &c., he was also acquainted with the Malay and Armenian languages; and was one of the first Europeans who acquired a knowledge of Chinese, which he learned from a young Chinaman, called Chinfo-coung, who had been brought to Europe by the Jesuits. His most celebrated work, entitled 'Veterum Persarum et Magorum Religionis Historia,' Oxf., 1700, reprinted in 1760, displays

* Lord Clarendon's orders, dated 22nd May, 1661, are printed in Beames's 'General Orders of the High Court of Chancery.' A book entitled 'Reports of Cases in Chancery in the reign of Charles I. and to the 20th year of King Charles II.,' comprises the period in which Clarendon sat in the Court of Chancery. In a very great number of the cases reported in this book the chancellor seems not to have decided without the assistance of the judges.

an extraordinary acquaintance, considering the time in which he lived, with Oriental languages and literature. Of his other works the most important are:—'Tabulæ Stellarum Fixarum ex Observatione Ulugh Beighi,' Oxf., 1665, with a learned commentary on the different names of the stars among the Greeks and Orientals; 'Quatuor Evangelia et Acta Apostolorum, Lingua Malaïca caracteribus Europæis,' Oxf., 1677; 'Epistola de Mensuris et Ponderibus Serum sive Sinensium,' published at the end of Dr. Bernard's book 'De Mensuris et Ponderibus,' Oxf., 1688; 'De Ludis Orientalibus,' Oxf., 1694. All the works of Hyde, with the exception of the 'Veterum Persarum et Magorum Religionis Historia,' were republished by Granville Sharp under the title of 'Syntagma Dissertationum quas olim Hyde separatim edidit,' Oxf., 1767, 2 vols. 4to. In this edition Sharp has printed several of Hyde's works which had previously been unpublished, and has also given a list of many other works which have never been published, amongst which he mentions translations in Latin of Abulfeda, Abdallatif, and the history of Tamerlane, and dictionaries of the Turkish and Persian languages.

HYDER ALI is well known as the ablest and most formidable enemy of the British power in the East Indies. He was a soldier of fortune, who began his career in the service of the Raja of Mysore in 1749, and ascending step by step, reached in 1759 the rank of commander-in-chief of the Mysorean troops. The Raja however was but a puppet; and after one or two turns of fortune, Hyder not only established himself firmly as prime minister, but pensioned off his master with three lacks of rupees yearly, and became in 1761 the undisputed ruler of Mysore. From this moment he applied diligently and successfully to the increase of his power. His encroachments led to an offensive alliance between the Mahrattas, the Nizam of the Deccan, and the Company: but he found means not only to break up this confederacy, but to engage the Nizam in war against his late friends the British, in 1767. This war was carried on, little to the advantage of the English, for two years, when at last Hyder, by a bold and able stroke, placed himself in a condition to prescribe terms of peace. He drew the British troops to a considerable distance from Madras, and, availing himself of his great superiority in that arm, he put himself at the head of 6000 horse, and marching 120 miles in three days, suddenly appeared at the very gates of the capital. Fort St. George indeed might have defied his cavalry for ever: but the rich villas of the neighbourhood, the town, and its mercantile wealth, lay at his mercy; and the presidency felt compelled to negotiate a peace, of which the chief conditions were a mutual restitution of conquests and an alliance in defensive wars.

This treaty was not very well kept by the British. In 1770 the Mahrattas invaded Mysore, and reduced Hyder to great difficulty. He earnestly besought assistance; but obtained nothing beyond neutrality; and in 1772 was obliged to conclude peace on disadvantageous terms. In 1774 the divisions of the Mahrattas gave him an opportunity of recovering his losses, which he diligently improved; and between that time and 1778 he had done much to restore order, improve the revenue, and increase the strength of Mysore.

In 1777-8 fresh disturbance from the Mahrattas led him again to seek help from Madras. Disgust at a second disappointment, stimulated by the influence of the French, of whom he had many in his service, and with whom, so long as they retained possessions in India, he was united by mutual jealousy of the British, with other grounds of discontent and alarm, induced him in 1779 to form a second alliance with the Nizam and the Mahrattas. Little or no preparation had been made by the Madras presidency, when in July, 1780, Hyder burst with a vast army into the Carnatic. The open country was ravaged almost to the walls of Madras; and as the peasantry were oppressed and disaffected, Hyder was regarded rather as a deliverer than as an enemy. From this he derived a great advantage: he had always minute information as to the motions of the British troops; while they, on the other hand, found great difficulty in gaining trustworthy intelligence. During 1780 and the following year the war on the part of the British was chiefly defensive. Hyder endeavoured to avoid pitched battles, and to surprise and cut off detachments; and meanwhile he succeeded in taking several of the most important towns and fortresses. His enormous superiority in numbers and cavalry gave him the entire command of the country, which after two campaigns was so entirely wasted, that want of provisions, in the autumn of 1782, reduced the army, the garrisoned places, and Madras itself, to great distress. Peace was offered by the new governor of Madras, Lord Macartney; but Hyder declined his overtures with a dignified allusion to the breach of faith which he had already experienced. The war therefore continued on the same footing during the following year, until, in the autumn, Madras was reduced to a frightful state of famine; in short, the entire ruin of the presidency seemed at hand, when the death of Hyder, in November, 1782, relieved the English from a danger which his talents only had made formidable. His successes were due to his capacity for diplomacy, his military skill, care of discipline, and attention to merit, his tact in conciliating the different tribes which served under his banners, his economy in personal expenditure, minute attention to finance, and regular payment of his army. These are the qualities which have induced Major Rennell in his introduction to his 'Memoir of a Map of the Peninsula of India,' to entitle him the Frederic of the East.

Hyder's son and successor Tippoo inherited the resentment but not the ability of his father. He found it expedient to evacuate the Carnatic in 1783, and in March, 1784, concluded peace, on the terms of a mutual restitution of conquests. (Mill, *Hist. of British India.*)

HYDNO'PORA (Fischer), a genus of Polyparia, nearly synonymous with Monticularia of Lamarck. Goldfuss ranks some of the species under his somewhat indefinite group of Astræa.

HYDRA, island. [GREECE.]

HYDRA (constellation, ὕδρος in Ptolemy), the Water-snake, one of the old constellations. From the time of Aratus downwards it has always been a triple figure: a long snake, represented as trailing upon the ground, bears upon his back a cup (Crater), and nearer to his tail is seated a crow (Corvus). The mythological meaning is altogether unknown.

The great length of this constellation has caused it to be divided into four parts, which are designated as Hydra, Hydra et Crater, Hydra et Corvus, and Hydræ continuatio. The first contains the head and body up to about 10½ hours of right ascension, all near to and south of the bright star Regulus; the second contains the cup and the parts of the body adjacent; the third the crow, with the parts of the body adjacent; and the fourth (beginning at about 13 hours of right ascension) contains the tail. For the third part see CORVUS. In Flamsteed's catalogue Hydra and Hydræ continuatio are treated in all respects as two distinct constellations, with Corvus and Hydra et Crater intervening. Mr. Baily, in his new edition of the catalogue, has treated the two as one constellation, and numbered the stars accordingly, making 1, 2, &c., Hydræ continuationis to be 45, 46, &c., Hydræ.

Hydra.

Character. (Not in Bayer.)	No. in Catalogue of Flamsteed. (Piazzi.)	No. in Catalogue of Astron. Society.	Magnitude.	Character. (Not in Bayer.)	No. in Catalogue of Flamsteed. (Piazzi.)	No. in Catalogue of Astron. Society.	Magnitude.
	1	1021	6	(M^2)	26	1134	6
	2	1030	6		27	1136	6
δ	4	104[illegible]	4	A	28	1145	6
σ	5	1047	5	α	30	1147	2
	6	1057	6	τ^1	31	1151	5
η	7	1064	4	τ^2	32	1157	6
	9	1063	6		33	1161	6
ε	11	1073	4	ι	35	1169	4
	12	1074	6	κ	38	1172	4
ρ	13	1076	5	υ^1	39	1188	5
(B)	14	1079	5½	υ^2	40	1203	5
ζ	16	1089	4	λ	41	1212	4
ω	18	1104	6	μ	42	1238	4
(L^2)	20	1113	6	(*n*)	44	1257	6
(K)	21	1119	6		(69)	1139	7
θ	22	1121	4		(108)	1044	6
(K^2)	23	1126	6		(167)	1075	6
	24	1127	6		(232)	1199	6

Hydra et Crater.

Character. (Not in Bayer.)	No. in Catalogue of		Magnitude.	Character. (Not in Bayer.)	No. in Catalogue of		Magnitude.
	Flamsteed (Piazzi.)	Astron. Society.			Flamsteed. (Piazzi.)	Astron. Society.	
(ϕ^2)	1	1260	6		17	1354	6
(ϕ^3)	2	1265	5		19	1356	4
	3	1282	6	θ	21	1361	4
	4	1287	4	ι	24	1365	5
(b^3)	6	1292	6	ζ	27	1368	4
a	7	1300	4		28	1378	4
	8	1307	6		29	1381	6
(χ^1)	9	1311	5	η	30	1382	4½
	10	1316	6		31	1387	5½
β	11	1319	3½		(94)	1353	7
δ	12	1333	4		(98)	1355	7
λ	13	1337	5½	(*d*)	(140)	1457	5½
ϵ	14	1340	4		(161)	1374	6
γ	15	1342	4	(*e*)	(168)	1470	6
κ	16	1346	5	(χ^2)	(240)	1312	5½

Hydræ Continuatio.

Character. (Not in Bayer.)	No. in Catalogue of		Magnitude.
	Flamsteed. (Piazzi.)	Astron. Society.	
ψ	1	1509	5
γ	2	1524	3½
(S^1)	3	1591	6
(S^2)	4	1592	6
π	5	1603	4
	6	1612	6
	7	1630	5
	8	1637	5
	10	1667	5½
	11	1671	6
	12	1675	6
	13	1676	7
(*z*)	15	1695	6
(*u*)	(94)	1539	*
(*f*)	(135)	1552	6
(*g*)	(180)	1563	6
	(230)	1581	6
(*h*)	(274)	1597	5½

* This star is variable.

HYDRA. [POLYPE.]

HYDRABAD. [HINDUSTAN.]

HYDRACIDS. Acids have been divided into oxacids and hydracids. In the former an elementary body is combined with oxygen as the supposed acidifying principle; and in the latter a substance, usually an elementary one, is united with hydrogen as the imaginary acidifying power.

The class of hydracids contains some which have been already treated of, as hydrobromic and hydrochloric acid; others remain to be described. With respect to the general properties of hydracids it may be remarked that their acidity is in general very strongly marked; that they contain only one equivalent of hydrogen, and that when acted upon by metallic oxides they lose their hydrogen by its combining with the oxygen of the oxide, and the results are water and a chloride; thus, to put one of the most familiar cases, when hydrochloric acid is added to soda, or the oxide of sodium, the result is not a hydrochlorate of soda, but chloride of sodium and water. When however hydrochloric acid is united to bases which contain no oxygen, then real hydrochlorates are the result; thus ammonia, which is a powerful alkaline base, combines with hydrochloric acid to form hydrochlorate of ammonia, or sal ammoniac. So also when the same acid unites with morphia, or any other vegetable alkali, it is admitted that the resulting compound is a hydrochlorate of morphia, although this alkaline base and other vegetable alkalis do contain some oxygen. All the hydracids are gaseous, and are easily combined with water, forming solutions which possess the well known and strongly marked acid properties of sourness, acting upon carbonates, and reddening vegetable blue colours. They are all artificial products; at any rate hydrochloric acid is the only exception, which is sometimes a volcanic product, though in that case usually combined with ammonia.

Hydrochloric acid is tho only one which can be obtained by the direct action of its elements; but the usual method of obtaining it, as well as other hydracids, is that of treating a compound of the radical of the acid and a base with an oxacid and water, that generally used being sulphuric acid. Thus, as already mentioned, hydrochloric acid is obtained by acting upon chloride of sodium with sulphuric acid and water; the water suffers decomposition, and its oxygen combines with sodium to form soda, while its hydrogen unites with the chlorine, giving rise to hydrochloric acid; the soda combines with the sulphuric acid to form sulphate of soda. This may be taken as a type of the general action.

HYDRA'NGEA, a well-known genus of hardy shrubs, of which one species is commonly cultivated for the sake of its beautiful flowers. This plant is a native of China and Japan; it was originally observed in the gardens of Canton by Loureiro, who took it for a primrose, and called it *Primula mutabilis*. It was next met with by Commerson, a French traveller, who named it *Hortensia*, in compliment to Madame Hortense Lépeauto. Thunberg referred it to the genus *Viburnum*, and Smith called it by its present name, coupling with it the name Hortensia of Commerson, converted however into *Hortensis*. When this plant is hardy enough to survive the winter, it grows to a considerable sizo, and when covered by a multitude of its very large round heads of rosy flowers, becomes a magnificent object. But as it is rather tender, we more commonly see it grown in pots, by which its beauty is much diminished. To have it in perfection it should be planted in the open ground in rich soil; during winter it should be covered with a mat well stuffed with straw. As soon as it begins to move its buds in spring, it should be unpacked, and during summer it should be most abundantly supplied with water. We have known a large plant receive as much as 100 gallons of water daily. If thus treated, the Hydrangea is without a rival in the shrubberies of this country. The blue colour which the flowers of this plant now assume does not indicate a distinct variety, but is only owing to the soil in which the plant is made to grow containing a greater quantity of iron than usual.

HYDRA'RGYRUS. [MERCURY.]

HYDRASPIS. [TORTOISES.]

HYDRATES are compounds of bases and water, but all of them are not so termed; thus when water is united with sulphuric or nitric acid, the compound is very often termed a hydrate of that acid, or we say hydrated sulphuric or nitric acid. So also when crystallized salts contain water, they are termed hydrous or hydrated salts, but the water is usually called water of crystallization when the regularity of the form of a salt depends upon its presence.

The term hydrate is usually applied to compounds which contain water in definite proportion, which does not impart regularity of form, or in other words, give crystals with the body with which it so unites. Thus when water is added to potash it may form with it either water of solution, water of crystallization, or water which constitutes it an hydrate. If we take a solution of potash and evaporate it to a certain extent we obtain crystals of potash; heat these and the water of crystallization is expelled, but no heat whatever is strong enough to expel the whole of the water, and the last remaining portions form with the potash a hydrate, which is a hard substance totally devoid of crystalline form. So also when water is added to lime, a portion dissolves; crystals however of water and lime are obtained with difficulty, but hydrate of lime is the well known dry powder called slacked lime.

It appears therefore, from the above statements, that water of solution has comparatively little affinity for the substance with which it is combined; water of crystallization has more, but water with which the body constitutes an hydrate has the greatest affinity of all.

The water with which substances combine often imparts colour to them; thus sulphate of copper when nearly deprived of water is colourless, but when dissolved in water it becomes of a fine blue colour; and water of crystallization produces the same effect. So also oxide of copper is of a black colour, but the hydrate of copper obtained by adding potash to a solution of copper is of a beautiful blue colour.

HYDRAULICS. This term is applied to the art of constructing machines in which water is employed as a moving power, or by which that fluid is put in motion; and in it are necessarily included the principles by which such machines are executed. The art of constructing docks, quays, or any buildings whose foundations are laid under water, is denominated hydraulic architecture.

Though machinery of some kind for the purpose of raising water in order to drain lakes or marshes appears to have been executed in Egypt at a very remote period, nothing positive can be said to be known concerning that which existed at an earlier time than the age of the Ptolemies; unless we admit that a simple wheel carrying earthern pitchers on its circumference, a contrivance which is still employed there, was, as is likely, in use before that epoch. The spiral engine (κοχλίας) of Archimedes, as it is called, is said by Diodorus Siculus (i. 34) to have been used in that country for raising water from the river for the purpose of irrigation; and the clepsydra, for measuring the lapse of time, though probably far more antient, is known to have been then employed, both in Egypt and Greece, for astronomical as well as civil purposes.

The hydraulic machines described by Vitruvius in the tenth book of his 'Architecture' are sufficiently simple to allow the supposition that they had been invented at a very early epoch; and, as he mentions no others, it may be perhaps concluded that those alone, or together with an apparently simple machine for extinguishing fires, were in general use in his own time, which is supposed to have been that of Augustus. He describes a *tympanum*, or hollow wheel, which was employed for the purpose of raising water from a river or reservoir: the wheel was partly immersed in the water, and as it turned round the water entered at certain orifices in the circumference, from whence it descended to the axle by troughs in the direction of the radii: from the axle it was conveyed in pipos to the salt-works or gardens where it was to be employed. He mentions a wheel with buckets, which took up water from a reservoir on the ascending side of the wheel, and discharged it on the opposite side, in consequence of the reversion of their position. He moreover notices a species of chain-pump, and the spiral machine of Archimedes. All of these were intended for the same purposes, and were turned either by the impulse of a stream in which they were placed, or by men walking upon them; that is, probably, on the exterior circumferences of the wheels attached to the axles of the machines.

Water-wheels for grinding corn are also described by Vitruvius; and, lastly, the same writer gives a brief and obscure indication of an hydraulic organ for producing modulations of sound. These seem to have been effected by moving a piston up and down in a cylinder, and thus forcing the air which was allowed to enter the latter to pass through a pipe into the upper part of an inverted cone, which was sunk, like a diving-bell, in the water of a cistern. The air in the cone was prevented from returning into the cylinder by a valve placed at the orifice of the pipe; and being condensed between the top of the cone and the water below, on touching the keys of the instrument the modulations were produced by its escape through the organ-pipes, which opened into the upper part of the cone. This instrument was invented in the second century B.C. by Ctesibius, to whom also is ascribed the first construction of the common pump; and nearly at the same time Hero of Alexandria devised the artificial fountain which still bears his name.

Since those days hydraulic machinery has been brought to the state in which it now exists by many successive improvements. It may be remarked however that on account of the high degree of perfection which, within a few years past, the steam-engine has attained, the employment of hydraulic machines for raising great quantities of water, or as first-movers with respect to extensive works of any kind, has of late considerably diminished. Yet where the circumstances are favourable, as when a supply of water for working the machine can be readily obtained, and when natural means exist of conveying away that which has been raised, the latter, from being less expensive in its construction, is still preferred to the former.

The most remarkable of the hydraulic machines which have been employed for raising water are the works at Marly, and those which till lately existed at London Bridge. The former, by far the most extensive, were constructed in the latter part of the seventeenth century, and raised the water of the Seine by three different stages to a reservoir at the height of 533 feet above the surface of the river; from that reservoir, by aqueducts and conduits, it was carried to Versailles and Trianon. Fourteen wheels were employed in as many watercourses; the wheels were about 36 feet in diameter, and on their axles were cranks by which, in all, 253 pumps were worked. The average quantity of water raised is said to have been about 40,000 gallons per hour.

The Phœnicians, who in an early age were distinguished by a spirit of commercial enterprise, appear to have bestowed vast care and to have displayed considerable talent in rendering the harbours of Tyre secure places for shipping, as well as in fortifying the town against the aggressions of their powerful neighbours. Tyre appears to have had two ports, the greatest of which was of an oval figure, and capable of receiving 500 vessels. It was situated on the north side of the town, which thus protected it against the south winds, while a rocky island in front served as a dyke to break the force of the ocean. Two moles, or sea-walls, in the form of segments of circles, extending into the sea towards the west, formed an outer port, and a third mole secured the entrance against the violence of the waves in that direction. The moles were raised by stones thrown into the ocean, which is said to have been there about 25 or 30 feet deep; and at the two extremities of the third mole, or breakwater, as it may be called, were constructed high towers, which served for the defence of the entrances, and were provided with turrets containing lights, by which ships were enabled to enter the harbour by night. The second port was intended for merchants' ships, and was partly enclosed within the town, of which it was situated on the south side, and was also protected by an advanced mole or breakwater. Such, when the city was taken and destroyed by Alexander, appear to have been the disposition of the ports and the nature of the works, which served as models in the construction of the like works at all the other great maritime places of the antient world. On this account the Phœnicians may justly be considered as the fathers of hydraulic architecture.

The city of Carthage, a colony of Tyre, was built on a peninsula, on the western side of which a tongue of land projected so as to form with it a large basin where ships were completely sheltered from all winds. On the same side was a small island, between which and the town ran an arm of the sea; and this was converted into a magnificent harbour, which was occupied by vessels of war only. The two extremities were closed by walls stretching across the channel; small entrances only being left for the passage of ships. High walls concealed the port from the people of the town, and also from the view of persons in ships on the neighbouring seas; and the circuit of the island was bordered by magnificent quays.

The splendid port of Alexandria, which was constructed during the reign of Ptolemy Philadelphus, with those of Rhodes and Syracuse, attest the advanced state of hydraulic architecture among the antients; but no written accounts of the methods employed by them in executing such works have been transmitted to us, except the very brief notice contained in the fifth book of Vitruvius.

The ports of Venice, Genoa, Leghorn, and Civita Vecchia afford sufficient evidence of the skill of the Italian engineers in forming secure harbours for shipping, while their country enjoyed the advantages of an almost exclusive commerce; and, in later times, the maritime powers of Europe have spared no expense in the formation of harbours, as well for their ships of war as for those of their merchants.

No countries in Europe possess more advantages with respect to naval power than Great Britain and Ireland. The islands and headlands on their coasts form excellent natural ports; and these, where necessary, have been converted into secure harbours by every means which the science of the hydraulic engineer could devise. The Breakwater at Plymouth, the lighthouses which have been raised in the ocean, and the vast docks at the principal seaport towns, are so many practical examples which render the

British Isles a complete school for the study, in detail, of every subject connected with this branch of art.

Besides the construction of harbours for ships, the formation of the aqueducts which supplied the cities with water must have constituted an important part of the duties of the hydraulic engineer among the antients; and Vitruvius, in his eighth book, explains at some length the manner of conveying the water between the *castella*, or reservoirs, at the springs and in the towns. It may be observed here however, that the antients did not always construct aqueducts on arches, to convey the water across valleys; though this method was preferred, from an opinion that water transmitted through pipes was less healthy. We find that water was, occasionally, so transmitted; and that it was the practice to place, at intervals along the line of pipes, *columnariæ*, or open tubes, in vertical positions, in order to allow the escape of the air, which, separating from the water in the pipes, would have impeded or entirely prevented its motion.

Hydraulic architecture is now chiefly concerned in the construction of walls or masses of masonry whose foundations are laid in the beds of rivers or in that of the sea; such are the piers of bridges; walls which support the banks; and jetties extending from thence into the water, either for the purpose of forming quays to receive merchandise from ships, or to contract the breadth of a river when it is intended to increase the velocity of the current, in order to remove bars which might, if suffered to remain, interrupt the navigation. The practice of the art also involves the formation of artificial harbours and docks for shipping, and of locks for the passage of vessels at the falls on rivers or canals. In all these cases great precautions are requisite to secure the foundations, and give the superstructure sufficient strength to resist the hydrostatical pressure of water which may find its way under or behind, and cause the destruction of the work; and the difficulties increase in proportion to the depth of the water and rapidity of the current. The starlings of the old bridges at London and Rochester were examples of the rude methods antiently employed in this country for building in water. Caissons resting on piles driven deep into the ground under the intended work are occasionally employed when the water is not very deep and the soil good. But no work of magnitude can be considered as secure whose foundations are not laid by the engineer in the bed of the water; for this purpose the part on which the construction is to be raised must be laid dry by enclosing it within a coffer-dam, and actually drawing off the water by engines.

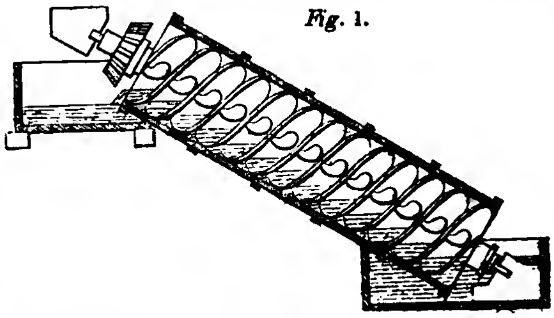
The following are brief descriptions of the hydraulic machines which are in frequent use for domestic and general purposes, when the work to be performed is not of such magnitude or importance as to require an application of the power of steam.

The Siphon.—The simplest machine of this kind, and one which is used in many different branches of art, is the siphon. This is nothing more than a bent tube whose arms are of unequal length: one of the arms being immersed in the liquid which is to be drawn from a vessel or reservoir, and the air being removed by suction, or by means of a syringe, or by previously filling the siphon, the liquid in the vessel immediately rises in the immersed arm, in consequence of the pressure of the atmosphere on that which surrounds the tube; then passing over the bend, it flows from the open orifice at the lower extremity of the other arm. When the fluid to be raised is water, the vertical height of the bend in the tube, above the surface of the water in the vessel, must not exceed about 33 feet, because a column of water of that height would be in equilibrio with the pressure of the atmosphere, and could not by the latter be forced over the bend. If mercury were to be raised, the height of the bend in the siphon must, for a similar reason, be less than 30 inches. The external arm of the siphon must be longer than that which is immersed in the fluid, or its orifice must be on a lower level than the surface of that fluid, in order that the weight of the column of fluid in the former may exceed that in the latter, and thus a continual stream be produced.

A siphon may be made to discharge water at the upper extremity by means of an air-vessel at that place. Thus, while the tube is filled with water, if the communication between the descending branch and the lower part of the air-vessel be closed by the shutting of a valve, the water, which would have otherwise descended, rises in the vessel, where it condenses the air; and, from the reaction of the latter, it is made to escape, as in a forcing-pump, through an open pipe whose lower extremity is under the surface of the water in the vessel. This was the invention of M. Hachette, and is denominated the ram siphon.

Archimedes's Spiral (*fig.* 1) is either a flexible tube open

Fig. 1.



at both ends and wound spirally on the exterior surface of a cylinder; or it may be a plate of metal coiled about an axis, like the threads of a screw, and enclosed within a hollow cylinder so as to be completely water-tight. The machine is fixed in an inclined position, with its lower extremity immersed in the water which is to be raised. While it is at rest the water occupies the lower part between two of the threads or bends of the spiral, at bottom; but, when turned on its axis, this part of the machine being made to ascend, the water will by its gravity be caused to descend into the lower part between the next bends of the spiral, while in reality it rises, with respect to its former position, in consequence of the rotation of the tube, or bends, within which it is confined. Thus the water continually proceeds towards the upper part of the machine, from whence it is discharged into a reservoir placed to receive it.

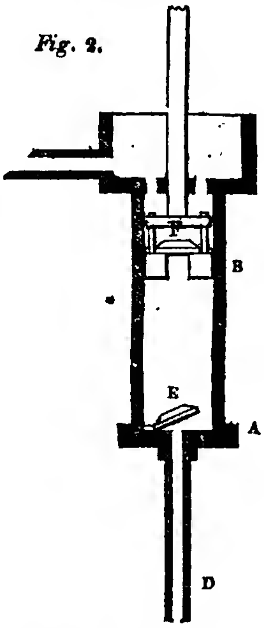
It is shown, by writers on hydraulics, that this machine cannot raise water when the angle which a line drawn centrally on the spiral bends makes with planes parallel to the base of the cylinder is greater than the angle which the latter makes with the horizon; and it is recommended that, in practice, the angle which the axis of the cylinder makes with the horizon should be between 40 and 60 degrees. Such a machine is particularly useful when the water is mixed with gravel, weeds, and the like, which would spoil the action of a common pump. For computations concerning the force requisite to turn the machine, and the quantity of water which it will raise in a given time, see Gregory's *Mechanics*, vol. ii.

A machine consisting of a pipe wound spirally about the surface of a cylinder, or cone, which is made to revolve about its axis when the latter is in a horizontal position, is called a spiral-pump. At one extremity of the spiral, water and air in nearly equal quantities being allowed to enter, the former will, in consequence of the revolution, be forced up an ascending pipe which may be attached at the other extremity.

Pumps.—The common pump is a machine for raising water by the pressure of the atmosphere: it consists of a cylindrical body, or barrel, from the lower part of which a tube descends into the water contained in the well or reservoir. In the interior of the cylinder is a moveable piston surrounded with leather in order that it may be water-tight, yet capable of moving up and down with freedom. The piston is perforated, and the orifice is covered above by a valve which opens upwards; and a similar valve at the bottom of the cylinder, or barrel, covers the upper extremity of the tube which leads to the well.

Now, if we suppose a power applied, by a lever or otherwise, at the extremity of the rod to raise the piston from A to B (*fig.* 2), the air contained in the tube D tends by its elasticity to occupy the lower part of the cylinder, which it enters by forcing up the valve E; and its elasticity diminishes in consequence of its occupying a greater space than before. Hence the air exerts on the surface of the water within the tube, at D, a less pressure than that which the external air exerts upon the water in the well; and the water consequently rises in the tube to a certain height above D, which is such that the weight of the column of water, together with the diminished pressure of the air, is equal to the pressure of the external air. The valve E then falls over the orifice; and the piston B being depressed, the air contained between it and the bottom of the cylinder will be condensed, in which state it will force up the valve F and escape at the top of the pump. The valve F then falls,

Fig. 2.



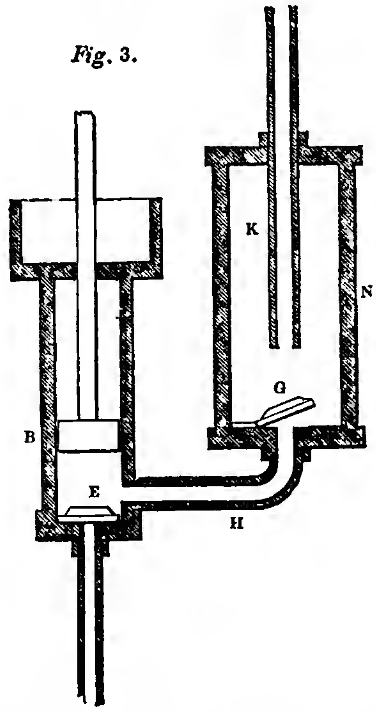
and, if the piston be again elevated, the water will rise higher in the tube D for the same reason as before. The operation of raising and depressing the piston being repeated a few times, the water will at length enter into the cylinder through the valves E and F; after which it will, at each stroke of the piston, be forced through the spout. The valves E and F closing after the water has passed them, the latter is prevented from returning, so that a cylinder of water whose height is equal to that through which the piston is raised, will, by each upward motion, be forced through the aperture, provided it be of sufficient magnitude.

The vertical height of the piston above the surface of the water in the well must always be less than 33 feet, for the reason given in speaking of the height of a siphon. But when the water has got above the piston it may be raised to any height, provided the piston-rod be long enough and sufficient power be applied.

That which is called a lifting-pump is frequently similar in construction to the common pump above described; but the lower valve E is always below the surface of the water in the reservoir, and the piston B is so when depressed to the bottom of the cylinder or barrel. On raising the piston, the water above it, whose weight keeps down the valve F, is lifted up and the pressure of the external atmosphere forces the water of the reservoir to enter into the cylinder through the valve E. Then, by successive depressions and elevations of the piston, the water is at length raised to the top of the pump and discharged by the spout. The volume of water lifted at each stroke is, of course, equal to that of a cylinder whose base is the area of the upper surface of the piston and whose height is the distance from thence to the top of the pump.

The forcing-pump is one in which the water, when raised in the barrel, is driven through an orifice in its side by the depression of the piston; it is also, in general, provided with an air-vessel, into which the water is forced, and from whence, by the elasticity of the condensed air, it is made to issue through a pipe inserted in the upper extremity. The principal cylinder, or barrel, is similar to that of the common pump, and, as in the latter, a valve at E (*fig.* 3) opens upwards. The piston B is solid, or without a perforation; consequently, when the water has been raised as before, above the valve E the depression of the piston drives it along the tube H and through the valve G into the air-vessel N. Succeeding strokes continue to force water into the vessel till it gets above the lower orifice of the pipe K, and thus prevents the escape of the air from thence. In the upper part of the vessel the air consequently becomes condensed, and, acting by its elasticity on the surface of the water, compels it to issue through the pipe K in a continuous stream.

Fig. 3.



A centrifugal pump is sometimes made to consist of two hollow cylinders at right angles to one another, in the form of the letter T. The lower extremity of such a machine rests by a pivot on a support in the water which is to be raised, and the machine is made to revolve on a vertical axis by means of wheel-work. Near the bottom of the vertical cylinder is a valve, opening upwards, which is closed by the weight of the column of water above when the tube is filled; and at each extremity of the horizontal cylinder is a valve opening outwards, which, when the machine is not in motion, is made to cover the aperture by means of a spring. When the machine is to be put in action, it must be filled with water by holes formed for the purpose in the upper part; these holes being then stopped, the machine is made to revolve rapidly, when the water in the horizontal arm acquires centrifugal force, by which it opens the valves at the extremities and flows into a reservoir placed there to receive it. The diminution of the gravity of the water in the vertical tube in consequence of that force, by taking off part of the pressure on the valve at the bottom, allows the pressure of the atmosphere on the exterior water to force the latter through that valve into the cylinder, and thus maintain a constant supply in the machine.

For raising water from great depths and in large quantities chain-pumps, as they are called, have been frequently employed. In this machine (*fig.* 4) a chain, carrying a number of flat circular pistons, passes round a wheel at the upper, and sometimes also at the lower extremity; each piston as it goes over the wheels being in part received in the intervals between the radii, as in the figure. The wheel being put in motion the pistons descend in a barrel on one side, and enter from below into another on the ascending side, when, pushing the water before them, they raise it into the reservoir. If the wheel is turned with considerable velocity the barrel will be generally quite full of water.

Pumps of this kind are frequently fixed in inclined positions; and it is when the inclination of the barrel is about 24½ degrees, the distance of the pistons from one another being equal to their diameter, that the greatest quantity of water is raised.

Chain-pumps are sometimes constructed without pistons or barrel; in this case the chain passes over two wheels, one at the top and the other at the bottom, and a number of buckets are attached to it. By turning the wheel the buckets dip into the water with their open ends downwards, and rising on the other side, convey the water into the reservoir.

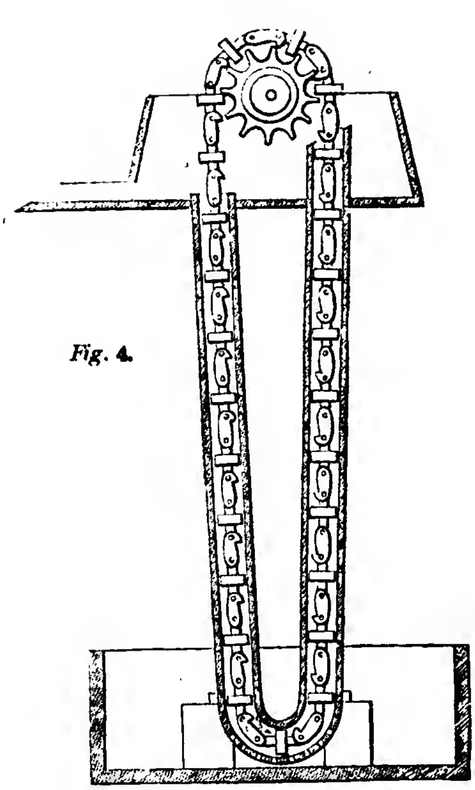


Fig. 4.

The Hydraulic Press.—This machine, which was invented by Mr. Bramah, is one of very great power in compressing bodies or lifting weights; or, again, in drawing up trees by the roots, or piles from the beds of rivers.

A (*fig.* 5) is an iron cylinder in which works the piston

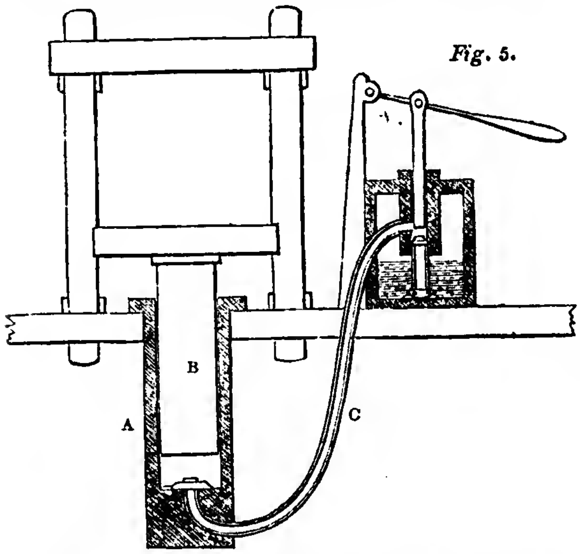


Fig. 5.

B. At the bottom of the former is inserted the tube C, whose aperture, under the piston, is covered by a valve. The other end of C communicates with a small forcing-pump, by which water is driven through the said valve into the lower part of the cylinder, where its hydrostatical action is exerted to raise up the piston.

Now suppose the diameter of the cylinder to be 10 inches, and that of the piston in the forcing-pump to be one quarter of an inch, then the proportion between the surfaces of the pistons will be that of 1600 to 1; and, on the principle of the equal pressure of fluids in every direction, the force with which the piston B is raised is to the resistance against the lower surface of that in the forcing-pump in the same proportion.

Water-wheels.—Water may be made to act as a moving power against wheels by its weight, its momentum, or by both combined. In the first case the wheel is provided with a number of buckets, or troughs, into which the water is received near the level of the axle of the wheel; the vessels thus filled becoming heavier than those on the other side, the wheel is made to revolve by that excess of weight merely. But if the water fall into the troughs over the top of the wheel, or at least from a certain height above the axle, the wheel will revolve both by the weight and by the momentum which the water acquires by its fall. The latter is called an *overshot*, and the former a *balanced* wheel.

Again, if the lower part of the wheel be placed in a stream of water which is made to act on float-boards fixed on the circumference, the machine has the name of an *undershot* wheel. Lastly, when the wheel is placed in a sort of channel, or *race*, as it is called, which is formed between two projections of masonry below the bed of the upper portion of the stream, and so as to coincide very nearly with the lower quadrant of the wheel's circumference on that side, the water descending from the stream upon float-boards, or troughs, and thus acting both by its momentum and weight, the machine is called a *breast*-wheel.

Many contrivances have been adopted for enabling the buckets or troughs of an overshot wheel to retain, during their descent, as much as possible of the water which, by entering into them, causes the wheel to revolve; and one of those, which Dr. Robison considers as the most approved, may be thus briefly described: premising that the ring of wood between the concentric circles Q D S and P A R (*fig.* 6), constituting the ends of the troughs, is called

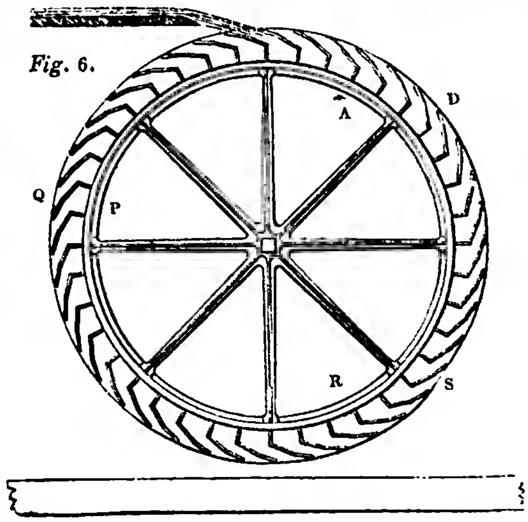


Fig. 6.

the shrouding; and that the inner circle P A R is called the sole of the wheel: the sole usually consists of boards made fast to strong rings, which are firmly connected with the radii. The partitions which determine the forms of the troughs consist of three boards, whose positions are indicated in *fig.* 7 by the lines A B, B C, and C D, which may

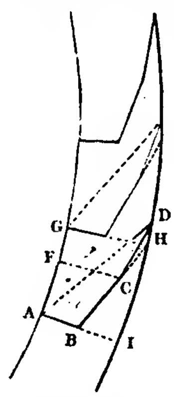


Fig. 7.

be thus traced.—Imagine A I, G H, &c., to be drawn in the direction of radii at a distance from each other equal to 9 degrees, or one-fortieth of the circumference of the wheel, if there are to be forty troughs, then the depth A I and G H of the shrouding may be made equal to ⅝ of the interval, or sole, A G; and A B may be made equal to half

AI; join B and H, and make BC of such a length that the portion FC of a radius of the wheel may be equal to $\frac{3}{8}$ of AI; and, lastly, draw CD so as to make HD equal to $\frac{1}{4}$ of IH.

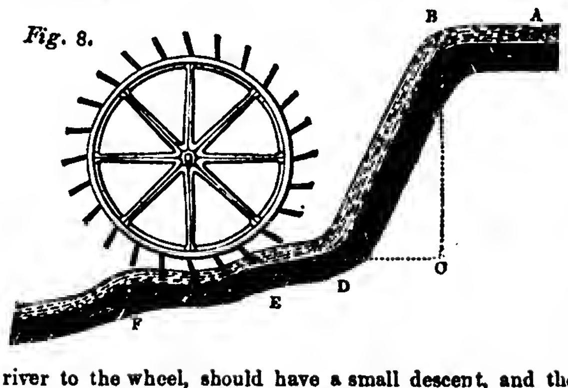
From this construction it will follow that the area FABC is nearly equal to DABC; so that the water which would fill the former space will remain in the trough when AD becomes horizontal; in which case AB will make an angle of about 35 degrees with a vertical line; and when the trough descends so much lower that one-half of the water runs out, the line AB will make an angle of about 24 degrees with the vertical. Therefore the wheel being filled to the degree just mentioned, it will begin to lose water at the distance of about one-eighth of the diameter from the bottom; and half the water will be discharged from a trough at about one-twenty-fourth of the diameter farther down. Had a greater quantity of water been supplied to each trough when it was under the spout, the discharge would have begun at a greater height from the bottom, and a greater portion of the whole water received would have been lost.

Different persons have arrived at opposite conclusions respecting the velocity which should be given to an overshot wheel in order that it may produce the greatest quantity of work. Popular as well as scientific reasonings tend to show that more work is done by the wheel in proportion as it moves slower, to a certain degree; but we have, at present, no means of deciding what are the relations between the rates of motion and the quantities of work performed. Mr. Smeaton's inference from his experiments is, that in small works the rim of an overshot wheel should have a velocity of about three feet per second only; but in large works it may be greater. He estimates the greatest quantity of work performed at about two-thirds of the power expended.

The theory of undershot wheels is still less perfectly known; but it seems, from the experiments of De Parcieux and Bossut, that a sensible advantage is gained by inclining the float-boards to the produced radii of the wheel at an angle of about twenty degrees, each board when at the lowest place having its edge turned towards the upper part of the stream. Such inclination will cause the water to heap up along the float, and thus act by its weight as well as its pressure; the floats should consequently be rather broader than the depth of the vein of water which they intercept.

The canal AB (*fig.* 8), which conducts the water from the

Fig. 8.



river to the wheel, should have a small descent, and the masonry at B should be rounded; the inclination DBC of the fall may be about 25° 50′, and a concave figure should be given to the masonry at D. The distance from D to E should not be less than three or four feet; and the masonry under the lower floats should be curved so as to coincide nearly with the arc described there by the latter, in order to force the water to act as long as possible against them. But beyond F the bed should fall to a depth of several inches, that the water may flow off without retarding the motion of the wheel.

It has been determined by experiment that the effect of the wheel is the greatest when its velocity is about half the velocity of the stream; and it is asserted that the efficacy of an overshot wheel is more than double that of an undershot wheel of equal magnitude.

Mr. Smeaton considers that a breast-wheel unites in some measure the advantages of both the others; for when the water strikes at a certain point below the surface of the stream, and afterwards descends in a circular arc upon the floats, the effect of such a wheel will be the same as that of an overshot wheel when the latter is acted on by a head of water equal to the difference of level between the surface of the reservoir and the point where the wheel is struck, together with that of an undershot wheel which is acted on by a head equal to the difference of level between the point where the wheel is struck and the surface of the water below.

HYDRIODIC ACID. [Iodine.]

HYDRO'BATA, Vieillot's name for the Water Blackbirds, *Cinclus*. [Merulidæ.]

HYDRO'BATES, Temminck's name for the Sea Ducks. [Fuligulinæ, vol. xi., p. 5.]

HYDROBROMIC ACID. [Bromine.]

HYDROCELE (from ὕδωρ, water, and κήλη, a tumour) is a collection of watery fluid in the tunica vaginalis testis. It is characterized by the formation of a tumour, which enlarges gradually without heat or pain, has a pyriform shape, is firm and elastic, often appears transparent when a light is placed behind it, and does not, like a hernia, diminish in size when the body is in a recumbent posture, nor communicate any impulse when the patient coughs. In most cases the fluid collects without any distinct cause, but in some it follows rapidly after an injury of the part. The quantity of fluid which accumulates varies from a few ounces to four or six pints. The disease often occurs in those who are otherwise in perfect health, and in persons of all ages; it may be seated on one or both sides of the body. The treatment consists, 1st, in the evacuation of the fluid by tapping; and 2nd, in preventing it from accumulating again by exciting such active inflammation of the opposite surfaces of the tunica vaginalis as may produce their adhesion and the obliteration of the cavity. The latter purpose is generally fulfilled by the injection of some stimulant fluid, or the introduction of a foreign body into the cavity.

HYDROCE'PHALUS (from ὕδωρ, water, and κεφαλή, head), water in the head, is a name applied to two diseases nearly peculiar to infancy and childhood, which are distinguished as the acute and the chronic. These diseases differ entirely in their nature. Acute hydrocephalus is a disease rapid in its course and essentially inflammatory in its nature, and of which the effusion of fluid in the head is but one, and that not a constant effect or concomitant. To constitute chronic hydrocephalus (an affection which may last many years), the only essential condition is the accumulation of a watery fluid within the skull, which may or may not be caused by or attended with inflammatory action.

1. *Acute Hydrocephalus* is a most frequent and fatal disease of the early stages of life. It occurs most commonly between the first and the eighth year, and corresponds in a great measure to the inflammation of the brain (phrenitis and arachnitis) of later years.

The rapidity of the disease when once formed, and its frequently fatal termination, render it a matter of the greatest importance to detect its first or premonitory symptoms. But these, which it frequently falls to the lot of the parents and friends only to observe, are unfortunately seldom so marked as to be thought to demand medical aid, and are indeed with great difficulty distinguished from the symptoms of other affections of far less formidable nature.

The child is perhaps liable to momentary giddiness while moving quickly, is fretful and nervous, and its rest is disturbed; it loses its appetite, its bowels are costive, and the motions offensive. The eyes become heavy and very sensible to light, the face is pale, and the features devoid of animation. There is more and more indisposition to motion; the little patient complains of heaviness of the head, and loses its strength; its gait is unsteady. Of the above symptoms, those referrible to the bowels are frequently most prominent: purgative medicine is given, and sometimes relieves the symptoms for a time. The child may remain in this state for several days or weeks without anything more than heaviness or slight pain in the head being complained of, and without any fever; but when the symptoms persist after purgative medicine has acted, they should be looked upon with apprehension; and if there be no known cause, such as the presence of worms in the intestines or the eruption of a tooth, to account for them, they should be closely attended to from the commencement.

The symptoms more surely indicative of the disease are more intense pain in the head, to which the child constantly carries its hand; intolerance of light, sound, and motion; squinting; heat of the head; knitting of the brows; disturbed sleep, with grinding of the teeth, the child frequently waking with a scream; the pulse being at the same time slow and irregular, and not quick as in fever from worms or teething. The appetite is lost, the evacuations from the bowels are unhealthy, and vomiting ensues. The abdomen, if previously distended, now falls in and becomes quite flat. Stupor, interrupted by screams, follows. After these symptoms have continued for some hours or days, there will sometimes be a temporary recovery of sense; the child will see, hear, and know its friends, and will take its food; but this promising state is soon interrupted by convulsions of the whole body, or of one side, paralysis of one side, return of the squinting, complete loss of sight and hearing, and inability to swallow; still greater emaciation ensues, the breathing becomes irregular, the extremities cold, and death follows.

This is the more usual course of the disease; it then generally lasts several days or even weeks. But it in some instances comes on suddenly, and proves fatal in a few hours. In other cases the symptoms are less severe and more prolonged; and chronic hydrocephalus, gradually develops itself.

The appearances which are found in the brain after death are congestion of the blood-vessels, effusion of serum mixed with lymph in very variable quantity between the membranes at the base of the brain or in its cavities, and softening of the substance of the brain itself, particularly of those parts of it which form the floor of its cavities or ventricles. Sometimes there is merely effusion of clear serum, sometimes no effusion, but merely softening of the cerebral substance.

Causes.—Children of scrofulous diathesis, or of irritable temperament, and those, it is said, of precocious intellect, with a large head, are most subject to this disease. Such children should be as much as possible guarded from agencies likely to excite increased flow of blood to the brain, such as cold or external violence to the head, the influence of the sun, the suppression of eruptions of the skin, and particularly of the scalp, the use of narcotic remedies, as opium, too great excitement of the mind, and the early exercise of the intellectual powers.

The *treatment* must vary in the different stages of the disease, but will generally consist in endeavouring to subdue inflammatory action, in removing any causes which may, directly or indirectly by sympathy, keep up irritation of the brain; and lastly, in the latter stages, in supporting the strength of the system.

2. *Chronic hydrocephalus.*—The disease to which this name is applied is correctly denominated water in the head, being always accompanied with a considerable collection of watery fluid in the cavity of the head, sometimes within the membranes of the brain only and exterior to the organ itself, but more frequently in the ventricles or cavities of the cerebral hemispheres, which are then distended to the form of a sac. The quantity of fluid is sometimes so great as to cause an increased size of the skull, amounting to great deformity; the face, remaining of its natural size, appears disproportionately small. The disease generally arises before or very soon after birth; and the cranial bones not being completely ossified at the time of its commencement, they become separated to a distance from each other, and the sutures remain open for a long period. When the disease comes on after birth its early progress is very insidious.

Symptoms.—The intellectual faculties are always deranged, and the senses generally more or less disordered; there is usually impaired vision or blindness, with squinting; speech is imperfect; the voluntary power over the limbs is partially lost, giving rise to an unsteady gait, as a frequent symptom. The digestive functions, respiration, and circulation, are in most cases unaffected until near the termination of the disease. The unfortunate patient is sometimes the subject of occasional epileptic fits. In the latter stages of the disease the loss of intellect and of the power of motion increases, till at last complete coma and paralysis ensue.

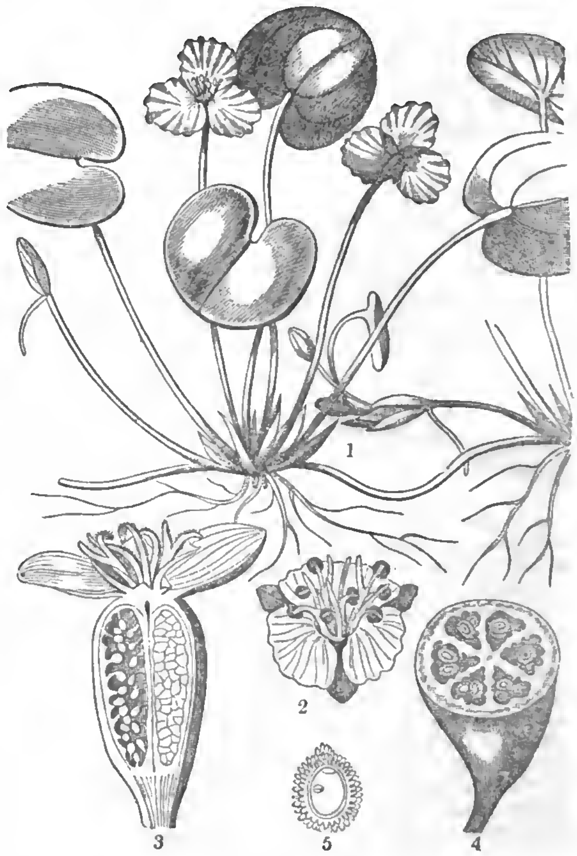
The duration of the disease is extremely various. It may terminate fatally even before birth, or the child may live for many months or years. A man named Cardinal, the subject of water in the head, died a few years since at Guy's Hospital, aged thirty-two years: and a woman is mentioned by Gall and Spurzheim as having lived to the age of fifty-four years, though after death four pints of fluid were found in her head.

The amount of fluid accumulated in the brain or its membranes is as various as the duration of the affection. It may not exceed a half a pint or a pint, or it may reach the quantity of several pints. In the patient Cardinal, ten pints of fluid were contained in the head. Cases are recorded in which as many quarts have been found.

Causes.—The children of scrofulous parents, and those of a rickety diathesis, are most prono to chronic hydrocephalus. Any causes acting on the mother so as to interfere with the proper nutrition of the fœtus may produce it. Sometimes several children of the same parent are similarly affected from birth. Chronic hydrocephalus may be left as a consequence of the acute disease.

Treatment.—In the majority of cases medical treatment is quite useless, except in the early stage of the disease, and when it has come on subsequently to birth. If there are symptoms of subacute inflammation existing, the means calculated to subdue this are used with benefit. The next great object to be effected is to remove the accumulated fluid. This may be attempted by internal remedies supposed to accelerate absorption, or it may be effected by puncturing the head. The latter operation has been performed at different times by many surgeons, and in numerous instances with success.

HYDROCHARA'CEÆ, a small natural order of Endogenous plants inhabiting ditches, lakes, and rivers in various parts of the world. They have tripetaloideous flowers, often separate sexes, and an inferior ovary. The latter character cuts them off from Alismaceæ and Butomaceæ, to which they bear some resemblance in habit. None of the species are of any known use, except the Janji of India, or Valisneria alternifolia, which is used for the purpose of conveying water mechanically to sugar in the process of refining it. Valisneria spiralis, a plant of this order, is remarkable for its spiral flower-stalk, which enables it to accommodate itself to the depth of the stream in which it floats, so as always to keep its flowers above water when it is necessary.



Hydrocharis Morsus Ranæ.

1, a portion of the plant, with flowers, leaves, and stem; 2, a male flower; 3, a female flower; 4, a section of the ripe fruit; 5, a seed, with a part of the testa stripped off to show the embryo.

HYDROCHLORIC ACID. [CHLORINE.]

HYDROCHŒRUS, Brisson's name for the *Capybara* of Marcgrave, *Capyigoua* of D'Azara, *Cochon d'Eau* of Des Marchais, *Irabubo* of Gumilla, *Capivard* of Froger, *Capüguara* of Dobritzhof, *Cabiai* of Buffon, *Nüimpoon* of the Botocudo Indians.

ORGANIZATION AND ARRANGEMENT.

Dental Formula: incisors $\frac{2}{2}$; molars $\frac{4-4}{4-4}=20$.

Molars compound, the posterior teeth the longest, and formed of numerous laminæ, which are simple and parallel; the laminæ of the anterior molars forked.

Teeth of Capybara. (F. Cuvier.)

At a meeting of the Zoological Society of London (1832), Mr. Owen, on the occasion of exhibiting a large old cranium of the *Capybara* belonging to Mr. De la Fons, remarked, that perhaps the most extraordinary instance of the enlarged views which result from unwearied observation of the internal structure of animals is afforded by Cuvier's bold enunciation of the affinity of the *Elephant* to that order of the *Mammalia* which contains the most minute forms of the class, and, in support of that affinity, adduced the *alveolæ* of the last molar tooth in Mr. De la Fons's specimen as illustrating an additional analogy between the molars of the *Rodent* and those of the *Elephant*, namely, that the number of transverse *laminæ* increases as the jaw enlarges with age, the whole number not coming into use at once.

'In the *Capybara*,' says Mr. Owen, 'the posterior grinders, like those of the *Elephant*, present a greater number of component *laminæ* than the anterior ones, which are of earlier formation. Those of the upper jaw, according to the figure and description in the "Ossemens Fossiles" (V. pl. 1, p. 24), are composed of eleven *laminæ*, of which all but the first, which is notched externally, are simple. In the figure too, it is worthy of observation that the last or eleventh *lamina* is imperfect, and exhibits a construction analogous to the imperfectly-formed laminæ or denticles in the *Elephant's* grinder, viz. a division into component columns. In the work of M. F. Cuvier, "Sur les Dents des Mammifères," the number of *laminæ* in the last grinder of the upper jaw of the *Capybara* is stated as "onze ou douze;" but eleven only are exhibited in the figure, and we may suppose therefore the doubt as to the precise number to be founded on uncertainty as to the propriety of considering the first deeply-notched *lamina* as single or double. In the *cranium* in the College Museum the number of the laminæ is twelve, the forked one being regarded as single. In Mr. De la Fons's specimen the *alveolæ* clearly indicate that the number of *laminæ* of the last molar had been thirteen, with the rudiment of the fourteenth; the extent of the grinding surface is however proportionally longer than would result from the additional *laminæ* alone; for as these *laminæ* do not cease to grow so long as the animal lives, they increase in thickness as age advances.' (*Zool. Proc.*)

Mr. Morgan (1830, *Linn. Trans.*, vol. xvi.) describes the stomach as formed by a single membranous bag; and, as in other mammiferous vegetable feeders in which this simple form of stomach is found, the cœcum as large and complicated in proportion. Finding nothing requiring particular notice in the rest of the alimentary canal, Mr. Morgan proceeded to examine the structure of the mouth and throat. After noticing the considerable extent of the grinding surfaces of the molar-teeth, he remarks that it must be obvious how necessary such an arrangement of parts must be to the health of the animal, when the nature of its food and the simple structure and limited functions of its most important digestive organ are considered, a provision being thus made for the proper mastication of the hard vegetable substances upon which the animal must occasionally subsist. But Mr. Morgan found another structure, undescribed up to the time when he made his examination, by which the process of perfect mastication is rendered indispensable to the passage of the food from the mouth to the stomach. This structure, by which the possibility of swallowing any portion of unmasticated nutriment is prevented, is shown in an extraordinary formation of the *velum palati mollis*, or soft palate. In other animals this membrane generally forms an imperfect floating septum, suspended from the back part of the roof of the palate, and interposed between the cavity of the mouth and pharynx, but it was found in the capybara and in some of its congeners to be much more extensive in its attachments, and different in its form and uses. On separating the jaws the mouth appears to terminate in a nearly blind pouch; for the communication with the pharynx seems as if shut by a strong membrane of a funnel shape, the concavity of which recedes towards the throat. 'This membrane is an extended *velum palati* attached to the whole circumference of the fauces and root of the tongue, and is prevented from forming a *complete* septum by the existence of a small central circular aperture, by which a communication between the mouth and the pharynx is established for passage of food; so that through this small membranous funnel, or strainer (if I may be allowed the expression), it is physically impossible that any considerable portion of unmasticated nutriment should find its way, by natural means, from the mouth into the alimentary canal: and from this circumstance the first process towards digestion must be rendered certain and complete; for the *grosser* particles of food must remain in the mouth from the interposition of the membranous sieve or strainer, which is thus placed between the organs of mastication and those of digestion.' Mr. Morgan observes that the same provision for the complete mastication of all solid substances, previous to their being swallowed, will be found in others of the same group, but he confines his well executed descriptions and figures of the anatomy of these parts to the dissections he had made of the capybara. To these descriptions and figures we refer the reader, offering only the conclusion to which Mr. Morgan comes as to the use of this conformation of the *velum palati*: this appears to him to have reference to the digestive organs, and to be confined almost entirely to the process of deglutition.

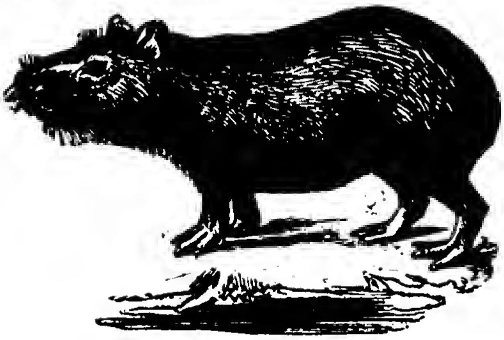
In 1834 portions of the *viscera* of a *Capybara*, taken from an individual which had recently died in the Zoological Society's menagerie, were exhibited at one of their meetings. They consisted of the stomach, the enormous *cœcum*, and the *fauces*. In calling the attention of the meeting to the latter parts, Mr. Owen availed himself of the opportunity of demonstrating the structure first observed by Mr. Morgan, and the former zootomist remarked that the construction abovementioned is indeed found in many other *Rodents*, but does not obtain in the whole of the animals of that order. (*Zool. Proc.*)

The size of the laminæ in the posterior molar teeth, and the increase in their number, indicate some approach to the pachydermatous form, and we find among some of the earlier zoologists who have noticed it a disposition to approximate it to the Hogs. Thus Marcgrave says (*Piso*, book iii), 'Capybara inter porcos aquaticos sive fluviatiles recipitur, quia figura et natura bimulum porcum emulatur.' Brisson's name, *Hydrochœrus*, Water Hog, and Des Marchais' *Cochon d'Eau*, point the same way. Linnæus, in his last edition of the *Systema Naturæ* (12th), arranges it under the genus *Sus* (*Belluæ*), as *Sus Hydrochæris*, and immediately after the *Sus Tajaçu*, or *Peccary*, next to which animal it is placed in Piso's Marcgrave. Pennant, in his 'Synopsis,' calls the *Capybara*, with *River Hog* (Wafer, in Dampier), as one of the synonyms, the *Thick-nosed Tapir*; but in his 'History of Quadrupeds' he makes it the first species of his genus *Cavy*, giving it a place immediately before the *Guinea Pig*. Gmelin (13th ed. 'Syst. Nat.') places it among the *Glires*, as the last species of the genus *Cavia*, immediately after the Guinea Pig, *Cavia Cobaya*; by which arrangement the animal comes next to the Beaver, *Castor*. Cuvier makes *Hydrochœrus* a genus of his *Rodents*, giving it a position between *Lagomys* and the Guinea Pig. Fischer brings it under the *Glires*, between *Lagomys* and *Dasyprocta*. Mr. Gray places it in the order *Glires*, family *Leporidæ*, subfamily *Hydrochœrina*; Hydrochœrus being the only genus of that subfamily, which stands between the subfamilies *Caviina* and *Dasyporcina*. M. Lesson arranges it between *Kerodon* and *Cavia* (*Glires*). Mr. Swainson also places it at the head of the Cavies, *Cavia* (*Glires*).

Generic Character.—The dentition we have given above. The other characters are principally found in the four anterior and three posterior toes with which the feet are furnished (all of which are armed with large nails, or rather hoofs, and united by membranes), the compressed muzzle, the absence of the tail, and twelve teats.

The only species is *Hydrochœrus Capybara*, *Cavia Capybara* of Gmelin, *Sus Hydrochœris* of Linnæus, most of whose synonyms we have given above.

Description.—Head very large and thick; nose wide; whiskers long and stiff; eyes large; ears rounded and moderate; legs short; hair of the body short and rough, a little like hog's bristles, but finer; colour reddish-brown above, yellowish below; size of a rather small two-year old pig, being probably the largest of existing *Rodents*.



Hydrochœrus Capybara.

Geographical Distribution.—Confined entirely to the New World, and found in the neighbourhood of the great rivers in Brasil, Guiana, and Paraguay; some say that it is found as high as the Isthmus of Darien.

Food, Habits, &c.—Marcgrave states that the *Capybara* lives upon herbs and fruits; that it is a nocturnal animal swimming across rivers and torrents in search of food, and raising such a horrible clamour as to have terrified the narrator before he knew the cause. He says that they wander in infinite congregations about the banks of the rivers, and as they are slow of foot, that they save themselves from the hunters by swimming, though, notwithstanding, immense numbers are killed. Pennant, who quotes Muratori, says that it runs slowly, swims and dives remarkably well, and keeps for a long time under water, feeds on fruits and vegetables, is very dexterous in catching fish, which it brings on shore and eats at its ease, sits up and holds its prey with its fore-feet, feeding like an ape, takes its food in the night, and commits great ravages in gardens, keeps in large herds, and makes a horrible noise like the braying of an ass.

Some part of this last account seems rather highly coloured. We doubt very much, from the structure of the teeth and digestive organs, the alleged fact of its feeding much on fish; though Bewick, who gives by no means a bad figure of the animal, places a newly-caught fish before it, probably on the authority above quoted.

Utility to Man.—Marcgrave speaks of the flesh as sufficiently good food, especially if it be roasted; he says indeed that inasmuch as it yields in dignity to that of wild and domestic hogs, the head of the Capybara only is considered a delicacy. Pennant, on the contrary, in the account above alluded to, says that it grows very fat, and that the flesh, which is tender, is eaten, but it is added that the flavour is oily and fishy. Cuvier however speaks well of it. 'C'est un bon gibier,' says that author in his 'Règne Animal.' The majority of authors speak of it as being easily tamed and growing familiar; but the Capybara which died at the Regent's Park was very morose to strangers, and all endeavours at conciliation were answered by stampings, cries, and malevolent attempts to strike with the fore-feet and head. The disposition of an animal however, and its capacity for domestication, should not be judged of from the actions of an unfortunate individual shut up in a cage, deprived of all the accessories that make its life agreeable in a state of nature, and with a temper ruined by constant irritation, disappointment, and ill health. Those who speak of the Capybara as being easily tamed had most probably opportunities of observing the manners of some of these quadrupeds where they were allowed that certain degree of liberty and indulgence without which an attempt to gain the confidence of animals and render them familiar is generally hopeless.

Mr. Owen justly observes (*Zoology of the Voyage of H.M.S. Beagle*) how highly interesting it is to find that the continent to which this existing aberrant form of Rodent is peculiar, should be found to contain the remains of an extinct genus, characterized by a dentition which closely resembles the Rodent type, but manifesting it on a gigantic scale, and tending to complete the chain of affinities which links the Pachydermatous with the Rodent and Cetaceous orders. [TOXODON.]

N.B.—The *American Tapir* is included under the genus *Hydrochœrus* of Erxleben, and the Guinea Pig under the genus *Hydrochœrus* of F. Cuvier, according to Dr. Fischer.

HYDROCYANIC ACID. This acid, which, as its name imports, is a compound of cyanogen (bicarburet of azote) and hydrogen, was first obtained by Scheele in 1782; and as it was procured, though intermediately, from Prussian blue, it was originally called prussic acid. This acid probably exists ready-formed in several vegetable products, as the leaves of the cherry-laurel and the peach-tree; for when these or bitter almonds are subjected to distillation with water, the distilled fluid has the peculiar smell and poisonous properties of hydrocyanic acid, and, like it, produces under certain circumstances Prussian blue when added to a solution of iron. It is however possible that the hydrocyanic acid thus obtained is a product, and not an educt, its elements only existing in the vegetable matter.

Various processes have been proposed for obtaining this acid: that of Gay-Lussac, who discovered the compound nature of its base [CYANOGEN], and by which acid of the greatest strength and most marked properties is procured, is the following:—Put into a glass retort some bicyanide of mercury; adapt to the retort a glass tube of about two feet long and half an inch in diameter; put into one-third of the tube, and that which is nearest the retort, pieces of marble, and let the other two-thirds be occupied by fragments of chloride of calcium. Pour upon the bicyanide of mercury about two-thirds of its weight of concentrated hydrochloric acid: apply a gentle heat to the retort, and by its action bichloride of mercury remains in the retort, and hydrocyanic acid is formed, and liberated in the state of vapour, and condensed in a receiver cooled by ice. The marble is employed for arresting any undecomposed hydrochloric acid which may be volatilized, and the chloride of calcium to absorb moisture.

Another method of preparing this acid, which is adopted in the London Pharmacopœia, is that of decomposing ferrocyanide of potassium by distillation with sulphuric acid; this acid is extremely weak compared with that procured by the process just described, the properties of which are as follows:—it is a colourless liquid, with a strong and peculiar odour; its taste is at first cooling and afterwards burning, and it is extremely poisonous. Its specific gravity is 0·6969; it boils at about 80°, becomes solid at about 5° Fahr., and then crystallizes in fibres. As an acid, its powers are but feeble; for though it reddens litmus paper, its blue colour returns as the acid evaporates; and in this property it resembles carbonic acid. It is so very volatile, that when dropped on paper, the sudden evaporation of a portion of it renders the remainder so cold that it solidifies; and this effect is produced even when the temperature of the atmosphere is nearly 70°. The vapour of hydrocyanic acid has a specific gravity of 0·9363, air being 1. With water and alcohol it combines in all proportions.

Hydrocyanic acid is composed of—

One equivalent of hydrogen . .	1 or	3·7
One „ cyanogen . .	26	96·3
Equivalent . .	27	100

In the state of vapour it may be considered as constituted of—

50 cubic inches of hydrogen . .	1·075 grains
50 „ cyanogen . .	27·950 „
100 cubic inches	29·025 grains.

Neither condensation nor expansion occurs during the combination of the gases which form the acid.

Hydrocyanic acid, especially if it be exposed to light, is subject to spontaneous decomposition, the first indication of which is that the acid acquires a brownish tint, which gradually deepens, and eventually ammonia is evolved, and a black powder subsides.

On account of the facility with which it decomposes, it forms but few salts, and like other hydracids it is decomposed when added to metallic oxides, the results being a metallic cyanide and water. Hydrocyanate of ammonia may however be formed, but it is an unimportant salt.

HYDRODYNAMICS. Under this word are usually comprehended the conditions of equilibrium and of motion in non-elastic fluids, with the resistances which they oppose to bodies moving in them. When a fluid is in a state of rest, the investigation of its equilibrium and that of bodies immersed in it, together with the pressure exerted by the fluid on bodies immersed in it, or containing it, form the subjects of hydrostatics. Hydrodynamics, which was formerly included under the term hydraulics, is concerned chiefly in investigating by mathematical reasoning, or in showing from observation and experiment, the laws relating to the discharge of fluids through orifices and tubes in vessels or reservoirs, and to their motions in canals or rivers.

Concerning the laws of the motions of fluids as they were known to the antients little can be said; the only notice of this branch of science, even in the time of the Roman empire, is contained in the treatise *De Aquæductibus*, which was composed by Frontinus, in the reign of Nerva or Trajan. This writer shows that the quantity of water issuing from an orifice depends on its magnitude, and on the height of the water in the reservoir above the orifice; and he states that a short tube applied to an orifice permitted a greater discharge of fluid than could be obtained from a simple perforation of equal diameter. He appears however to be unacquainted with the manner of determining the velocity when the height or *head* of the water is given; and it is not certain that this elementary proposition was solved till the time of Torricellius, who, in 1643, assigned the law correctly, for that case only however in which the aperture is very small compared with the height of the water in the vessel or reservoir.

It appears that, even at the end of the sixteenth century, the cause of the ascent of water in pumps was little known; for Galileo, having occasion to make some observations on the phenomenon, could give no better reason for it than that it was caused by an attraction which he supposed the piston exercised on the water; and not being able to make the column of water follow the piston when the latter was about 34 feet above the surface of that in the well, he attempted to explain the circumstance by saying that the weight of the column was then so great as to overcome the attraction of the piston. We are indebted to Torricellius for the discovery that the rise of the water is owing to the pressure of the atmosphere on that which, in the well, surrounded the pump; and which is thus forced into the barrel, in consequence of the removal of the internal air, till the weight of the column raised is in equilibrio with that pressure.

Castelli, a disciple of Galileo, in his treatise *Della Mesura dell' Acque Correnti* (1628), appears to have been the first who applied himself to the investigation of the motion of fluids in rivers; and, together with several other circumstances relating to such motion, he shows that when the bed of a canal whose transverse section is variable has taken a permanent form, the velocities at different sections are inversely proportional to the areas of those sections. This branch of the science was subsequently much cultivated in Italy, probably on account of its connection with the important operations then in progress for improving the navigation of the Po, and draining the marshes in the northern part of that country. The Marquis Poleni wrote, in 1695, a work entitled *De Motu Aquæ mixto;* and, in 1718, another concerning the flow of water through orifices and short tubes. And numerous works containing the results of their investigations and experiments relating to the same subjects have been made public by other distinguished Italian mathematicians.

The 'Principia' of Newton contains (lib. ii., sect. 7) a series of propositions concerning the motions of fluids. In the first edition (1687) the law of the velocity of water flowing from vessels, being founded on experiments made with orifices of considerable magnitude, appeared to differ from that which had been observed by Torricellius; but the discovery of the *vena contracta*, which was introduced in the second edition (1713), explained the reason of the apparent discrepancy. Newton also investigated the resistance of fluids to bodies moving in them; and it may be said that his theory forms the groundwork of all our knowledge concerning that subject.

Daniel Bernoulli (in 1738) was the first who applied the higher branches of mathematical analysis in the investigation of general equations relating to the problems of hydrodynamics; and though objections were made to the principle which he adopted, yet the independent investigations of succeeding mathematicians have only confirmed the results at which the former had arrived. The subject was taken up, in 1744, by D'Alembert; who, assuming that the motion of each horizontal lamina of fluid in a vessel, during its descent in consequence of the efflux from the orifice, is compounded of two motions, viz. that which it had at the moment preceding any given time, and that which is subsequently lost, arrived at equations containing all the circumstances attending the efflux at the orifice. And, subsequently, he investigated corresponding equations from the assumption, first, that a rectangular canal supposed to exist in a fluid mass which is in equilibrio is itself in equilibrio; and secondly, that a molecule of fluid supposed to be incompressible retains the same volume under a different form in passing from one place to another.

The researches of Euler, La Grange, La Place, and other Continental mathematicians have, since, contributed greatly to establish the principles of the science on an analytical basis. The laws of the motions of fluids in canals and rivers were, with every possible precaution to ensure accuracy, determined experimentally by the Abbé Bossut in 1771, and by the Chevalier Du Buat in 1786.

In investigating the circumstances attending the discharge of fluids through orifices it is usual to suppose the fluid to be divided into an infinite number of indefinitely thin laminæ perpendicular to the axis A B (*fig.* 1) of the

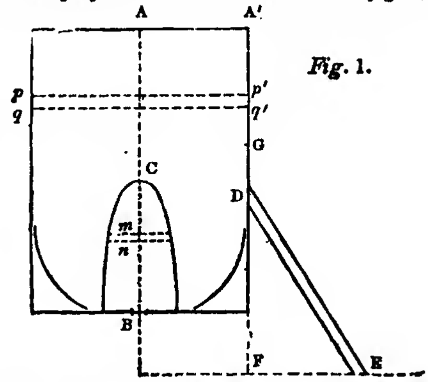


Fig. 1.

vessel in which it is contained, and that in the descent of the fluid these laminæ preserve their parallelism till they come near the orifice, when they assume the shape of a funnel, about which the fluid is stagnant. In the process immediately following, let the vessel be cylindrical or prismatical, in a vertical position, and have an orifice at B. Now if $p\ p'\ q\ q'$ be such a lamina, its distance from A being expressed by x and its area (perpendicularly to the axis) by a, we shall have $a\,dx$ for the volume of the lamina;

also, D being its density, we have $a\,\mathrm{D}\,dx$ for its mass. The force with which this lamina tends downwards is its gravity, and the resistance experienced in the descent is the excess of the pressure from below upwards over the downward pressure of that above the plate. If g represent the force of gravity, then $\mathrm{D}\,ag\,dx$ is equal to the action of gravity on the plate in its descent.

Let p represent the pressure exerted downwards by the water above, against any elementary portion of the lamina; then, the pressure of the water at the upper and under surfaces of the lamina being proportional to the depth of those surfaces below A, $p+dp$ acting upwards may represent that of the water below: hence the resistance of the water below the lamina will be $a\,dp$; and therefore the motive force by which the lamina descends will be $ga\,\mathrm{D}\,dx - a\,dp$. This being divided by the mass of the latter will, by mechanics, give $\frac{ga\,\mathrm{D}\,dx - a\,dp}{a\,\mathrm{D}\,dx}$ or $\frac{g\,\mathrm{D}\,dx - dp}{\mathrm{D}\,dx}$ for the accelerative force of descent. But in variable motions the accelerative force is expressed by $\frac{dv}{dt}$ (v being the velocity and t the time); or, since $v = \frac{dx}{dt}$, the accelerative force is expressed by $\frac{d^2x}{dt^2}$: therefore $\frac{d^2x}{dt^2} = \frac{g\,\mathrm{D}\,dx - dp}{\mathrm{D}\,dx}$.

But the quantity of water flowing through the orifice at B in any given time being evidently equal to that which would pass through the space $pp'qq'$, whose depth is dx, in the same time; if v be the velocity of a particle in its descent through the depth pq or dx, and u that of a particle in the orifice, we shall have, in the element dt of time (a' being the area of the orifice), $a'u\,dt = a\,dx$, or $ax = \frac{a'u\,dt}{a}$; whence, considering a, a' and dt as constant, we get $d^2x = \frac{a'\,du\,dt}{a}$: which, being substituted in the above equation for $\frac{d^2x}{dt^2}$, we obtain $\frac{g\,\mathrm{D}\,dx - dp}{\mathrm{D}\,dx}\,dt^2 = \frac{a'\,du\,dt}{a}$, or $ag\,\mathrm{D}\,dx - a\,dp = \mathrm{D}\,a'\,du\frac{dx}{dt}$.

But the equation $a'u\,dt = a\,dx$ gives $\frac{dx}{dt} = \frac{a'u}{a}$; therefore the last equation becomes $g\,\mathrm{D}\,dx - dp = \frac{\mathrm{D}\,a'^2u\,du}{a^2}$, whose integral is $g\,\mathrm{D}\,x - p = \frac{\mathrm{D}\,a'^2u^2}{2a^2} + \text{constant}$; whence

$$p = g\,\mathrm{D}\,x - \tfrac{1}{2}\frac{a'^2}{a^2}u^2\,\mathrm{D} + \text{constant}.$$

Let $x = h$ ($=$ A B) and $a = a'$, then

$p = g\,\mathrm{D}\,h - \frac{1}{2}\mathrm{D}\,u^2 + \text{constant}$; and subtracting this equation from the preceding, we have

$$o = gx - \tfrac{1}{2}\frac{a'^2}{a^2}u^2 - gh + \tfrac{1}{2}u^2.$$

This expresses the relation between the velocity u and the difference between the weights of two filaments of the fluid having unity for the base of each, and whose heights are h and x. When $x = o$, the equation becomes $o = -\frac{1}{2}\frac{a'^2}{a^2}u^2 - gh + \frac{1}{2}u^2$; or considering the orifice as infinitely small so that a' and the whole first term of the second member vanishes, we have $o = -gh + \frac{1}{2}u^2$; whence $u = \sqrt{2gh}$.

Now gh expresses the weight of a prism of fluid having unity for the area of its base and whose height is h; and this is the pressure of the fluid against a small orifice at the bottom of the vessel: but, while the height h is the same, the pressure is the same whatever be the position or inclination of the orifice: therefore $\sqrt{2gh}$ will express the velocity at the same depth, whether the orifice be at the bottom or side of the vessel. By the theory of forces this is equal to the velocity acquired by a body in descending by gravity through a height h, equal to that of the column of fluid, the orifice being infinitely small.

It may be concluded from the above theorem that the velocity of a fluid spouting upwards through an orifice in a vessel would cause it to ascend to the level of the upper surface of that in the vessel, if the resistance of the air were abstracted.

It follows, also, that the velocities of spouting fluids, at different depths below the upper surface, are proportional to the square roots of the depths; that the quantities of fluids discharged in equal times at different depths in the vessel, the latter being constantly full, are to one another in a ratio compounded of the areas of the orifices and the square roots of the depths; and the quantity of water which would be discharged in a given time t, through an orifice a' in a vessel kept constantly full at the height h, is expressed by $a't\sqrt{2gh}$.

The velocity u or $\sqrt{2gh}$ expresses the length of a cylinder of water which would flow through the orifice in one second; consequently the time of discharging from a cylindrical or prismatical vessel, the area of whose base is a and whose height is h, a quantity of water equal to that which the vessel will contain, the latter being however kept full during all the time that the water is flowing, will be found by making ah equal to $a't\sqrt{2gh}$; whence t (the time required) $= \frac{a}{a'}\sqrt{\frac{h}{2g}}$. The value of g is 32·167 feet, or 386 inches; and in these values of u and t it is evident that the areas and height must be of the same denomination as g.

When a vessel is suffered to discharge itself gradually, the velocity of the effluent water diminishes continually. Now if x be the depth to which the water has descended at the end of the time t, h being the whole height when the vessel is full, $h-x$ will be the height of the fluid at that time; and we shall have $\sqrt{2g(h-x)}$ for the velocity in the orifice. This may be supposed constant during the time dt, and then the quantity of fluid discharged in that element of time would be equal to $a'\,dt\sqrt{2g(h-x)}$. In the time of this discharge the upper surface of the fluid will descend through the depth dx; therefore the area of the upper surface being a, we have $a\,dx = a'\,dt\sqrt{2g(h-x)}$, and $dt = \frac{a\,dx}{a'\sqrt{2g(h-x)}}$ If the vessel is an upright cylinder or prism, a is constant, and the integral of the expression is $t = -\frac{2a}{a'\sqrt{2g}}\sqrt{h-x} + \text{constant}$. But, when $x=o$, we have $t=o$; therefore $o = -\frac{2a}{a'\sqrt{2g}}\sqrt{h} + \text{constant}$; whence $t = \frac{2a}{a'\sqrt{2g}}(\sqrt{h} - \sqrt{h-x})$; which, when $x=h$, becomes $t = \frac{a}{a'}\sqrt{\frac{2h}{g}}$; and comparing this with the time in which an equal quantity would run off, the vessel being kept full, it will be found to be double the latter.

Next, if it were required to determine the quantity of water which would flow through an orifice of finite magnitude when cut in the vertical side of a vessel which is kept constantly full, it must be observed that the velocity of the effluent fluid at different points in the depth of the orifice varies as the square root of the distance of the point from the upper surface. Now let A B ($=h$) be the vertical height of the water in a vessel in one side of which is formed the orifice whose axis is C B, and imagine the horizontal ordinates at m and n to be drawn indefinitely near each other. Let C B $=h'$, C$m = x$, the ordinate at $m = y$, $mn = dx$: then $y\,dx$ is equal to the elementary area of the orifice; and the water flowing through the area in the time t, being that which is due to the height Am, is expressed by $ty\,dx\sqrt{2g(h'+x)}$; which, being integrated between $x=o$ and $x=h-h'$, would give the quantity of water discharged through the whole orifice in the time t. If the orifice were rectangular, y would be constant: suppose it $=b$; then the indefinite integral would be $bt\sqrt{2g}\int(h'+x)^{\frac{1}{2}}dx$, or $\frac{2}{3}bt\sqrt{2g}(h'+x)^{\frac{3}{2}}$, which between the said limits becomes $\frac{2}{3}bt\sqrt{2g}(h^{\frac{3}{2}}-h'^{\frac{3}{2}})$: and if the orifice extended from the bottom to the top of the vessel, having then $x=h$, or $h'=o$, the expression would be $\frac{2}{3}bt\sqrt{2g}\,h^{\frac{3}{2}}$. If a rectangular orifice of the same form and magnitude were situated at the bottom B, with its longer side ($=h$) horizontal, the breadth b being very small in this, and also in the preceding case, the quantity discharged in the same time t, the velocity of the effluent water being now equal in every part of the orifice, and being that which is due to the whole height h, would be expressed by $b t \sqrt{2g}\, h^{\frac{3}{2}}$. The discharge found above is manifestly equal to two-thirds of this quantity.

In the second book of the 'Principia,' Newton shows that all the particles of water in issuing from an orifice in a vessel do not pass perpendicularly to the side or bottom in which it is formed, many of them converging towards the orifice in every direction; so that after passing it they form a stream of diminished breadth, which he called the *vena contracta*. By careful measurement he found the diameter of the latter and that of the orifice to be to one another in the ratio of 21 to 25; and he infers that the velocity in the contracted stream must be to that at the orifice in the same proportion as the squares of those numbers; that is, nearly as 1 to $\sqrt{2}$. Hence, finding from experiment that the velocity in the said stream was equal to that which a body would acquire by falling through the whole height of the fluid column in the vessel, he concludes that the mean velocity in the orifice must be that which is due to half the height of the same column. The ratio between the diameters of the stream and of the orifice is rather differently stated by late writers. Du Buat makes it as 6 to 9, while 4 to 5 is the ratio assigned by Venturi. No actual acceleration of the particles is supposed to take place after they have passed the orifice; but those near the surface of the stream having their direct motion diminished by friction, or by acquiring a revolving motion in their descent, the mean velocity of the whole is reduced to something less than that of the central particles which issue more directly. Since, in theory, the quantities of water discharged through orifices are made to depend on the mean velocity of the particles, it follows, when the discharge is made through a small orifice in a thin plate, that the quantity which flows in a given time is always greater in practice than it would appear to be by the theoretical formulæ. The experiments of Bossut show however that the ratio between the results of theory and practice is very nearly constant whatever be the height of the column of fluid; and it is found that the effective discharge may always be represented with sufficient accuracy by the expression $0{\cdot}62at\sqrt{2gh}$, a being the area of the orifice.

The distances, measured on a plane passing through the base of a vessel, to which fluids will be projected from orifices at different depths in its side, may be easily determined (the resistance of the air being neglected) by combining the action of gravity on the particles of fluid after they have left the orifice with the velocity communicated to them in consequence of the pressure arising from the depth of the orifice below the top of the column; and the path of the filament may be shown, as in the theory of gunnery, to be a parabolic curve.

The results of experiments tend to show that, when the height of a head of water in a vessel and the diameter of an orifice in its base or side are given, the discharge of water through a tube inserted in the orifice (its length not exceeding three or four times its diameter) is, to that through the simple orifice, nearly in the ratio of 12 to 11; and it is observed that, with a given diameter at its farthest extremity, the tube which is formed to coincide as nearly as possible with the natural figure of the *vena contracta* affords the greatest discharge. When the tube is fixed vertically in the base of a vessel, the effect is increased in proportion nearly to the length of the tube; since the velocity at the lower extremity of the tube is that which is due not merely to the height of the fluid above the base of the vessel, but to the height above the extremity of the tube. Again, if a short tube be applied horizontally to an orifice in the side of a vessel, the part nearest to the vessel having the form of the vena contracta, and, from the narrow part of the tube, diverging conically to the opposite end, the discharge of water is found to be more abundant than from a tube whose form beyond the vena contracta is cylindrical. For, when the water has filled the tube, the cylindrical stream through the contracted part communicates its motion laterally to the rest of the water, till it causes the whole to acquire the same velocity. The quantity discharged in this case, compared with that discharged from a cylindrical tube, is considered to be nearly in the ratio that the diameter of the conical tube at its extremity bears to that of the vena contracta.

The above expression for the effective discharge of water in short pipes being augmented in the ratio of 12 to 11 becomes $0{\cdot}68at\sqrt{2gh}$, and the mean velocity in the pipe is $0{\cdot}68\sqrt{2gh}$. Comparing this with $\sqrt{2gh}$, the velocity with which the fluid would issue if there were no friction in the pipe, it will be found, since the effective heights of the fluid above the orifice are proportional to the squares of the velocities, that the height, or head, due to the observed velocity in a short pipe, having at the place of its insertion the form of the vena contracta, and allowing for friction, is equal to about $\frac{46}{100}$ of the whole height.

It is customary to express the slope, or inclination, of a pipe or canal, when uniform, by the quotient arising from the division of the vertical height of one end above the other by the whole length. But, in the case of a reservoir, as A B, having a conduit-pipe D E; let A A′ be the surface of the water, and E, in the horizontal line F E, be the lower orifice of the pipe. Then, if A′G express the height due to the observed velocity at E, G F will be the height necessary to overcome the friction in the pipe, and $\frac{GF}{DE}$ is considered as the effective slope.

The passage of water through long pipes is greatly retarded by adhesion and friction in the interior; by the resistance experienced where bends take place; and by the disengagement of air, which remaining stationary in the pipes when the latter are laid along a level surface, or rising to the higher parts of any vertical bends, opposes an obstacle and sometimes entirely arrests the motion of the water. Experiments alone can, at present, afford information concerning the amount of the retardation in pipes of given lengths and diameters; and those which were conducted by the Abbé Bossut at Meziéres in 1779 are the most complete of any which have yet been made. The water was allowed to flow through pipes whose diameters were 1¼ inch and 2 inches, and whose lengths varied from 30 to 180 feet. They were chiefly of tin, and were inserted in the side of a reservoir in which the water during any experiment was always kept at one height; which was either 1 foot or 2 feet above the axis of the pipe. The general rules deduced from the experiments are,—that the discharges in given times, with pipes of the same length and with the same head of water, are proportional to the squares of the diameters; and, when the diameters are equal, the discharges are inversely proportional to the square roots of the lengths of the pipes. In order to afford the means of obtaining by calculation the supply which may be expected from a pipe of given dimensions, it may be assumed that when a pipe is 30 feet long and 1¼ inch in diameter, the discharge at its extremity is about one-half of that which would be obtained from a simple orifice, or short tube, of the same diameter. The experiments made by M. Couplet at Versailles, in 1730, were with pipes whose lengths varied from 280 to 2340 fathoms, and the diameters from 4 to 12 inches. The pipes were of iron or stone, or of both combined, and they were bent in various directions both horizontally and vertically. A pipe whose length was 600 fathoms, and which was 12 inches in diameter, when the head of water was 12 feet, afforded a discharge amounting to about $\frac{1}{10}$th; and a pipe of equal diameter, whose length was 2340 fathoms, when the head of water was 20 feet, discharged only $\frac{1}{16}$th, of that which would have been obtained from a simple orifice. Bossut found that, in order to produce a continued discharge in a pipe, the head of water should be about 1¾ inches in 180 feet.

The orifice or pipe through which water is allowed to flow is called *adjutage;* and it may be mentioned here that, by writers on hydrodynamics, short pipes applied as above are denominated *additional pipes*.

The motion of water in the bed of a river depends on the action of gravity by which the particles endeavour constantly to descend, and on the mobility of the particles by which they are enabled to assume a level surface when at rest. The descent by gravity takes place in consequence of the difference, in a longitudinal section of the river, between the levels of any two points on its surface, whatever be the form of its bed; since the molecules of water, which are in every part of a transverse section, have equal facilities of moving in the direction in which, from the general slope, the motion can take place. And, by the nature of an inclined plane, the accelerative force by which a particle is moved is to that of gravity as the difference of level between any two points at the surface in a longitudinal section is to the distance between those points on the surface. That the motive force of the molecules composing a river depends on the upper surface only may be easily admitted, when it is considered that the bed may have any inclination and any degree of irregularity, yet if the upper surface be horizontal the water will be at rest.

If the water of a river experienced no resistance from the sides and bed, its motion would go on continually accelerating from its source to its mouth, like a solid body falling by the action of gravity; and the consequences would be, that besides the destruction ensuing from the violence of the torrents in the lower lands, the moisture would be drawn from the soils in the upper regions, which would thus become incapable of supporting vegetable and animal life. The adherence of the particles of water to each other, and the friction against the beds, produce a resistance which increases with the velocity of the current, and becomes at length equal to the accelerative force of the descent; and then a uniform motion is established.

But when a current is in a state of equilibrium, the velocities in different transverse sections of the river may be very unequal, on account of the variations in the areas of those sections, through all of which the same quantity must flow in the same time; since otherwise the equilibrium of the river would not be permanent. It follows that the products of the areas of the sections multiplied by the velocities in each must be equal to each other, and that the velocities in different sections must be inversely proportional to the areas of those sections.

If the difference of level between any two points on the surface of a river or canal, in a longitudinal section, be equal to one inch, and if l, in inches, be the distance of those points on the surface, the slope of the river may be represented by $\frac{1}{l}$. Then, since the accelerative power of gravity vertically, is to the accelerative power on any plane, as the length of the plane is to its vertical height; we shall have $\frac{g}{l}$ for the accelerative power in a river whose slope is $\frac{1}{l}$. Again, if the resistances to the motion of the fluid were, as is sometimes the case nearly, proportional to the squares of the velocities, so that the resistance might be represented by $\frac{v^2}{m}$ (m being constant, and v reuresenting the mean velocity); then, because when water in a river moves uniformly, the resistance is, as in all like cases, equal to the accelerative force, we should have $\frac{v^2}{m} = \frac{g}{l}$; whence $v = \sqrt{\frac{mg}{l}}$. But the resistances in canals and rivers are not strictly proportional to the squares of the velocities; and it is found by experiment that, in one and the same bed, $v\left\{\sqrt{l} - \text{hyp. log. } \sqrt{l + 1\cdot6}\right\}$ may be considered as constant, and may be represented by $\sqrt{mg}$. Also, in beds whose transverse sections differ both in area and figure, when the mean radius is represented by r (where

$$r = \frac{\text{area ACB of the section}}{\text{arc ACB}}\Big)\, \textit{fig.}$$

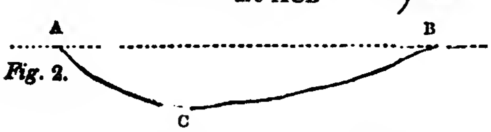


Fig. 2.

it is found by experiment that $\frac{\sqrt{mg}}{\sqrt{r} - 0\cdot1}$ is constant and equal to 307 inches; hence $\sqrt{mg} = 307\,(\sqrt{r} - 0\cdot1)$ and $m = 244\,(\sqrt{r} - 0\cdot1)^2$. Consequently we obtain

$$v\left\{\sqrt{l} - \text{hyp. log. } \sqrt{l + 1\cdot6}\right\} = 307\,(\sqrt{r} - 0\cdot1),$$

or $v = \frac{307\,(\sqrt{r} - 0\cdot1)}{\sqrt{l} - \text{hyp. log. } \sqrt{l + 1.6}}$. But further investigation leads to the conclusion that this expression for v must be diminished by $0\cdot3\,(\sqrt{r} - 0\cdot1)$ on account of the resistance by which the particles of water oppose a separation from each other. (Du Buat, *Traité d'Hydrodynamique*).

As an approximation we may make $\sqrt{mg} = 307\sqrt{r}$, and $v = 307\sqrt{\frac{r}{l}}$. And by experiment it has been found that if v' = the velocity at the surface of a river, v'' the velocity at the bottom, and v the mean velocity (all being expressed in inches per second), we shall have

$$v'' = (\sqrt{v'} - 1)^2 \text{ and } v = \tfrac{1}{2}(v' + v'').$$

The mean velocity in any one section may be practically found, tolerably near the truth, by placing in it a rod of wood loaded at one end with a weight sufficient to allow it to float upright in still water. The greater velocity at the upper surface will make the rod incline towards the direction of the stream; and, consequently, when it has acquired a state of equilibrium, it will float in an oblique position: the top of the rod will move slower than the water at the upper surface of the river, and the bottom will move faster than that in the lower part. Hence, the mean velocity of the water in that part of the breadth of the river may be considered as nearly equal to the observed velocity of the rod. The experiment must be tried in different parts of the breadth of the river; and, in order to find the quantity of water which flows through the section in a given time, the area of the section must be obtained by measuring the breadth and sounding the depths at intervals across the river.

A knowledge of the velocity at the bottom of a river is of considerable use in enabling the hydraulic engineer to judge of the action of the stream on its bed; and it is evident that, to ensure permanency, the accelerative force of the water should be in equilibrio with the tenacity of the channel. It is stated that a velocity of 3 inches per second at the bottom will remove fine potter's clay: a velocity of 6 inches will lift fine sand; that of 12 inches will sweep away small gravel; 24 inches will roll away rounded pebbles; and 3 feet per second will carry along angular stones of the size of an egg. Bossut found, that when the velocity of the stream was just sufficient for lifting the sand, a ridge advanced about 20 feet in a day.

Irregularities in the sides and beds of rivers, whether arising from natural causes, or produced by artificial obstructions, are the causes of currents setting obliquely across, and of eddies being formed. These not only diminish the velocity of the water by creating impediments to its motion, but are sometimes seriously detrimental to the navigation, and to the stability of the structures which are founded in the bed of the river. When walls are made to project into the stream, the water striking them is forced to rise above its general level, on account of the obstruction; and is afterwards reflected towards the middle of the channel, with a velocity due to the rise thus produced. This current carries with it, by a lateral communication of motion, some of the water from the parts beyond the obstruction; the surface of the river being here, consequently, depressed, a portion of the water from the oblique current falls by gravity into the lower part, and thus a sort of whirlpool is formed at the place where the obstruction terminates. This process goes on continually; and the pressure upon the bed of the river under the whirlpool being diminished in consequence of the centrifugal force arising from the spiral motion, the water under the bed forces its way upwards, removing the gravel and sand, and frequently displacing the materials which form the foundation of the work there constructed.

When a body moves in a fluid at rest, its anterior surface being perpendicular to the direction of the motion; if an indefinitely thin lamina of fluid be supposed at every successive instant of time to be displaced, the resistance experienced by the moving surface may be considered equal to the weight of a column of the fluid whose base is the surface pressed, and whose height is that which is due to the velocity; that is to say, the resistance may be supposed to be equal to the pressure which would produce the same velocity at an orifice in the base or side of a vessel. A difference of opinion has however existed respecting the amount of the pressure sustained by the moving surface. For a vein of water issuing from a vessel and striking a plane surface at rest is shown by Newton (*Principia*, lib. ii., prop. 36), and the fact seems to be confirmed by the experiments of Krafft and Bossut, to exert a pressure upon that surface equal to the weight of a column of water whose height is twice that which is due to the velocity. Du Buat however has proved that, even if such should be the case with respect to the central part of the impinging column of fluid, the mean pressure is less, on account of the lateral deviations of the exterior filaments, and the amount first stated above is that which is generally assumed.

If the velocity be represented by v, the height due to that velocity is equal to $\frac{v^2}{2g}$; then a representing the area of the moving surface, and D the specific gravity of the fluid, we shall have $\frac{av^2}{2g}$ D for the pressure against, or the resistance experienced by that surface in moving through the fluid.

But when the anterior surface of the moving body is oblique to the direction of the motion, the resistance above found must be diminished on account of the inclination. Thus, let I be that inclination; the number of parallel filaments which act against a plane perpendicularly is, to the number which can act upon it in an oblique position, as radius (= 1) is to sin. I. And by mechanics, the intensity of any force acting obliquely on any plane is a decomposed part of the whole force, and is to the latter in the ratio of $\sin.^2$ I to rad.^2 (= 1). Therefore the effective pressure against an oblique plane varies, as $\sin.^2$ I; consequently when the moving plane is oblique to the direction of its motion, the resistance which it experiences is to be expressed by $\frac{av^2}{2g}$ D $\sin.^2$ I.

If a cylindrical body, terminated in front by an equilateral cone, move through a fluid in the direction of its axis; it can easily be shown that the resistance experienced is one-fourth, and if the body be terminated in front by a hemisphere the resistance is one-half of that which would be experienced by the same cylinder if it were terminated in front by a plane perpendicular to its axis.

When a prismatical body is placed in a stream of water the effort necessary to keep it immovable in the fluid is equal to the difference between the pressures in front and behind. The pressure in front is equal to the sum of the pressure produced by the moving water and of the dead pressure, as it is called, which takes place when the body is at rest in still water; and the pressure on the rear face is merely equal to this last. When a body of that kind is made to move in a fluid at rest, its progress is retarded by the same difference of the pressures before and behind, and by the friction of the water against the sides. Additional causes of retardation are the heaping up of the water in front when the velocity is considerable, and a diminution of the pressure on the hinder face on account of the surface of the water there being depressed below the general level; a circumstance arising from the lateral communication of motion in fluids, by which the water, driven off from the front, and proceeding in a diverging direction on each side towards the rear, carries away with it from thence some of the water which should counteract in part the pressure on the front.

The circumstances attending the resistances experienced by bodies of various forms and lengths when caused to move in water have, within a few years, been made the subject of numerous experiments which were carried on by the late Colonel Beaufoy in the Greenland Docks. Ample details of these valuable experiments are given in the volume lately published; and the following are some of the results:—

The friction of bodies moving in water is equal to a power of the velocity whose exponent is 1·949.

The pressure sustained at the head end varies in rather a higher ratio than the square of the velocity, when the velocity is small, and the exponent diminishes with an increase of velocity.

The diminution of pressure on the stern, caused by the fluid not pressing so strongly there when the body is in motion as when at rest, varies in a lower degree than the square of the velocity; and the exponent diminishes with an increase of velocity.

A globe experiences about one-third of the resistance which is encountered by a cylinder.

A globe cut in halves and separated by the intervention of a cylinder whose base and length are each equal to a diameter of the former, experiences a diminution of resistance which, compared with that of a complete globe, is nearly equal to one-fifth of the latter.

Bodies whose head-ends are formed with curve lines have great advantage in respect of resistance over those formed with right lines.

The greatest breadth of a moving body should be at a distance from the head extremity equal to two-fifths of the body's length; that the body may move through the water with the least resistance.

Increasing the length of a solid of almost any form by the addition of a cylinder in the middle greatly diminishes the resistance with which it moves, provided the weight in water continues to be the same.

By comparing the resistance of bodies near the surface with those having similar head and stern ends, and which were immersed to the depth of six feet, those at the surface were found to experience more retardation than the others.

(Mariotte, *Traité du Mouvement des Eaux*, 1686; Newton, *Philosophiæ Naturalis Principia*, 1713; Daniel Bernoulli, *Hydrodynamica*, 1738; D'Alembert, *Traité de l'Equilibre et du Mouvement des Fluides*, 1744; *Essai d'une Nouvelle Théorie sur la Résistance des Fluides*, 1752; Emerson, *Mechanics*, 1759; Lecchi, *Idrostatica Esaminata*, 1765; Don George Juan, *Examen Maritimo*, 1771; Michelotti, *Sperienze Hydrauliche*, 1774; Smeaton's *Experiments on Water-wheels*, in the *Philosophical Transactions*, 1759 and 1776; Belidor, *Architecture Hydraulique*, 1782; Prony, *Nouvelle Architecture Hydraulique*, 1790; Bossut, *Traité Théorique et Expérimentale d'Hydrodynamique*, 1796; Venturi, *Recherches Expérimentales sur la Communication Latérale du Mouvement dans les Fluides*, 1797; Prony, *Recherches Physico-Mathematiques sur la Théorie des Eaux Courantes*, 1804; Mollet, *Hydraulique Physique*, 1810; Du Buat, *Principes d'Hydraulique et de Pyrodynamique*, 1816; Hachette, *Traité Elémentaire des Machines*, 1817; Borgnis, *Théorie de la Mécanique Usuelle*, 1821; Robison, *Mechanical Philosophy*, 1822; Gregory, *A Treatise of Mechanics*, 1826; Poisson, *Traité de Mécanique*, 1833.)

HYDROFLUORIC ACID, a compound of fluorine and hydrogen, which was first made known by Scheele. Mr. Knight (*Phil. Mag.*, xvii., p. 357) first suggested an apparatus for procuring it in a state of purity, though not of the greatest strength. The properties of this acid were minutely examined by Gay-Lussac and Thenard in 1810. (*Recherches Physico-Chimiques.*) Fluor-spar, or what is more correctly termed fluoride of calcium, is to be mixed with twice its weight of strong sulphuric acid, and put into a leaden or silver retort, to which a receiver of the same metal is to be adapted, and surrounded with ice or snow mixed with salt. When a moderate heat is applied to the retort the sulphuric acid acts upon the fluoride of calcium, in a mode analogous to that in which its action is exerted upon common salt in preparing muriatic or hydrochloric acid; the results are sulphate of lime, which remains in the retort, while the fluorine of the fluoride uniting with the hydrogen of the decomposed water of the sulphuric acid forms hydrofluoric acid, which, coming over in the state of vapour, is condensed in the cooled receiver; the product is best kept in a silver bottle with a stopper of the same metal.

The properties of this acid are, that it is fluid, clear, colourless, and volatile; and when it escapes into the air, which it does at about 60°, it forms with the moisture of it white fumes, as hydrochloric acid does. Its vapour is extremely pungent and irritating, and it acts strongly on vegetable blues. The specific gravity of hydrofluoric acid is 1·0609, but by the gradual addition of a certain quantity of water, the density may be increased to 1·25. Its attraction for water is very great, and when dropped into it they combine with a hissing noise. The liquid acid is extremely corrosive; when a drop is allowed to fall upon the skin it produces painful sores.

The reason for the necessity of distilling and keeping this acid in metallic vessels is that it acts upon and decomposes glass with great facility, on account of its affinity for the silica which it contains. And hence it has, to a certain though not to a very useful or ornamental extent, been employed to engrave on glass. [FLUOSILICIC ACID.] Although, on account of the difficulty of obtaining fluorine in the separate state, if indeed it has ever been accomplished, the name of hydrofluoric acid has been given to this compound, it is rather from analogy than direct proof that it is considered to consist of hydrogen and fluorine. When exposed to voltaic electricity, hydrogen is evolved from the negative pole, and the positive platinum wire is covered with a brown substance, which is probably fluoride of platinum.

It is considered as composed of—

One equivalent of hydrogen	. . .	1 or	5·26
One " fluorine	. . .	18	94·74
Equivalent	. .	19	100

When hydrofluoric acid is brought into contact with certain metals it is decomposed, hydrogen gas being evolved, and a metallic fluoride formed: upon potassium this action is extremely energetic, and is attended with the evolution of gas and the formation of fluoride of potassium. With metallic oxides it forms a fluoride and water.

Hydrofluate of ammonia may be obtained by saturating the acid with the alkali; it is an unimportant salt, not being applied to any purpose whatever.

HYDROGEN, an elementary body, which, as it is known only in the aëriform state, is usually termed hydrogen *gas*. From the earliest dawn of chemical science elastic fluids have been known which had the property of burning on the approach of flame, and were confounded under the general name of *inflammable air*. As it was afterwards found that there was a difference in their densities, they were distinguished as *light* and *heavy* inflammable air; it is the former of these which is now called hydrogen. Hydrogen gas was first minutely examined, and the mode of preparing it in various ways stated, by Mr. Cavendish. (*Phil. Trans.*, 1766.)

As one of the most remarkable properties of inflammable air is that of forming water by combining with oxygen, the name of hydrogen was given to it by the framers of the French nomenclature, from ὕδωρ, *water*, and the root γεν, which implies *generation*. Hydrogen gas may be obtained in several modes, but it is usually procured by the decomposition of water, by causing some substance to act upon it which has affinity for its oxygen and none for the hydrogen, so that this element is separated, and assumes the elastic or gaseous state.

One of the simplest processes, but not the easiest, is that of putting iron turnings or wire into a gun-barrel, inserting a retort containing water into one end of the barrel and a small curved tube into the other, which is to be immersed under water in the pneumatic trough, and a bottle containing water inverted over the orifice of the tube. When the gun-barrel is heated to redness, and the water boiled in the retort by a lamp, the vapour of the water passing over the ignited iron is decomposed, oxide of iron is formed, hydrogen gas plentifully liberated, and received in the inverted bottle of water. For every nine grains of water decomposed, there are obtained eight grains of oxygen, and one grain of hydrogen gas, which measures 46·51 cubic inches.

There are some metals, as potassium and sodium, the affinity of which for oxygen is so great, that they decompose water even without the assistance of heat.

The usual method however of obtaining hydrogen is that of acting upon iron or zinc by dilute sulphuric acid, and in this case water is decomposed, its hydrogen evolved, and the oxygen, as already mentioned, combines with the metal; but the metallic oxide formed is dissolved by the acid employed, and sulphate of iron or zinc is formed, and the crystallized salt is obtained by due evaporation.

When hydrochloric acid is used with a metal instead of the sulphuric acid, hydrogen gas is also procured by their mutual action; but in this case the hydrogen is derived from the decomposition of the acid, and not of the water, so that a metallic chloride and hydrogen gas result; not a hydrochlorate of a metallic oxide. The hydrogen gas however obtained by the action of zinc or iron is never perfectly pure; it appears not only to dissolve a minute portion of these metals, but, especially when iron is used, according to Berzelius, a small quantity of volatile oil is formed by the combination of a portion of the hydrogen with the carbon which the metal always contains; and it is to this that hydrogen gas owes the peculiar and disagreeable odour that it possesses, and which is only to be got rid of by passing the gas through alcohol or potash, with which the oil combines.

The properties of hydrogen gas are, that it is colourless, inodorous, insipid, and it has resisted all attempts which have been made to condense it by the united agency of cold and pressure; and it has not been separated into two or more kinds of matter, and is therefore undecomposed, and, as far as our knowledge at present extends, it is simple or elementary in its nature. It is the lightest body in nature, 100 cubic inches weighing only 2·15 grains. It refracts light powerfully; by heat it is merely expanded, and suffers no change by the action of electricity, and in electrical decompositions of its compounds it is evolved at the negative pole. This gas extinguishes flame by itself; but when it meets with a supporter of combustion, as oxygen, it burns readily, and with a continuous but feeble flame, and much heat. When mixed with oxygen, a taper causes immediate and loud explosion, attended with the formation of water by the combination of the gases. It is irrespirable for any length of time, but when inspired for a short period it renders the voice remarkably but not permanently shrill; it does not appear to be poisonous, for when mixed with a due proportion of oxygen it may be respired without inconvenience; when it proves fatal, it seems to do so by the mere exclusion of oxygen.

It is very sparingly soluble in water, 100 cubic inches taking up only about one inch and a half of the gas; nor is there any other liquid which is capable of dissolving it in notable quantity. Hydrogen, neither in the gaseous state nor in solution, possesses either acid or alkaline properties.

In its separate state hydrogen has not been applied to any very useful purpose; but on account of its extreme lightness it has been used to fill air-balloons; at present however, by reason of the facility with which it is obtained, from its being prepared for illumination, coal gas is substituted for aëronautic purposes. This however, from its greater density, requires much larger balloons than hydrogen gas.

When mixed with oxygen gas, and the mixture gradually burned in a small jet issuing from Brookes's blowpipe, intense heat is generated; and even if burned in the air, the oxygen of which serves as a supporter of combustion, a considerable degree of heat is generated.

When a very small jet of hydrogen gas is burned, the flickering nature of the flame causes musical sounds when a tube of glass or metal, or even of paper, is held over it.

Hydrogen unites with all other elementary gaseous bodies, and forms with them compounds not only of great curiosity, but of vast importance and utility thus with oxygen it forms water [WATER], with azote, ammonia [AMMONIA], with chlorine, hydrochloric acid [CHLORINE], with fluorine, hydrofluoric acid [HYDROFLUORIC ACID].

It combines with bromine [BROMINE] to form hydrobromic acid. By its union with several non-metallic solids, as with carbon, iodine, phosphorus, selenium, and sulphur, it forms compounds of very different properties; for an account of these we refer to the substances above named, except those which it forms with carbon, and which will be now considered under the head of

Carburetted hydrogen, or rather the *carburets of hydrogen* (or *carbo-hydrogens*), for they are extremely numerous and offer some of the most remarkable instances of what is termed *isomerism* [ISOMERISM], or of the existence of compounds, of perfectly similar composition, possessing very different properties; not such as require nice chemical research for their detection, but the obvious qualities of gaseous, liquid, and solid forms.

The compounds of carbon and hydrogen may be divided into four classes; the gaseous, fluid, solid, and hypothetical, the last comprehending such as have never been obtained in a separate state, but which are considered as compound radicals or bases, and whose elements, at any rate, unquestionably exist in combination with certain other bodies. We shall treat of these compounds in the order mentioned.

1. GASEOUS CARBURETS.—*Carburetted Hydrogen Gas* is that which has been longest known: it is frequently produced in coal-mines, and called *fire-damp*. When mixed with air and exposed to flame it occasions dreadful and destructive explosions. [LAMP, SAFETY.] It was in the early state of pneumatic chemistry described as *heavy inflammable air*, to distinguish it from hydrogen gas, which is lighter, before their different nature had been discovered. It has also been named *light* carburetted hydrogen, to mark the difference between it and another gas since discovered, and also *bihydroguret of carbon*, *inflammable air of marshes*, and *hydrocarburet*.

Carburetted hydrogen gas is also generated in stagnant pools by the action of the carbon of decomposing vegetable matter upon water, by which carbonic acid and the gas in question are formed. By stirring the pools the mixed gases rise, and may be received in bottles filled with and inverted in water. The carbonic acid amounts to about 1-20th part of the gas, and it contains nearly as much azote: the formor may he separated by agitation with a solution of potash.

The fire-damp of coal-mines generally contains atmospheric air; the purest specimen examined by Sir H. Davy from Hepburn colliery contained 1-15th of it, hut no other impurity. In the Apennines, near Pietra Mala, the gas disengaged from a shale stratum was found by Sir H. Davy to be pure carburetted hydrogen. Coal gas and the inflammable gas obtained by heating moist charcoal contain a large proportion of carburetted hydrogen, but very much contaminated with other products. No artificial process for obtaining this gas pure has been discovered. The best method of procuring it is that of disturbing stagnant water, as already stated, and washing with potash to separate the carbonio acid: the azoto which it retains does not prevent the exhibition of its peculiar properties.

The properties of carburetted hydrogen gas are, that it is colourless, nearly inodorous, and insipid. It has not heen rendered fluid by the united agency of cold and pressure. Water absorbs about 1-60th of its volume. It is fatal to animals, extinguishes flame, but is highly combustible when it meets with a supporter of combustion, and extremely explosive when mixed with it. It burns when a taper is applied to it in contact with the air with a yellow flame, and on account of the carbon which it contains it yields much more light during combustion than pure hydrogen gas. [GAS LIGHTS.]

One hundred cubic inches of this gas weigh very nearly 17·2 grains: its specific gravity compared with air is 0·554. It consists of 200 cubic inches of hydrogen gas, weighing 43 grains, condensed to one-half, and combined with 12·9 grains of carbon. It is composed of

One equivalent of carbon	.	6
Two equivalents of hydrogen	.	2
Equivalent	.	8

It is theoretically also regarded as composed of

100 cubic inches of the vapour of carbon,
200 „ hydrogen gas,

condensed to 100 cubic inches.

Its proper appellation is *dicarburet of hydrogen.*

When carburetted hydrogen is passed through tubes made intensely hot, it is decomposed, each volume yielding two volumes of hydrogen, and charcoal is deposited. It is not decomposed by electricity.

One hundred volumes of tbis gas require 200 volumes of oxygen gas for their perfect combustion, and the results are water and 100 volumes of carbonic acid. Chlorine gas and carburetted hydrogen, when quite dry, do not act upon each other at common temperatures, even if exposed to the sun's rays; nor although moisture be present does any action occur in the dark, but the action of light occasions it, the nature of the products depending upon the proportions of the gases employed: they are however hydrochloric acid, oxide of carbon, and carbonic acid. No combination of carburetted hydrogen and any other substance, either elementary or compound, has been discovered.

2. *Olefiant Gas; Bicarburetted Hydrogen, Bihydrocarbon, Hydroguret of Carbon.*—This gas is an artificial product, and was discovered in 1796 by MM. Bondt, Dieman, &c. It is prepared by mixing in a retort three volumes of sulphuric acid and one volume of alcohol: when heat is applied decomposition readily takes place. Alcohol is composed of 3 parts of hydrogen, 12 of carbon, and 8 of oxygen. When, then, it yields olefiant gas, which consists of 1 of hydrogen and 6 of carbon, it is evident that 2 of hydrogen, 6 of carbon, and 8 of oxygen must be separated by the action of tho sulphuric acid; water is probably formed, much carbon is deposited in tbe retort, and carbonic acid and sulphurous acid are generated with the olefiant gas. It is purified from these by being passed through or agitated with lime-water or potash.

Olefiant gas, so called from its property of forming an oil-like fluid when combined with chlorine, is a colourless, elastic fluid: when pure, it has but little odour and is tasteless. It has not heen rendered fluid hy exposure to cold and pressure; it is soluble in about eight times its hulk of water; it is destructive of animal life, is not inflammable unless a supporter of combustion be present, and then it burns with a dense white light, or, if mixed with air, it explodes with great violence on the contact of flame. On account of the larger proportion of carbon which it contains it gives much more light when burning than carburetted hydrogen, and when one measure is burned with three measures of oxygen gas, water and two measures of carbonic acid gas are formed.

One hundred cubic inches of olefiant gas weigh 30·1 grains very nearly; consequently, its specific gravity is rather less than that of air. It has been already stated that it is formed of one part by weight of hydrogen, and 6 parts by weight of charcoal; and although these are equivalents of those elements, it is generally supposed to consist of

Two equivalents of carbon		,	12
Two	„ hydrogen	.	2
	Equivalent	.	14

Or theoretically of

200 cubic inches of the vapour of carbon,
200 „ hydrogen,

400 „ condensed to 100 cubic inches.

The correct name of this gas is *carburetted hydrogen*, but that has so long been appropriated to light carburetted hydrogen that it would now lead to confusion to make the alteration. Bicarburetted hydrogen is an improper appellation, because it implies a compound of two equivalents of carbon and one equivalent of hydrogen. The name of hydrocarbon has in some cases been conveniently adopted.

When olefiant gas is passed through red-hot porcelain tubes, it is decomposed, at least partially, for carbon is deposited, and the gas increases in bulk, showing hy the expansion that hydrogen is set free. When a succession of electric sparks is passed through it, it is resolved into hydrogen gas and charcoal; the hydrogen, for a reason which has een stated, occupying twice the bulk of the olefiant gas subjected to experiment.

Chlorine and Olefiant Gas, as has already been stated, act upon each other; when they are mixed and suffered to remain in contact they combine and condense into the oil-like fluid already alluded to, and which has been called chloric æther and hydrochloride of carbon. The best name is however chloride of hydrocarbon. When first formed it contains a little æther and hydrochloric acid, from which it is separated by being washed with water, distillation from chloride of calcium, successive agitation with potash, water, and sulphuric acid, from which last it is separated by distillation.

Chloride of Hydrocarbon is a colourless volatile liquid; odour æthereal, taste sweetish, insoluble in water, specific gravity 1·2, that of its vapour 3·4 (air = 1), hoiling point about 150° Fahr., burns with a green flame, depositing charcoal, and evolving hydrochloric acid. When passed in vapour through a red-hot porcelain tube it is resolved into charcoal, light carburetted hydrogen, and hydrochloric acid.

It is composed of

One equivalent of chlorine		.	36
One	„ olefiant gas	.	14
			50

Admitting this to be a neutral compound, it agrees with the view already mentioned as to the constitution of olefiant gas, namely, that though its constituents are six parts hy weight of carbon and one part of hydrogen, it consists of two equivalents of each = 14. When a mixture of two volumes of chlorine and one of olefiant gas is fired by a taper, combustion immediately takes place, a large quantity of charcoal is deposited, and two volumes of hydrochloric acid gas are formed.

Iodine and Olefiant Gas also comhine to form *iodide of hydrocarbon*, or *hydriodide of carbon.* It was discovered by Mr. Faraday, who obtained it by exposing iodine and olefiant gas in the same vessel to the solar rays. It is a solid, colourless, crystalline body, has an aromatic odour, a sweetish taste, and is so dense as to sink in sulphuric acid: neither water nor acid or alkaline solutions act upon it, but it dissolves in alcohol and æther, on the evaporation of which the iodide crystallizes.

It is composed of

One equivalent of iodine	.	126
One „ olefiant gas	.	14
Equivalent	.	140

Bromine and Olefiant Gas unite to form *bromide of hydrocarbon*. It was first formed by Serullas, who obtained it by adding one part of iodide of hydrocarbon to two parts of bromine in a glass tube. Reaction quickly takes place, accompanied with heat and a hissing noise; bromide of iodine and bromide of hydrocarbon are formed; water dissolves the bromide of iodine, and the bromide of hydrocarbon falls to the bottom of the vessel; it is coloured by bromine, which is to be removed by potash.

Bromide of hydrocarbon is fluid, colourless, very volatile, has a penetrating æthereal odour, and a very sweet taste. It is heavier than water, very slightly soluble in it; at about 22° Fahr. it becomes solid.

It consists of

One equivalent of bromine	.	78
One „ olefiant gas	.	14
		92

We have now described the only gaseous carburets of hydrogen which have been hitherto proved to be distinct and well-characterized species, and also some of their compounds: it is however probable that another gaseous compound exists in oil gas, and it has been called *superolefiant gas*, *terhydrocarbon*, and *tritocarbohydrogen*. It is supposed to consist of 3 equivalents of carbon and 3 equivalents or 6 volumes of hydrogen condensed into one volume: no definite mode however of obtaining this compound in a separate state has been pointed out. It is also probable that oil gas may contain olefiant gas, holding in solution some of the volatile compounds of carbon and hydrogen discovered by Mr. Faraday; it is therefore extremely difficult to determine by analysis what are mixtures and what are compounds, and to distinguish and separate them from each other.

Liquid Carburets of Hydrogen.—These are very numerous. Those which we shall first describe are all composed of six of carbon and one of hydrogen by weight; but they are of course isomeric bodies, and must be composed of different multiples of these proportions, which have not however been in many cases ascertained.

Caoutchen, obtained by subjecting caoutchouc to distillation. It is a colourless fluid, has a peculiar and æthereal odour; specific gravity 0·666. It remains liquid at 14° Fahr., and boils at 582°.

Ceten, procured by distilling ethal with anhydrous phosphoric acid. It is a colourless oily liquid, which boils at 527°: the density of its vapour is 7·884.

Elaen, an oily liquid obtained by distilling metaoleic and hydroelaic acids. It boils at 230°, and the density of its vapour is 4·488.

Etherin, so called from being supposed to exist in æther. Mr. Faraday obtained it from the volatile liquid which is derived from the inflammable vapours contained in oil gas when subjected to a pressure of thirty atmospheres. When this liquid is heated merely by the hand the vapour of etherin rises, and is condensed by a freezing mixture.

Its properties are, that it is a highly volatile liquid, which boils at so slight an elevation of temperature that it is converted below 32° into vapour. On being cooled to 0°, it again condenses into a liquid, which, at the temperature of 54°, and while kept under the pressure of its own vapour, has a specific gravity of 0·627.

It is sparingly soluble in water; alcohol takes it up largely, and sulphuric acid condenses 100 times its volume of the vapour, and, though it becomes brown, no sulphurous acid is given out; neither hydrochloric acid nor the alkalis affect it. The vapour is extremely combustible, burns with a brilliant flame, yielding water and carbonic acid.

It appears to consist of

Four equivalents of carbon	.	24
Four „ hydrogen	.	4
Equivalent	.	28

Or it is theoretically regarded as composed of

400 cubic inches of carbon vapour		51·6 grs.
400 „ hydrogen gas		8·6 „
condensed to 100 cubic inches, weighing	.	60·2 grs.

Its density is therefore 1·941, and by experiment Mr. Faraday found it to be 1·91.

Eupion. [Eupion.] The number of equivalents which it contains has not been ascertained, but the proportions are as above stated, or six of carbon to one of hydrogen.

Heveen, obtained by the distillation of caoutchouc with sulphuric acid. It is a comparatively dense fluid, its specific gravity being 0·921, and it boils at 579°.

Liquid Hydrocarburet.—This was obtained by Mr. Faraday, after separating solid bicarburet of hydrogen from the fluid procured by pressure upon oil gas, at a temperature of 0°. The remaining liquid was found to exhibit such properties as to identify it as a peculiar and definite compound. The number of the equivalents which it contains has not been determined.

Naphtha.—This fluid occurs, among other places, at Amiano, in the duchy of Parma, and exists also in petroleum, from which it may be obtained by distillation; and coal-tar yields a very similar fluid. Naphtha, when pure, is a colourless, limpid, very volatile liquid, with a strong peculiar odour. Its specific gravity is 0·753; it boils at 176° to 212°; the density of its vapour is 2·833: it remains liquid at 0°. It is insoluble in water, but combines in all proportions with alcohol, æther, petroleum, oils, and sulphuric acid. It is very inflammable, and burns with much smoke.

Chemists are not quite agreed whether its composition is equivalent to 6 of carbon and 1 of hydrogen, or whether it is composed of 6 equivalents of carbon to 5 of hydrogen. In the last case its composition would be

Six equivalents of carbon	.	36
Five „ hydrogen	.	5
		41

Oleen, procured by distilling metaoleic and hydroelaic acids. It is a fluid which boils at 131°, and the density of its vapour is from 2·875 to 3·02.

Benzine.—This is composed of 2 equivalents of carbon 12 + 1 equivalent of hydrogen 1 = 13. [Benzine.]

Volatile Oils.—The following volatile liquid oils are constituted of carbon and hydrogen, and the proportion of 10 equivalents of carbon = 60 + 8 equivalents of hydrogen = 8. Their different properties would however indicate that they are isomeric compounds rather than that all should be composed of exactly these equivalents:—Oil of copaiva, juniper, lemons, black-pepper, savin, and turpentine.

A compound of ten equivalents of carbon and 8 of hydrogen has been called *camphen* and *camphogen*, as being the basis of camphor.

Solid Carburets of Hydrogen.—*Hatchetine.*—[Hatchetine.]

Ozocerite.—This substance is composed of the same proportions of carbon and hydrogen as the preceding. It occurs in Moldavia, and a variety of it has been found in Urpeth Colliery, near Newcastle-upon-Tyne; it is soft, unctuous, gives a greasy stain to paper; semi-transparent; by transmitted light, of a brownish-yellow colour; by reflected light, yellowish-green and opalescent; odour slight fatty, which is more perceptible when melted. It fuses at 140° Fahr., attains its greatest fluidity at about 160°, and begins to boil at 250°. It distils without apparent decomposition. It burns with a pale blue flame, surmounted by a white one, and leaves no residue.

It is very sparingly soluble in alcohol, more soluble in æther, and does not appear to suffer any change when boiled either in concentrated hydrochloric, nitric, or sulphuric acid.

Paraffin was discovered about the same time by Dr. Christison and Dr. Riechenbach; the former obtained it from the petroleum of Rangoon, and called it *petrolin*. In distilling beech-tar, Dr. Riechenbach found that the heaviest of these liquids which it yields is unctuous, and contains paraffin, which is separated and purified by repeated distillation, heat, and the action of sulphuric acid.

Its properties are, that at common temperatures it is a fatty but rather firm solid; it is tasteless, inodorous, and its density is 0·87; at 111° Fahr. it melts into an oily liquid, and evaporates without change; it burns with a pure white flame. It is soluble in alcohol, oil of turpentine, naphtha, and the fat oils when heated, and it unites with most fatty bodies by fusion; neither chlorine, acids, nor alkalis have any action upon it, and it may be fused with potassium without change. It consists, like olefiant gas and hatchetine, of 6 of carbon and 1 of hydrogen, but neither the density of its vapour nor its equivalent is known.

Solid oil of roses is crystalline, and becomes liquid at 95°, and boils at 536° to 572°. It is composed of 6 carbon and 1 hydrogen, but its equivalent has not been determined.

Idrialin was obtained by M. Dumas from a mineral found in the quicksilver mines of Idria, whence its name; this substance is solid, insoluble in water either cold or hot, and only slightly dissolved by alcohol or æther, but readily so in boiling oil of turpentine, from which it deposits on cooling; it imparts to sulphuric acid a beautiful blue tint, like sulphate of indigo. It is composed of 18 parts of carbon and 1 of hydrogen, which represent 3 equivalents of carbon and 1 equivalent of hydrogen; its equivalent has not been ascertained.

By the destructive distillation of amber, a carburetted hydrogen similar in composition and properties to idrialin has been lately obtained.

Naphthalin.—This name was given by Dr. Kidd to a substance which had been previously described by Mr. Garden in 1819, and by Mr. Brande in 1820, who stated his belief that it was a carburet of hydrogen. This substance is one of the products of the distillation of coal, and is contained along with naphtha in coal-tar, on distilling which naphtha first passes over, and the naphthalin afterwards rises and is condensed in the neck of the retort. Its properties are that it is solid, colourless, and crystalline; when quite pure it is nearly inodorous, but has generally a disagreeable odour; its taste is pungent and somewhat aromatic; it is unctuous to the touch, heavier than water, in which it is insoluble when cold, and only slightly dissolved if hot. It is soluble in alcohol and æther, and from a hot solution it deposits on cooling. Naphtha, oil of turpentine, and olive oil, also dissolve it. It fuses at about 180° to 200°, assumes a crystalline texture on cooling, volatilizes slowly at common temperatures, and boils at 410° Fahr. It does not exhibit either acid or alkaline properties with test papers; it is not acted upon by alkalis; with acetic and oxalic acids it forms pink-coloured solutions; hydrochloric acid dissolves it but sparingly; and by boiling in nitric acid both are decomposed. With sulphuric acid it combines to form a compound called by its discoverer Mr. Faraday sulphonaphthalic acid. The vapour of naphthalin was found by Dumas to have a specific gravity of 4·528; now supposing 100 volumes of the vapour to contain 1000 measures of carbon vapour, and 400 of hydrogen gas, its weight would be—

			Grains.
1000 cubic inches of carbon vapour		. .	129·
400	„	hydrogen gas . .	8·6
100	„	naphthalin vapour .	137·6

According to Dumas, the specific gravity is 4·528, whereas that indicated by the above hypothesis is 4·43.

It follows, if the above statement be correct, that naphthalin consists of—

Ten equivalents of carbon . .	60
Four „ hydrogen . .	4
Equivalent	64

Chlorine and Naphthalin combine to form a solid and a liquid compound; the solid chloride is insoluble in water, and nearly so in alcohol; boiling æther takes it up, but deposits on cooling in rhombic crystals; it melts at 320°, but it may be distilled unchanged; neither acids nor alkalis act upon it, except the fixed alkalis when heated. It appears to be a bichloride of naphthalin, composed of—

Two equivalents of chlorine . .	72
One equivalent of naphthalin .	64
Equivalent	136

The liquid chloride of naphthalin is obtained by evaporating the ætheroal solution. It has a light yellow colour, an oily appearance, is heavier than and insoluble in water. Alcohol dissolves it, but æther more readily; acids act but feebly upon it, and it may be distilled without suffering decomposition.

It is probably composed of—

One equivalent of chlorine . .	36
One „ naphthalin .	64
Equivalent	100

Paranaphthalin has been supposed to be a peculiar carburetted hydrogen, closely allied to naphthalin in composition and properties. According however to Riechenbach it is a mixture of naphthalin and paraffin.

Caoutchouc has already been noticed as a carburet of hydrogen. [CAOUTCHOUC.]

HYPOTHETICAL CARBURETS OF HYDROGEN.—*Ethule*, or *Ethereum*, is one of these, which has already been noticed; it is regarded as hypothetical because it has never been obtained in a separate state. Æther is supposed to be an oxide of ethereum, alcohol a hydrated oxide, and sulphovinic acid a hydrated bisulphate of oxide of ethereum.

It is regarded as composed of—

Four equivalents of carbon . .	24
Five „ hydrogen .	5
Equivalent	29

Methylen.—In the 60th vol. of the 'Philosophical Magazine' Mr. Philip Taylor described a peculiar volatile inflammable fluid under the name of *pyroligneous æther*, as being obtained during the preparation of pyroligneous acid from the distillation of wood. It has since been called pyroxylic spirit. [PYROXYLIC SPIRIT.]

According to Dumas and Peligot, pyroxylic spirit is composed of—

Two equivalents of carbon . .	37·4
Four „ hydrogen .	12·6
Two „ oxygen .	50
Equivalent	100

They consider however that it contains a peculiar carburetted hydrogen which they call methylen, composed of 1 equivalent of carbon 6 + 1 equivalent of hydrogen 1 = 7, and that pyroxilic spirit is in fact composed of—

One equivalent of methylen . .	7
One „ water . .	9
Equivalent	16

Although methylen has never been obtained in a separate state, yet it has been separated from the water, and combined with various acids, as with hydrochloric acid, nitric acid, sulphuric acid, oxalic acid, &c. With some of these it forms crystallizable salts.

We have now noticed the more important compounds of carbon and hydrogen; but chemical research is almost daily adding to their number. In the 'London and Edinburgh Philosophical Magazine' for October last, several new compounds are mentioned by M. Pelletier, who has promised further details on the subject; and some others are described by M. Laurent, but which appear to be isomeric with, if not absolutely similar to, previously described compounds.

It will be observed that some of these compounds, as naphthalin, ethule, and more especially methylen, act the parts of alkalis by combining with and saturating acids, and producing crystalline salts with them; and it is a curious circumstance that methylen, which is a theoretic carburet, appears to possess the most extensive power of combination: indeed it may perhaps be on this very account that it has not yet been isolated.

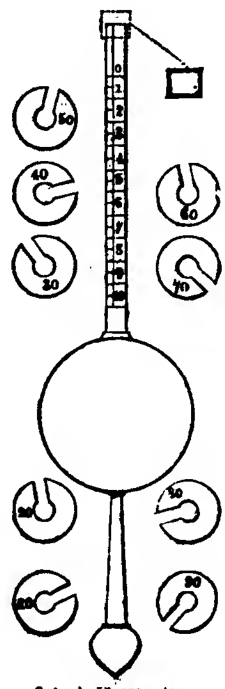
HYDROLEA'CEÆ, a very small and unimportant natural order of Monopetalous Exogenous plants, allied to Convolvulaceæ, with which they were once united. They are weeds inhabiting the East Indies, with alternate glandular or stinging leaves, monopetalous regular flowers, with a gyrate inflorescence, definite stamens, a superior polyspermous 2- or 3-celled fruit, and seeds with the embryo lying in the midst of fleshy albumen. In their gyrate inflorescence they correspond with Boraginaceæ.

Hydrolea spinosa.

1, a flower, seen from beneath; 2, a stamen; 3, a ripe seed-vessel; 4, a section of a seed, showing the embryo.

HYDRO'METER (ὕδωρ, water, and μέτρον, a measure) is an instrument for determining the relative densities or specific gravities of fluids. The principle of the hydrometer is this:—It is known that when a body is immersed in a fluid it loses as much of its weight as is equal to the weight of that portion of the fluid which it displaces. [HYDROSTATICS.] Thus if a body suspended from the extremity of one arm of a balance be counterpoised by weights applied to the other arm, and while thus suspended it be immersed in a vessel of water, it will be found that one arm of the balance will preponderate, and that in order to restore the equilibrium as much weight must be applied to that arm from which the body is suspended as is equal to the weight of the water displaced. Hence if the same body be immersed successively in two different fluids, the portions of weight which it will thereby lose will be directly proportional to the specific gravities of those fluids; because the diminution of weight is always equal to the weight of the fluid displaced, that is, to the magnitude of the body multiplied into the specific gravity of the fluid. The above supposes the body to be specifically heavier than the fluid. If it be lighter it will float upon the surface, so that its tendency to descend, or its weight, will then be entirely counteracted by the fluid; from which it appears that when a body floats upon the surface of a fluid, the weight of the portion of fluid displaced is equal to the entire weight of the body. Now since the weight of the fluid displaced by a floating body is constant (being always equal to the weight of the body), whatever may be the density of that fluid, it is obvious that if we can determine how much of the body is immersed we may immediately deduce the specific gravity of the fluid; because when the weight is constant, the specific gravity varies inversely as the bulk.

Upon this principle is constructed the instrument known by the name of Sykes's hydrometer, which is now universally employed in the collection of the spirit revenue of Great Britain. It consists of a thin brass stem about six inches in length, passing through and soldered to a hollow ball of the same material, and about one inch and a half in diameter. To the inferior extremity of the stem, from which the hollow ball is about one inch distant, a permanent pear-shaped weight is attached; so that when the instrument is placed on a fluid the other extremity may float perpendicularly to the surface. There are also ten weights of different magnitudes, nine of which are circular, and applicable by means of a slit to the lower branch of the stem. These are marked 10, 20, 30, 40, 50, 60, 70, 80, and 90 respectively, and by their successive application the instrument may be sunk so as to obtain the complete range of specific gravity, from that of pure alcohol to that of distilled water. The other weight is of the form of a parallelopiped, and may be fixed when necessary to the upper branch of the stem. The upper branch of the stem is divided into ten equal parts or degrees, each of which is subdivided into two parts. The whole is adjusted at the temperature of 60° Fahr., and tables are computed whereby the necessary corrections may be determined for all variations above or below that point. In order to determine the strength of spirit by means of the hydrometer a portion is placed in a tall glass cylinder, and the temperature observed. One or more of the circular weights is then attached to the lower stem of the instrument, so that the lower extremity of the scale may sink beneath the surface of the fluid, and when the whole has become stationary the number upon the scale in contact with the surface of the fluid is observed. This number added to the number marked upon the circular weight employed will give a third number, adjacent to which, in the tables above mentioned, and under the head of the proper temperature, will be found the per centage of strength required.



Sykes's Hydrometer.

The most convenient method of obtaining the specific gravities of fluids is by means of what chemists call a 'thousand-grain bottle.' This is a bottle of a globular form, with a ground-glass stopper, so adjusted as to contain exactly 1000 grains of distilled water, at the temperature of 60° Fahr., and accompanied by a weight, which is an exact counterpoise for the bottle when thus filled. In order to determine the specific gravity of a fluid by this means, it is simply necessary to fill the bottle with that fluid at the temperature of 60°, and place it, together with the adjusted weight, in the opposite scales of a delicate balance; then the number of grains which it will be found necessary to add to one of the scales, in order to produce equilibrium, will be the difference between the specific gravity of the fluid and that of water taken at 1000.

HYDROME'TRIDÆ, a family of insects, belonging to the order Hemiptera. This family was established by Dr. Leach, and is thus characterised:—Rostrum with two or three distinct joints; labrum very short; eyes moderate; feet very long, formed for walking on the water, with the claws minute, inserted laterally into a fissure on the extremity of the terminal joint of the tarsus.

The genera *Hydrometra*, *Gerris*, and *Velia* of Latreille belong to this family. Those species which have cetaceous antennæ, the head prolonged into a snout and receiving the rostrum beneath, belong to the first of these three genera, of which the *Hydrometra stagnorum* will serve as an illustration." This insect is about 3-8ths of an inch in length, and not broader than an ordinary sized pin, of a black or brown colour, with pale brown legs, and is very common on ponds and ditches, generally near the margin. Like the other species of the family Hydrometridæ, it possesses the power of walking upon the surface of the water: it differs however from those of the two remaining genera, inasmuch as its movements are comparatively slow.

In the genus *Velia* the antennæ are filiform, four-jointed, the first joint the longest, the remaining joints long, about equal to each other, and bent at an angle with the first; rostrum two-jointed; legs moderate, and nearly equidistant.

Velia rivulorum (Latreille) is a very common insect in this country, frequenting running streams, and running on the surface of the water with great rapidity. It is about 1-4th of an inch in length, and 1-12th in breadth; of a black colour, the body red, spotted with black, the thorax brown, with two white spots, and the elytra each with four white spots.

The principal characters of the genus *Gerris* are:—Antennæ filiform, four-jointed, the basal joint nearly as long as the remaining three; rostrum three-jointed, legs long, the second pair the longest, and inserted far from the first.

Gerris paludum is about 5-8ths of an inch in length, and 1-12th in breadth, of a brownish-black colour above, and silvery-white beneath. This insect is very abundant, and its peculiar habits of darting about on the surface of the water must have attracted the attention of all persons. Its food appears to consist chiefly of such insects as are blown or accidentally fall into the water, which it seizes with its fore legs.

HY'DROMYS. [MURIDÆ.]

HYDROPHI'LIDÆ, a family of Coleopterous insects established by Leach. The insects of this family are included by Latreille in his section Palpicornes. They have generally nine joints to the antennæ, but sometimes only six; the terminal joints always form a perfoliated knob; the maxillary palpi are very long and slender; the body is usually oval or rounded, convex above and flat beneath, or nearly so: the tarsi are five-jointed, and the mandibles bidentate.

The principal genera of the family Hydrophilidæ may be thus characterized:—

Genus *Hydroüs*.—Antennæ with the terminal joint acuminated; sternum produced into an acute spine, which reaches considerably beyond the insertion of the posterior pair of legs; scutellum large; labrum entire; tarsi of the four posterior legs compressed and furnished with bifid claws. The male sex has the anterior tarsus dilated.

Hydroüs piceus (Hydrophilus piceus of the older authors) is one of the largest beetles of this country, measuring about one inch and a half in length. It is of a glossy black colour and oval form, convex above and flat beneath, and has the elytra somewhat pointed at the apex. This insect is not very uncommon in stagnant waters in certain parts of England. It lives near the bottom of the water, and may be said to walk rather than swim in that element. The female insect deposits her eggs in a little nest composed of a gummy substance, which is ejected from the abdomen, and in this nest the eggs float until they are hatched. The larvæ, which are of a lengthened form and brownish colour, live in the water.

Genus *Hydrophilus* (Leach).—Labrum emarginated; mandibles internally ciliated; antennæ, with the terminal joint, somewhat obtuse, and obliquely truncated; sternum terminating in a slightly acute spine, which scarcely reaches beyond the insertion of the posterior legs; claws dentated at the base; the anterior tarsi simple in both sexes.

Hydrophilus caraboïdes (Linnæus), a common insect in some parts of England, and, like the species which is given as an illustration of the preceding genus, lives in stagnant waters. Its form is oval, convex above, and flattened beneath; and the elytra are rounded posteriorly. It is of a glossy black colour, sometimes with a bluish or violet hue, and about three-quarters of an inch in length.

The genus *Spercheus* (Fabricius) is chiefly distinguished by the antennæ, which apparently are only six-jointed; the clypeus emarginate; the maxilla with the external lobe palpiform: tibia smooth. The body is very convex.

Spercheus emarginatus (Fabricius) is about a quarter of an inch in length, and of a brownish colour above and blackish beneath. It lives in stagnant waters, and has been found adhering to the roots of plants. As yet this has always been considered a very uncommon insect in England.

Genus *Berosus* (Germar).—Eyes prominent; clypens entire; apparently eight-jointed, the terminal joint large and somewhat globular; thorax very convex; the elytra broader than the thorax, and also very convex; posterior tarsi ciliated.

Berosus luridus (Stephens) is less than a quarter of an inch in length, of an oval form, and greyish-yellow colour. The head is of a brassy green colour, and there is a spot of the same hue on the thorax. The elytra are striated. This species is common in ponds, &c. in various parts of England.

Genus *Hydrobius* (Leach).—Antennæ nine-jointed, the terminal joint somewhat compressed and acuminated; clypeus entire; scutellum small; sternum simple; eyes small and not prominent; claws simple.

The species of this genus are usually of small size, of an oval or rounded form, and always very convex. Like those of the preceding genera, they live in ponds and ditches, and appear to prefer stagnant waters. Mr. Stephens, in his 'Illustrations of British Entomology,' enumerates twenty-five species.

HY'DROPHIS. [HYDRUS.]

HYDROPHO'BIA (from ὕδωρ, water, and φόβος, fear) is the disease occasioned by inoculation with the saliva of a rabid animal, and is so called from the violent and suffocating spasms of the throat which occur when the patient attempts to drink, or when, in the latter stages, the mere idea of drinking arises in his mind. The disease is never produced in man by any other cause than the saliva of a rabid animal: those cases which have been said to arise spontaneously have not presented all the true characters of the affection, and have in general been only severe cases of hysterical or other convulsions, in many of which the imagination and the fear of real hydrophobia had much influence. Whether it is ever spontaneously generated in animals is less certain, because its origin in them is less easily traceable; but the fact that it is possible to keep the disease from packs of dogs, in which every fresh comer is submitted to a kind of quarantine, and the many instances now known of isolated situations in which, although dogs are very numerous, no case of hydrophobia has occurred for many years, tend to prove that in the dog also it arises only in consequence of the bite of some other rabid animal. It is probable that all animals are subject to hydrophobia, for all that we have an opportunity of observing, that is, all our domestic species, are; but it has not appeared that any, except the wolf, fox, cat, and dog, are capable of communicating it to each other, or to other species. There is no evidence whatever to prove that the disease can be communicated from one human being to another; men affected by it are not disposed to bite, and it is doubtful whether, if they did bite, the saliva would have any effect, for the experiments made with it upon animals are as yet contradictory and inconclusive.

The disease may be communicated to man either by the saliva being carried into a wound made by the tooth of a rabid animal, or by its being placed on the surface of a previous wound, as where dogs have licked the hand or face of a person in which there was any raw surface. However, it is only a small portion of the bites which a mad animal gives that convey the disease; if, for example, he bites through the clothes, there is a great probability that all the saliva will be wiped off from his teeth as they pass; and hence wounds of the hands and face are generally the most dangerous. It is probable too that the saliva differs in the degree of its virulence in different animals; the bite of the mad wolf seems generally more fatal than that of the dog. In a case known to John Hunter twenty-one persons were bitten by the same dog, and only one had hydrophobia; in another a wolf bit seventeen persons at Brive, and of these ten died by hydrophobia; in a third fifteen persons were bitten by a dog, in ten of whom the wound was on the flesh, and three died. In none of these cases had any preventive measures been used; and from the evidence collected from various sources Dr. Hamilton (*Remarks on Hydrophobia*, vol. i.) thought that whether preventive means were employed or not, only one person in twenty-five of those bitten by mad dogs would have hydrophobia. It appears that animals are more subject to the disease than man; for in a case where a dog bit four persons and twelve dogs, all the dogs died, but not one of the men. These results, although they should not prevent the surgeon from employing those measures which prevent the disease, fully explain how empirical remedies have obtained so much credit, the immunity from the disease being attributed to their influence, when it would have been as complete if they had never been used.

The period after the inoculation at which the symptoms of hydrophobia may exhibit themselves varies greatly. In the ten persons already mentioned who were bitten by the wolf, one was affected on the sixteenth and another on the sixty-eighth day after their wounds were received; in the five bitten by the same dog the deaths occurred between the thirtieth and sixty-third days. In general the disease appears between the thirtieth and fortieth days from the injury; but cases are known where it has been delayed as long as eighteen months, and Dr. Bardsley believes that a person who has been bitten and used no preventive measures cannot be considered as perfectly safe till at least two years have elapsed. Cases are indeed recorded in which there was no evidence of injury for ten and twelve years before the disease manifested itself, but at present neither the number nor the accuracy of such histories is sufficient to allow any safe conclusion to be drawn from them.

The bite of a rabid animal generally heals up like that of a healthy one: there is nothing whatever which would indicate danger from it, and the patient is attacked when he had forgotten that he was ever bitten. In some cases however, before hydrophobic symptoms appear, the scar of the wound becomes painful, red, and swollen, and pain is felt shooting from it along the course of the nerves of the part, as if it were going to ulcerate. The first decided indication of the disease is that the patient has headache and general uneasiness; he loses his appetite, and when he is about to drink be suddenly feels an aversion to any liquid, and is choked by any attempt to swallow it. He generally discovers this inability to drink accidentally, and often expresses his wonder that he should not be able to quench his thirst. The symptoms, once set in, rapidly increase in severity: any attempt to drink, and even anything that can suggest the idea of drinking, as the sound of liquid poured from one vessel into another, or the bright shining surface of polished metal looking like the surface of water, is sufficient to bring on the most frightful spasms of the throat, threatening instant suffocation, and producing the most severe pain. The convulsions, which were at first limited to the muscles of the throat and of deglutition, after a short time extend to other parts of the body; there is a constant agitation of the limbs, and a remarkable degree of nervous excitement; the patient is restless, anxious, and timid; his eye has a peculiarly unsteady glistening appearance, and he is often delirious, and talks with the greatest rapidity and earnestness to persons who are not present, or he thinks that his attendants are going to rob or murder him, and is haunted with frightful visions. As the disease proceeds, the convulsions of the throat become more frequent and severe; a breath of cool air, or the slightest noise or vibration of the room, is sufficient to excite them: there are severe headache, a rapid pulse, a foul tongue, and other symptoms of a generally disordered condition of the system. A copious secretion of thick tenacious mucus clogs up the air passages, and increases the feeling of suffocation, and it is in his attempts to free himself from this that the patient coughs and makes a loud harsh noise, which has been supposed to resemble the barking of the animal by which he was bitten. Sometimes there is furious delirium; but often for the last few hours of life the patient becomes quiet: he falls perhaps into a tranquil sleep, as if fatigued by his exertions, or he lies perfectly still, without spasms, and rational; but it is only a deceptive calm which presages his death; he rouses from his tranquillity, and, after one or two comparatively slight convulsions of the throat or of the whole body, expires. The duration of the disease is very rarely more than six days, and it often terminates fatally in twenty-four hours. In the latter cases the patient usually dies suffocated by one of the spasms of the throat; in the former he may have several remissions, in which the severity of the affection greatly decreases, and which may for a time seem to afford a hope of recovery. In most cases solids can be swallowed without much difficulty; and it is remarkable that in those who have been bitten by mad cats there is far less aversion to water than in those who have received the disease from the other species.

Nothing can at present be regarded as certainly known of the true nature of hydrophobia. Dissections of those who have died of it have shown the effects, but not the causes of its symptoms; as redness and turgescence about the throat and larynx, and general congestion from the frequent suffocative attacks. With this ignorance of its nature there is unfortunately an equal ignorance of any mode in which it may be treated with a prospect of success; for of all the medicines recommended (and probably no disease has been more variously treated) there is not one which has sufficient evidence to prove that it has been of the least avail, except in temporarily mitigating the symptoms. Opium in very large doses will produce quietude and great comfort to the patient by warding off the attacks of spasm, and will prolong though it will not save life; and large bleedings have been useful in lessening the severity of the convulsions. But the only question that can be satisfactorily considered is that of prevention, which is accomplished by the removal of the morbid saliva from the wound before it has had time to produce its fatal influence on the body. Excision is at once the safest and most simple means, and whenever it is practicable should be employed as early as possible; the parts bitten should be completely cut out, with some of the sound tissues around them, and care should be taken that the very bottom of the wound is removed; for if a portion of the wounded surface remain, the patient is not secure. In some cases however, as where the wound is superficial but extensive, or where it is situated on the face, or near an important organ, excision may be deemed unadvisable, and in these the best remedy is some violent caustic: pure nitric acid, or fused potash, or nitrate of silver, should be applied freely over the whole surface of the wound, so as to decompose every particle of the saliva. A third means is the careful washing of the wounds, but it is one on which it would be imprudent entirely to rely, though it should always be diligently employed until medical assistance can be obtained, and is useful after the parts have been cut out. The best mode of washing the wound is to pour water at a temperature of 90° or 100° on it, from a height of four or five feet, through the spout of a tea-kettle, and it should be continued for two or three hours, unless the other means are resorted to. It is not yet known at how late a period after the infliction of the injury it would be useful to remove the parts bitten; but considering the length of time during which the poison remains latent, and the probability that during that time it has only a local influence, it would certainly be prudent to remove the wounded parts after a lapse of even many days. Of course the value of these means is open to the objection already mentioned, that even when the patient does not suffer from hydrophobia it is uncertain whether his immunity depends on the measures employed; but it may be sufficient to state, that while every other remedy has frequently been unavailing, excision, when carefully employed, has been invariably successful, and the caustic has very rarely failed.

As a large majority of the cases of hydrophobia which occur in this country are the consequence of the bite of the mad dog, it may be useful to add the symptoms which be presents when in that state. He grows sullen and snarly; he leaves his home and runs about wildly, biting at whatever approaches him, though he will seldom go out of his way to attack, and be constantly gnaws grass and straws and pieces of wood or stone. To those however with whom he associates his demeanour is at first unaltered, and he caresses them as usual; and hence the cases in which death has followed the licking of a wound by dogs who showed no symptom of hydrophobia. It is an error to imagine that the mad dog avoids the water, for he will both drink it and swim in it as usual, and without presenting any of that horror of it which characterizes the disease in man. Towards the close of the disease he grows more furious, gnawing and biting at every thing around him, and frothing at the mouth. The disease is as incurable in the dog as in man, and usually lasts about the same length of time.

HYDROPHYLLA'CEÆ, alternate-leaved, gyrate-flowered, herbaceous, Exogenous plants, with regular monopetalous flowers, a definite number of stamens, unilocular fruit, with few or many seeds either adhering to 2 free placentæ, or parietal. It is near Boraginaceæ, but differs in the structure of its seeds and fruit. Many of the species, especially those of the genera Nemophila and Eutoca, are beautiful objects: they are all natives of North America.

Hydrophyllum virginicum.

1, an entire flower; 2, the ovary; 3, a ripe seed-vessel; 4, a section of a mature seed.

HYDROPS PERICARDII, or HYDROPERICA'RDIUM (from ὕδωρ, water, and περικάρδιον, the pericardium), is a collection of an unnatural quantity of fluid in the sac containing the heart. It is in all cases the consequence of some organic disease producing dropsy in other parts of the body, or of inflammation of the pericardium, the early stages of which are accompanied by the effusion of fluid, varying in quantity from a few ounces to two pints. As the inflammation subsides, the fluid, which is usually of a yellowish or reddish colour, is generally absorbed; but in some rare cases it continues to accumulate, so as to distend the pericardium and materially impede the heart's action. This disease can never require any means of treatment directed exclusively to itself, but must be treated by those proper for the conditions by which it is produced and maintained.

HYDROSAURUS. [Iguanidæ.]

HYDROSTATICS is the science which relates to the pressure and equilibrium of the fluids commonly called non-elastic, or incompressible; as water, mercury, &c., and to the equilibrium of bodies immersed in them. The elastic fluids, as air, steam, &c., are the subjects of pneumatics.

The two books of Archimedes entitled, in Latin, 'De Humido Insidentibus,' contain all that is known concerning hydrostatics, properly so called, among the antients. That philosopher showed from experiment that a mass of fluid will be in equilibrio when each of its particles is pressed equally in every direction. He explained that a floating body is held in equilibrio when its centre of gravity and that of the displaced fluid are in one vertical line; and that when bodies are immersed in a fluid of less specific gravity than themselves they lose certain portions of their weights. The latter principle led him to the means of ascertaining the quantities of two different ingredients when mixed together in one mass; and he applied it in detecting the quantity of alloy in a golden crown which had been executed for the king of Syracuse.

The cause of fluidity in bodies has been the subject of much discussion. It has been supposed to depend on the globular form of the particles, or on the caloric contained between them; or, finally, on both these circumstances combined. But, whatever be the primary cause, it is admitted by all that the property must arise, immediately, from the perfect mobility of the particles among one another; in consequence of which the mass immediately takes the figure of any vessel in which it is received, its upper surface assumes a level position, and by which, also, it begins to flow as soon as an orifice is made in any part of the sides or bottom of the vessel. Some difference exists however in the fluidity of different bodies: such as mercury, water, &c., in their ordinary state, possess this property in a high degree; while the particles of many fluids, as the oils, have a sensible adhesion to one another. Except pure alcohol, all the non-elastic fluids, at certain temperatures, become congealed, and thus entirely lose their fluidity.

Since pores are known to exist between the particles of all bodies, fluid as well as solid, it may readily be conceived that no fluids can be absolutely incompressible; and experiments have been made from which it is manifest that spirit of wine, oil, water, and even mercury, can, by pressure, be reduced in volume, in certain degrees; the fluids which have the greatest specific gravity suffering the least compression. But as this diminution is very small when compared with the volume of the fluid (being for water, according to the experiments of Mr. Canton (*Phil. Trans.*, 1762, 1764), only $\frac{1}{21740}$th part of the volume when the pressure is equal to that of the atmosphere in its ordinary state), for all practical purposes of hydrostatics such fluids may safely be considered as experiencing no change of volume by the compressions to which they may become subject.

Experiment has also shown that all the non-elastic fluids possess the property of transmitting equally in every direction the pressure exerted against any point on their surface. If, for example, a piston were forced into an orifice made in any part of the side of a vessel containing such a fluid, the effect of the pressure would be experienced equally at every point on the whole surface of the vessel. This property has hence been denominated the *quâquâversus* propagation of pressure; and it may be conceived to result from that perfect mobility of the particles among one another which has been above alluded to, and which enters into our first conception of fluidity.

But the pressure exerted by a fluid against the sides and base of a vessel in which it is contained, in consequence of a force thus partially applied, should be carefully distinguished from that which is caused by the gravity of the fluid; the former being the same in every part of the fluid mass, while the latter, at every point in the sides, depends on the depth of the point below the upper surface of the fluid.

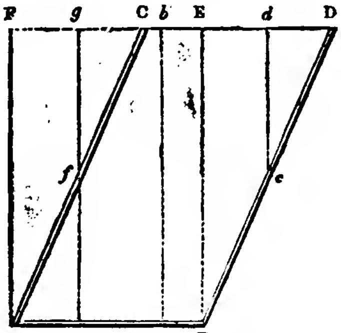
It has been said above that a fluid in any vessel will have its upper surface in a level plane, or in a horizontal position; but it must be observed that, since the fluids on the earth are attracted towards the centre of gravity of the latter (leaving out the consideration of all disturbing forces, and considering the earth as a sphere), the particles must dispose themselves every way spherically about that centre; and consequently the upper part of a fluid in any vessel must be understood to form a portion of a spherical superficies concentric with that of the earth.

The quâquâversus pressure above mentioned has long since been proposed to be employed as a means of transmitting the action of a moving power to any distance however great. For this purpose it has been projected to fill with water a horizontal tube having at each extremity a short arm in a vertical position; and in each of these arms to have a piston. Then that which is at one end of the tube having received the action of the moving power, it will, by means of the fluid, transmit the motion to the other; the rod of which should be in connection with the machinery on which it is intended to act. It may be remarked that the principle has been recently proposed for adoption in communicating intelligence between two places remote from each other.

From the same property it follows that if a fluid at rest in a vessel be supposed to consist of an infinite number of filaments, or infinitely slender columns in vertical positions, the pressure which, in consequence of the weight of the particles vertically above it, is exerted in every direction by any particle of such filament, will be counteracted by the equal pressure of all the surrounding particles, so as to remain at rest, and act by its gravity on the particle vertically under it. And that the pressure exerted by the fluid against every part of the surface of the vessel containing it, will, while the fluid is at rest, be perpendicular to the surface; since, otherwise, the reaction of the surface could not entirely destroy that pressure, and a part of it would disturb that equilibrium which, by hypothesis, is the condition of the fluid in the vessel. The amount of that reaction is, of course, equal to the weight of a filament of fluid vertically above the point and extending to the upper surface of the fluid; or to the weight of any one of the neighbouring filaments comprehended between the upper surface and a horizontal plane passing through the said point. The pressure of all the particles in the upper surface of the fluid is evidently nul.

It may, hence, also be proved, that the pressure on the base of any vessel containing a fluid, will be the same whatever be the form or position of the sides of the vessel, provided the fluid have always the same height above the base. For let ABCD (*fig.* 1) be a vertical section through a pris-

Fig. 1.



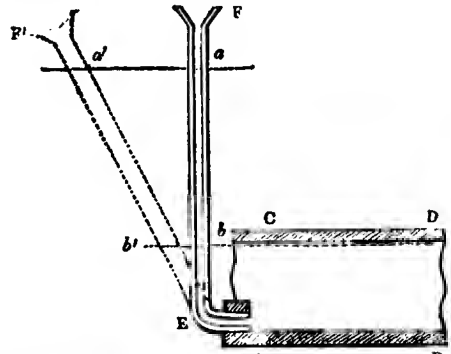
matical vessel; the pressure on any point a of the base is evidently equal to the weight of the vertical filament $b\,a$; that on any point c of the inclined side BD is the weight of the filament $c\,d$; and this last produces no effect on the base, because the lateral pressures of all the particles in every vertical filament, are counteracted by those of the particles in the neighbouring filaments. The same thing must be understood of all the water in the portion EBD. The pressure on any point e under the inclined side AC is equal to the weight of the filament $e\,f$, together with the pressure arising from the reaction of the side AC at f, in the vertical direction $f\,e$; and this reaction is, from what has been said, equal to the weight of a filament which may be supposed to exist above f, with a height equal to $f\,g$. Consequently, the pressure on AB, when the sides of the vessel are inclined to the horizon, will be equal to that upon the same base when the sides are in vertical positions. This is the foundation of the experiment usually exhibited in popular lectures, when columns of water of equal height, in cylindrical and conical vessels, having equal bases, but of course containing very different quantities of the fluid, are shown to be in equilibrio with one and the same weight applied to prevent the moveable bases from descending.

It may readily be inferred from the above that the pressure on the base will be equal to the weight of a vertical prism or cylinder of the fluid, whose base is that of the vessel, and whose altitude is that of the fluid which it contains, whatever be the form or inclination of the sides.

When the bases of two vessels containing fluid of the same kind are equal, the pressures on those bases will be proportional to the altitudes of the fluids; and if the altitudes are equal, the pressures will be proportional to the areas of the bases.

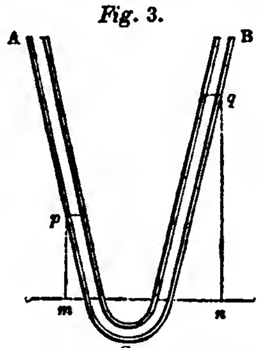
On the same principle may be explained the experiment which has been denominated the hydrostatical paradox. In this is employed a cylindrical machine formed of two circular plates of wood, as AB and CD (*fig.* 2), with sides of leather like those of a pair of bellows. A tube FE is inserted in an orifice near the bottom, and through this tube water is poured into the cylinder, till the boards AB and CD are at any distance asunder within the limits allowed by the leathern sides. Then, if any weight be placed on the board CD, it will cause the water to rise in the tube EF to a certain height, suppose a; and the weight of the small column $a\,b$ of water may be considered as holding in equilibrio the weight applied on CD; which will, in fact, be found to be equal to that of a cylinder of water whose base is the area of the board CD, and whose height is equal to $a\,b$.

Fig. 2.



If the tube EF were made to decline from the vertical so as to take any oblique position E F′; it would follow, since the pressure of a fluid by gravity depends on the vertical height only of the column, that the fluid in the tube, from the same pressure on CD, would rise till its upper surface is in a horizontal plane $a\,a'$ passing through a: and the weight of the column of fluid must be estimated by the area of the horizontal section at b' multiplied by the vertical height of a' above b'. Hence, also, any fluid in a bent tube ACB (*fig.* 3) will stand in each branch, the tube being

Fig. 3.



open at both ends, at the same vertical height above C, the lowest point. Thus water, which is conveyed in pipes from a reservoir, will occupy all the bends of the pipes, and rise at the further extremity up to a horizontal plane passing through the surface of the water in the reservoir, provided no vertical bend be higher than that level.

The power produced by the hydraulic press depends on the principle exhibited in the above experiment; and this experiment is, at the same time, the proof of that equality of pressure which it has been said that the particles of a fluid exert in every direction.

The pressure exerted by a fluid against the whole side of a vessel containing it, or against a surface immersed in it, whether that side or surface be plane or curved, is equal to the weight of a column of the fluid having the surface pressed for a base, and the distance of the upper surface of the fluid from the centre of gravity of the former surface for its altitude. For let DB (*fig.* 1) be the position of the surface pressed, and let an indefinitely small area at c on that surface be represented by m, and be pressed by the weight of the filament cd of fluid above it; then, since every part of the indefinitely small area may be supposed to be at the same vertical depth, which may be represented by n, it follows that the pressure on c will be proportional to mn. And the same thing will hold good with respect to every point in the surface DB. Therefore this surface may be conceived to be pressed by an infinite number of parallel forces, whose points of application are on the same surface, and whose intensities are represented by the products of the elementary areas into the distances of those areas from the upper surface CD of the fluid. But, by the theory of parallel forces in mechanics, the resultant of all those forces is a force whose intensity is represented by the sum of all the elementary areas (that is, the area of the surface pressed) multiplied into the distance of its point of application, that is, of the centre of gravity of the surface, from the same surface CD. By this theorem the pressure of water against the walls of reservoirs, lock-gates, &c. may be determined.

The pressure against one side of a cubical vessel filled with a fluid is equal to half the pressure upon the base; for the areas of the base and of each side are equal to one another, but the centre of gravity of the former is at a distance from the upper surface equal to the whole depth, and that of the latter at a distance equal to the half depth. It is shown moreover in treatises on hydrostatics, that if a hollow cone standing on its base be filled with a fluid, the pressure on the base will be equal to three times the weight of the fluid; that the pressure against the interior surface of a hollow sphere filled with a fluid is also three times the weight of the fluid. Again, if a vessel of any figure be full of a fluid, and have over every part of the sides and bottom a vertical filament of the fluid reaching to the upper surface, the whole pressure in a vertical direction on the bottom and sides of the vessel will be equal to the weight of all the fluid. Lastly, the pressure exerted on the sides of a vessel, estimated perpendicularly to the base, is equal to the weight of a rectangular prism of the fluid whose height is equal to that of the fluid, and whose base is a parallelogram, one side of which is equal to the height of the fluid, and the other to half the perimeter of the vessel. (Vince's *Hydrostatics*; Gregory's *Mechanics*, &c.)

It is of importance to determine the place of the centre of pressure against the side of a vessel filled with a fluid, or against a surface which is immersed in it; that is, to find the situation of a point in that surface, at which a force being applied in a contrary direction to that in which the fluid presses, the surface will be kept in equilibrio.

Let, for simplicity, the side or surface pressed be rectangular, and in a vertical position; let, also, b represent the breadth, and a the altitude of the surface, or depth of the fluid: then $\frac{1}{2}a$ will be the depth of the centre of gravity below the upper surface of the fluid. Now if x be the distance of any elementary area of the side below the same upper surface, such elementary area will be expressed by $b\,dx$; and the pressure of the fluid against it being proportional to the depth, will $= b\,x\,dx$. Then the tendency of that pressure to turn the side of the vessel round, about its upper extremity, which is supposed to be a horizontal line, will be bx^2dx; consequently the whole tendency of the fluid to turn the side round in that manner will be expressed by $\int bx^2dx$, which between the limits $x = 0$ at the top, and $x = a$ at the bottom, is equal to $\frac{1}{3}ba^3$. But, if P be the required place of the centre of pressure, and its distance from the upper surface of the fluid be represented by p, the tendency of the same pressure applied at P to turn the side about its upper extremity, will be $\frac{1}{2}a^2bp$ ($\frac{1}{2}a^2b$ being the horizontal pressure of the fluid against that side). Therefore we have $\frac{1}{3}a^3b = \frac{1}{2}a^2bp$, or $p = \frac{2}{3}a$; that is, the centre of pressure is at a distance from the upper surface equal to two-thirds of the depth of the vessel or fluid. And, by writers on hydrostatics, it is proved that, in all cases, when the surface pressed is symmetrical on each side of a line joining the centres of gravity and pressure, the latter coincides with the centre of percussion in mechanics.

When a triangle in a vertical position is immersed in a fluid so that its vertex coincides with the upper surface of the latter and its base is horizontal, the distance of the centre of pressure from the vertex is equal to three-fourths of the perpendicular of the triangle. And when a circle is so placed in a fluid with its upper part just touching the surface, the distance of the centre of pressure from that part is equal to five-eighths of the diameter.

The equality of the pressures in every direction, at any point in a fluid mass, is the cause, that if a solid body were plunged in a fluid, the pressure of the fluid immediately under it will tend to raise the body upwards with a force equal to the weight of the fluid displaced. But the weight of the body is a force acting vertically from above downwards; and, consequently, in an opposite direction to that caused by the reaction of the water. Since therefore the volumes of the body and of the displaced water are equal to one another; if their weights or densities should be equal, the body would remain in equilibrio in whatever situation it were placed in the fluid. But, should these weights or densities be unequal, the body would make an effort to ascend or descend, according as its density is less or greater than that of the fluid; and, in order to counteract these tendencies, it would be necessary to use a force equal to the difference between the weight of the body and of the displaced fluid. Hence, if a solid body be weighed in a fluid, it will be found that its weight, compared with that of the same body in vacuo, will be less than in the latter case by the weight of an equal volume of the fluid; and, consequently, when a body is weighed in a fluid, as water or air, the true weight, or that which would be obtained in vacuo, will be found by adding to the observed weight that of an equal volume of the fluid.

When a body floats in a fluid, in order to bring its upper surface to coincide with that of the fluid, it must evidently be loaded with a weight equal to the difference between the weight of the body or of the displaced fluid, and the weight of a volume of the fluid equal to that of the whole body. The weight which a floating body will thus bear is denominated the buoyancy of the body; and on the principle here stated depend the common rules for finding the buoyancy of rafts, vessels, &c.

If a solid body float in equilibrio in a fluid, the centres of gravity of the body and of the displaced fluid must evidently be in one vertical line; otherwise the upward action of the fluid below, which necessarily has its resultant in a vertical line passing through the centre of gravity of the place occupied by the body, would produce in the latter a rotatory motion contrary to the hypothesis. This circumstance has given rise to three denominations respecting the equilibrium of floating bodies. First, if the centre of gravity of the body should be below that of the displaced fluid, the body is said to possess a stable or firm equilibrium; so that if any derangement should take place from accidental causes, the body would, after a few oscillations, recover its former position. If the centre of gravity is above that of the displaced fluid, the body is in circumstances similar to those of a cone when placed on its vertex, that is, it is liable to be immediately overturned; and hence the body is said to float with a tottering equilibrium. And if the said centres should exactly coincide, the body would float in any position whatever: this is denominated an equilibrium of indifference. The first case is that of a cylinder whose axis is less than the diameter of its base; the second is that of a cylinder whose axis is greater; and the last is that of a homogeneous sphere.

The absolute weight of a given volume of any solid or fluid body is called its specific gravity. In this country, for convenience, it is customary to consider one cubic foot as the given volume, and to express the weight in avoirdupois ounces: thus the weight of a cubic foot of rain water being 1000 ounces, and that of a cubic foot of cast-iron being 7207 ounces, those numbers are used to denote the specific gravities of the bodies. From this definition it follows that, when the volumes of two bodies are equal, their specific gravities will be proportional to their weights: when the weights are equal, the specific gravities are inversely proportional to the volumes; and, in general, the weights of bodies vary in a ratio compounded of their volumes and specific gravities.

It may hence be easily shown that when two fluids of different specific gravities, as water and mercury, are in equilibrio in a bent tube, the vertical altitudes of the columns above the horizontal plane of junction will be inversely proportional to their specific gravities. For, let mn (*fig.* 3) be a line in the plane of junction; then the area of the section at m being common to both fluids, the bases of the columns in the two branches may be considered as equal to one another. Now, if the vertical altitude of the column mp be represented by a, and that of nq by A, the specific gravity of the fluid in mp by S, and that in nq by s; then the weights of the columns, or rather the pressures on every point of their bases, at m and n may be expressed by aS and As; and in the case of equilibrium these terms are equal to one another: therefore we have $A : a :: S : s$.

The specific gravity of a solid body is readily found by means of the hydrostatical balance, an instrument which differs in no respect from a common balance, except in being made with greater delicacy. It is customary to weigh the body both in air and in vacuo; from whence may be obtained the ratio between the density of the body and that of the fluid in which it is weighed.

The specific gravity of a fluid may be found from the following proposition: Let $a + b$ be the volume of a body which will float in the fluid, b being that of the immersed part; let also the specific gravities of the body and fluid be represented by s and s' respectively. We have then the weight of the oody $= (a + b)\,s$, and that of the displaced fluid $= b\,s'$; but these weights are equal to ono another: therefore, $b : (a + b) :: s : s'$. Consequently, the specific gravity of the solid body being supposed to be known, we have that of the fluid, after making a correction on account of the loss of weight in air. On the principle explained in this proposition is founded the construction of the hydrometer, by which the qualities of liquors are usually determined.

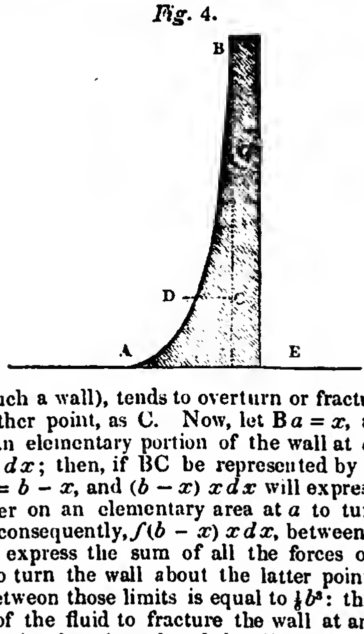
By means of the specific gravity of bodies may bo ascertained the quantities of the different materials which enter into any compound body. Thus, let w and w' represent the weights of a mixed metal in air, or vacuo, and water respectively, s and s' the known specific gravities of the two metals in the mixture, and let x be the weight in air or vacuo of the heavier metal. Then $\frac{x}{s}$ = the weight of water which would be displaced by x; $\frac{w - x}{s'}$ = the weight which would be displaced by the lighter metal; and we shall have

$$w' = \frac{x}{s} + \frac{w - x}{s'}\text{; whence } x = \frac{s\,(w - w's')}{s - s'}\text{, and}$$

$$w - x \;(= \text{the weight of the lighter metal}) = \frac{s'\,(w' - w\,s)}{s - s'}.$$

It has been shown that the pressure of a fluid against any point in an upright wall, or in the side of a vessel containing it, is proportional to the depth of that point below the upper surface of the fluid; but, in determining the form and dimensions of a retaining wall which shall be equally strong in every part of its height, it will be necessary to consider that the horizontal pressure of the fluid at any point, as a (*fig.* 4) (BAE representing a vertical section

Fig. 4.

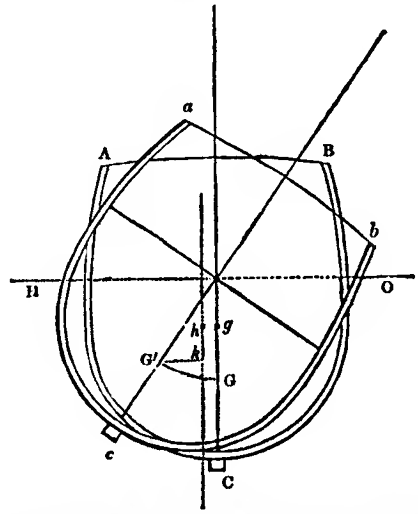


through such a wall), tends to overturn or fracture the wall at every other point, as C. Now, let $Ba = x$, and let the depth of an elementary portion of the wall at a be represented by dx; then, if BC be represented by b, we shall have $Ca = b - x$, and $(b - x)\,x\,dx$ will express the force of the water on an elementary area at a to turn the wall about C: consequently, $\int (b - x)\,x\,dx$, between $x = o$ and $x = b$, will express the sum of all the forces of the water above C to turn the wall about the latter point. But the integral betweon those limits is equal to $\frac{1}{6}b^3$: therefore the tendency of the fluid to fracture the wall at any point, as C, is proportional to the cube of the distance of that point from the upper surfaco of the fluid. The strength of the wall to resist transverse pressure in the direction of its thickness is, by mechanics, proportional to the square of that thickness; that is, proportional to CD^2. Therefore, in order that the wall may bo equally strong in every part, the form of a vertical section should be such that the squares of the horizontal ordinates, as CD, are proportional to the cubos of their vertical depths from the top. This is a property of the semi-cubical parabola, and the exterior or interior surface of the wall should have that figure. Agreeably to this principle also the thickness of tubes containing columns of fluid in vertical positions should increase from top to bottom, according to the same law.

This article may be concluded by an indication of the principles on which the stability of ships or other vessels on the water may be determined.

Let ABC (*fig.* 5) represent a vertical section through the centre of gravity G of a ship, and let HO be the surface of the water; let also g be the centre of gravity of the immersed part, while the plane of the masts is vertical. Now, by the action of tho wind or otherwise, let the ship be inclined so as to take the position $a\,b\,c$; the centre of gravity

Fig. 5.



of the immersed part and of the displaced water will then be removed to h, and that of the ship to G'. Draw a vertical line through h, and let fall upon it the perpendicular $G'k$; then the stability of the vessel, or the force by which it resists the effort of the wind to overturn it, is expressed by the product of the upward pressure of the water (or the weight of the vessel) acting in the vertical line $k\,h$ into the length $G'k$ of the lever, whose fulcrum is G'. And, that an equilibrium may subsist, this expression must be at least equal to the product of the force of the wind acting against the sails or hull into the distance of the centre of pressure from the centre of gravity of the ship.

HYDROTHO'RAX (from ὕδωρ, water, and θώραξ, the chest), dropsy of the chest, is a term applied to express the existence of a collection of serous fluid in the cavity of the pleura.

This collection may take place in consequence of inflammation of the pleura, which, like inflammation of other serous membranes, terminates in effusion; or it may result from the causes of general dropsy, viz. some obstacle to the circulation through the heart, or organic disease of the kidney. When it arises from the former cause it is merely a symptom of pleurisy. In some cases of pleurisy however, in which pain is absent, and in which fever does not exist, or is slight, this effusion and the difficulty of breathing to which it gives rise constitute almost the only symptoms of the disease. Abundant effusions of this kind, unattended by pain or fever, sometimes take place very rapidly, especially in old persons and in adults in a cachectic condition.

When hydrothorax results from inflammation of the pleura, it generally exists on one side only of the chest. When it is a consequence of obstacle to the circulation through the heart, or of organic disease of the kidney, it is generally double, although the effusions into the two pleural cavities may not take place quite simultaneously. In the latter case also hydrothorax is found in connexion with general dropsy. At first there is œdema of the lower extremities; this œdema gradually extends to the integuments of the trunk, to the arms, and even to the face; and subsequently serous fluid is effused into the cavities of the pleura, giving rise to hydrothorax, and into those of the pericardium and peritoneum.

A collection of fluid in the cavity of the pleura may be detected by physical signs: a dulness on percussion, and, when the effusion is moderate, a diminution of the respiratory murmur, and the presence of ægophony, on the affected side. If the effusion be so considerable as entirely to prevent the expansion of the lung, there is a total absence of ægophony or of any respiratory murmur on that side, whatever be the force with which inspiration is made, while on the opposite side the respiratory murmur is unusually audible.

When one side only is affected the patient generally lies on that side; when the effusion is double he lies on his back; or, which is the case when the effusion is considerable, he can breathe in the erect position only. The difficulty of breathing is generally greater in proportion to the rapidity with which the fluid is effused.

We have nothing to say respecting the treatment of hydrothorax, which is included in that of pleurisy and of general dropsy.

HYDRUS. The serpents of this genus have the posterior part of the body and the tail very much compressed and elevated vertically, so as to give them a facility of swiming adapted to their aquatic habits.

Cuvier places them with *Bongarus*, or *Bungarus* (Daud.; *Pseudo-boa*, Oppel) as constituting a tribe of serpents whose jaws are organized and armed nearly as in the non-venomous serpents; but which have the first of their maxillary teeth larger than the others, and pierced for conducting the poison, as in the venomous serpents with isolated fangs.

Daudin thus subdivides these water-serpents, which are said to be very common in certain parts of the Indian Sea.

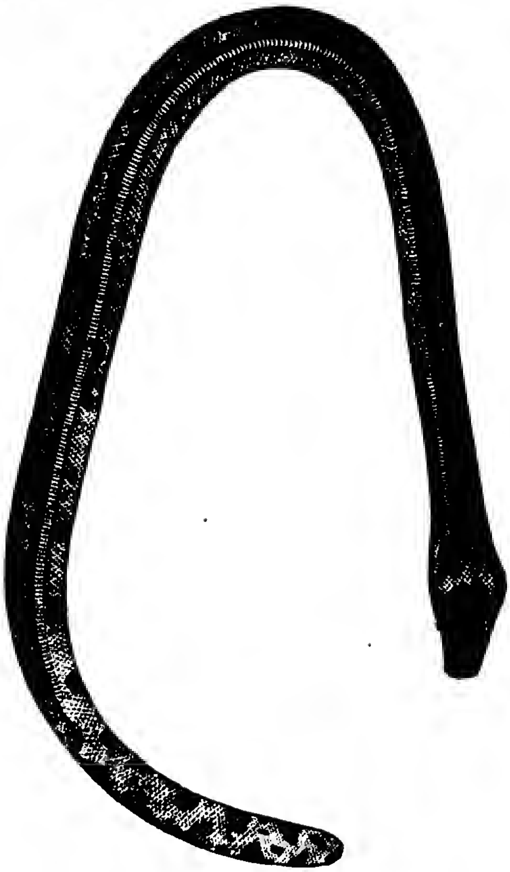
Hydrophis.

The species of this genus have, like *Tortrix* and *Erpeton*, a row of scales a little larger than the rest under the belly. Their head is small, not convex, but obtuse and furnished with plates.

Locality.—Species have been found in the salt-water canals of Bengal, and others farther in the Indian Sea.

The Pelamides.

These have large plates on the head, but their occiput has a swollen appearance, by reason of the length of the pedicles of their lower jaw, which is very dilatable, and all the scales of their body are equal, small, and disposed like an hexagonal pavement. Cuvier remarks that the species most known (*Anguis platurus*, Linn.; *Hydrus bicolor*, Schn.) is black above and yellow below. Though venomous, it is, he says, eaten at Taheite.

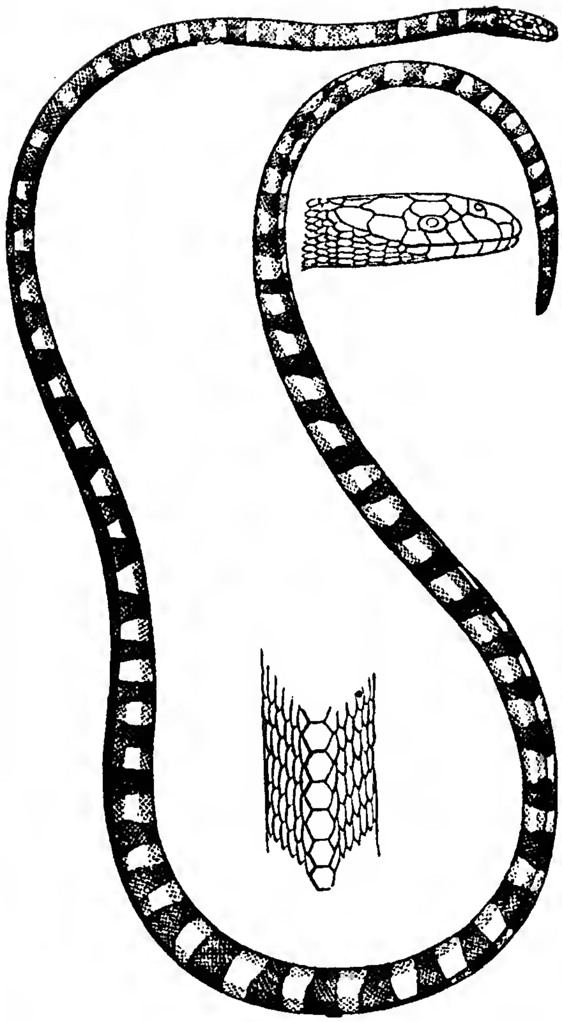


Pelamides. (Hydrus bicolor, Schn.)

Cuvier adds the following subgenus:—

Chersydrus.

This has the head and the whole of the body equally covered with small scales. Such is the *Acrochordus fasciatus* of Shaw, a very venomous serpent inhabiting the rivers of Java



Chersydrus fasciatus.

HYDRUS (constellation), the Water-snake, commonly called the Southern Snake, a constellation of Lacaille. It is situated between the south pole and the bright star in Eridanus (Achernar).

Character.	No. in Catalogue of Lacaille.	No. in Catalogue of Astron. Soc.	Magnitude.
β	15	27	3
η^2	132	213	4
α	136	219	3
δ	166	254	4
ϵ	196	295	5
ξ	214	310	5
θ^1	240	349	5
γ	309	439	3

HYE'RES, or HIE'RES, a town in the department of Var, in France, near the coast, about 9 or 10 miles east of Toulon, celebrated for the beauty of the district in which it is situated, and the warmth of the climate, which exceeds that of any other part of France. The gardens in the immediate neighbourhood of the town abound with standard orange and lemon trees; the grounds a little more distant are planted with olive-trees, which here attain their full size, and with vines. The neighbourhood produces much corn, and there are many meadows. The oranges of Hyères are considered to be of inferior quality. The town, which is resorted to by visitors, especially valetudinarians, is on the slope of a hill; the streets are steep, narrow, and inconvenient; but many of the houses are handsome, having been built for letting to visitors. The population of Hyères in 1831 was 8270 for the town, or 10,142 for the whole commune. Hyères was the birthplace of Massillon.

Off the neighbouring coast are five islands known as the Islands of Hyères: they lie nearly in a line from east to west, in the following order: L'Esquillade, a mere rock, seldom noticed; Ile du Titan or Levant; Porteros, or Portecros; Bagneau, or Bagneaux, very small; and Porquerolles. They are all small (Porquerolles, 5 miles long by 2 or 3 wide, and Titan, are the largest), and are mere steep barren rocks. They have some fortifications on them, and a small garrison is kept there. The English took possession of them during the late war, but abandoned them as useless. These islands were once noted for their oranges.

HYGI'NUS, CAIUS JULIUS (written also Higinus, Hygenus, Yginus, or Iginus), a freedman of Augustus Cæsar, and a celebrated grammarian, was, according to some, a native of Spain, but according to others, a native of Alexandria. He was placed by Augustus over the library on the Palatine hill, and also gave instruction to numerous pupils.

His works, which were numerous, are frequently quoted by the antients with great respect. The principal appear to have been:—'De Urbibus Italicis;' 'De Trojanis Familiis;' 'De Claris Viris;' 'De Proprietatibus Deorum;' 'De Diis Penatibus;' a Commentary on Virgil; and a treatise on agriculture.

The works mentioned above have all been lost; those which are extant, and are ascribed to Hyginus, were probably written by another individual of the same name. These are:—1, 'Poeticon Astronomicon, libri iv.,' Ferrara, 1475; 2, 'Fabularum Liber,' Basel, 1535. Another collection of 234 fables is also attributed to Hyginus; 3, part of a treatise, 'De Castrametatione,' published by Scriverius at the end of his edition of Vegetius, 1607, and by Scheel, together with the treatise of Polybius 'On the Roman Camp,' Amst., 1660; 4, 'De Limitibus Constituendis,' edited by Rigaltius, 1613, and by Goesius in the 'Rei Agrariæ Auctores,' 1674.

HYGRO'METER (ὑγρός, moist, and μέτρον, measure). In physical experiments it sometimes becomes necessary to ascertain the quantity of aqueous vapour contained in the atmosphere or other gas under examination. To attain this object several instruments called hygrometers have been invented, and are known by the names of their authors, as De Luc's, De Saussure's, &c. These for the most part rest upon one common principle, the diminution of bulk which takes place in organic substances consequent upon the abstraction of moisture. Thus De Luc employed a thin slip of whalebone, the contractions of which indicated the variations of moisture; and De Saussure had recourse to a human hair, by means of which he constructed a far more delicate instrument; but all of them have been superseded by the hygrometer invented by Mr. Daniell, the present professor of chemistry at King's College, and described by that gentleman in the 8th volume of the 'Quarterly Journal of Science.' It consists of two thin glass balls one inch and a quarter in diameter, connected by a glass tube about seven inches in length. The tube is bent in two places at right angles so as to form three arms of unequal length, the longest of which contains a small thermometer, whose bulb descends into the lower of the two glass balls. This ball, after being filled about two-thirds with æther, is placed over a spirit-lamp until the vapour of the æther has expelled the contained air through a capillary tube which is left open for the purpose, and afterwards hermetically sealed. The other ball is then covered with a piece of muslin, and the instrument thus adjusted is placed upon a stand, to which is attached a small thermometer indicating the temperature of the external air. When about to be used a small portion of æther is poured upon the muslin, which, by evaporating, lowers the temperature of the glass ball, and thereby occasions a rapid condensation of the æthereal vapour contained within the instrument. The condensation of the vapour within the tube produces a continuous evaporation from the surface of the æther in the lower ball, whereby the temperature of the included æther is continually reduced until a deposit of moisture from the surrounding atmosphere is observed to take place upon the exterior of the glass. At this instant the inner thermometer, which always indicates the temperature of the æther, is observed, and thus the dew point, or that at which the precipitation of atmospheric moisture takes place, is determined with considerable accuracy. Having ascertained the dew point, and likewise the temperature of the external air, the actual quantity of moisture contained in a cubic foot of air will readily be found from the formula,

$$\text{Weight in grains} = \frac{5656{\cdot}2}{448 + t} \times p,$$

where t denotes the temperature of the external air, and p the elasticity of aqueous vapour at the temperature indicated by the interior thermometer. The value of p for every degree of the thermometer is given in Mr. Dalton's *tables* of the expansive force of steam. (*Manchester Memoirs*, v. 559.)

HYLA. [FROGS, vol. x., pp. 487, etc., 496.]

HYLACTES, a genus of birds established by Captain Phillip Parker King, R.N., for a form allied to *Megapodius*, with the following

Generic Character.—*Bill* subelongated, rather thin, with a subemarginate apex; *nostrils* basal, longitudinal, the membrane subtumescent, and covered with hairs down the middle; *Wings* very short, rounded; fifth *quill* longest. *Tail* subelongated, graduated. *Feet* strong; tarsi rather elongated, scutellated in front; *toes* and *claws* elongated, the latter rather strong and subcompressed; *hallux* very strong, incumbent.

Example, *Hylactes Tarnii.*

Locality, the Island of Chiloe and Port Otway, in the Bay of Peñas. (*Zool. Proc.*, 1830—31.)

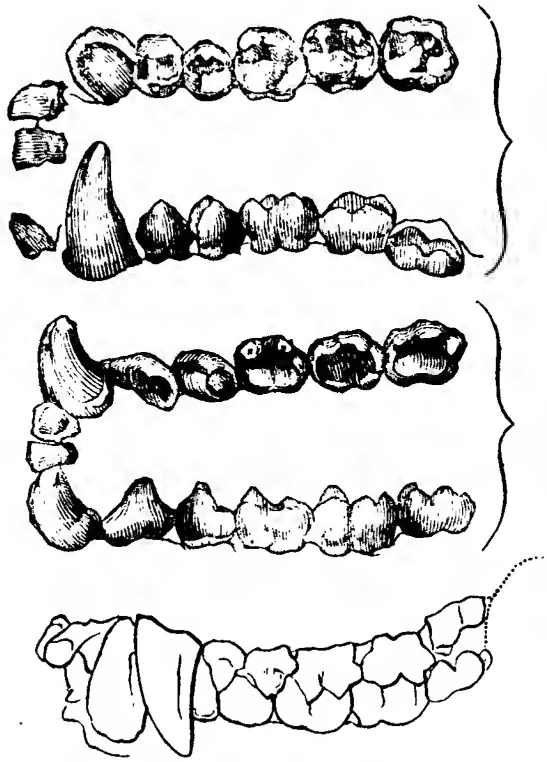
HYLÆOSAURUS, Dr. Mantell's name for the extinct Saurian discovered by him in the forest of Tilgate, and thence termed the *Forest Lizard.* The remains upon which this genus was characterized were embedded in a block of stone 4½ feet by 2½ feet, and consisted principally of bones of the trunk. A chain of five cervical and five dorsal vertebræ with corresponding ribs, and four detached vertebræ, were visible; as were the coracoids and omoplates of both sides. There was a peculiarity in the structure of the last-mentioned parts, which, in the opinion of Dr. Mantell, warranted the separation of this Saurian from all recent and fossil genera; for the *Hylæosaurus* had the omoplates of a crocodile with the coracoids of a lizard. There was also a still more extraordinary osteological structure, consisting of a series of spinous bony apophyses, which varied from 3 to 17 inches in length, and from 1¼ to 7 inches in width. These maintained a certain parallelism with the vertebral column, as if they had occupied a line along the back. Dr. Mantell suggested that these processes might be the remains of a dermal fringe or serration, with which, as in some recent species of Saurians, the back of the Forest Lizard might have been armed; but he, at the same time, noticed many anatomical peculiarities which led him to hesitate in determining positively that these parts had formed such appendages. He next entered upon a careful examination of the reasons why they could not be processes of the vertebræ. Dr. Mantell also discovered many dermal bones, which served to support the large scales, in the stone: he finally proposed the genus as depending for its characters on the peculiarity of the sternal apparatus and the spinous processes. The paper in which the remains of this large extinct Saurian were described was read before the Geological Society of London, in December, 1832.

Dr. Buckland (who, in his 'Bridgewater Treatise,' justly speaks of Dr. Mantell as the indefatigable historian of the Wealden fresh-water formation, in which deposits, of a period intermediate between the oolitic and cretaceous series, *Hylæosaurus* was found) is of opinion that this extinct Saurian was probably about 25 feet long, and speaks of its most peculiar character as consisting of the remains of the series of long, flat, and pointed bones, which, Dr. Buckland thinks, seem to have formed an enormous dermal fringe like the horny spines on the back of the modern Iguana. (See also Dr. Mantell's 'Geology of the South-East of England,' 8vo., London, 1833.)

We hope soon to see this interesting specimen, together with the rest of Dr. Mantell's noble collection, in our National Museum.

HYLO'BATES (from ὑλοβάτης, wood-walker, or one that goes through woods), Illiger's name for the long-armed Apes, or Gibbons. The general characters of these Apes as to dentition and form agree with those of the Orangs, but there is some modification of the dental system in the

Gibbons, which have also longer anterior extremities and have posterior callosities, though they have no tail. The vermiform appendix of the cœcum is also shorter. Dental formula:—Incisors $\frac{4}{4}$; Canines $\frac{2}{2}$; Molars $\frac{10}{10}$ = 32.



Teeth of Hylobates, increased 1·6th. (F. Cuvier.)

In the upper jaw the first incisor is large, terminated by a straight line, worn obliquely within, and cut transversely by the impression of the lower incisor; the second is smaller than the first, and worn obliquely on the side of the canine, which is wider than it is thick, trenchant on its posterior border, and presents two longitudinal furrows on its internal surface, separated from each other by a projecting rib,* the posterior furrow being larger and deeper than the anterior one. The two next teeth are false molars, and the second is rather larger than the first; but both are composed of blunt tubercles, one on the external and the other, smaller, on the internal border. The three next molars, which increase gradually in size from the first to the last, have the same form; they are composed of four tubercles, two of equal size on the external and two on the internal border, the posterior tubercle being smaller than that which precedes it: these tubercles are formed by furrows which divide the tooth unequally.

In the lower jaw the first incisor is small, and terminated by a straight line; the second is rounded on its external surface, terminated in a point, and strengthened on its internal surface by a longitudinal rib, which thickens it in the middle. The canine is more equal in its dimensions than that of the other jaw, and is terminated posteriorly by a process or heel; but its internal surface presents also the two furrows and the rib which are found in the other. The first false molar, which is placed obliquely, has only a single point; the second has two, one internal and the other external, situated nearer to the anterior than to the posterior border. Three molars succeed, which progressively increase in size, and resemble each other. They present five tubercles, two of which are anterior, and three, disposed in a triangle, posterior.

M. F. Cuvier takes this type of dentition from the *Siamang*, and says that it is also found in the *Wow-wow* and *Onko*.

The height of the Gibbons rarely exceeds four feet, and when they are placed in an erect posture their upper extremities reach the ground.

* In *Hylobates Hoolock* the canines are remarkably long.

Geographical Distribution of the genus.—India and its islands.

Habits, &c.—The forests are the haunts of these cheiropeds, and they are rarely seen at a distance from them. Gregarious, but shy and timid, they keep up a howling concert, resembling in this respect in some degree the Howling Monkeys of America, and having some of them guttural sacs like that tribe. In the forest the activity of certain species is great, and they make way on the trees with their long arms and lengthened feet most rapidly; but when surprised on open plain ground they are altogether as helpless. Other species (the Siamang, for instance) appear to be more sluggish; but these make good use of their acute eyes and ears, and are generally off before the enemy approaches near enough for a capture.

In confinement they are gentle, and seem capable of great attachment to those who are attentive to them. Dr. Burrough gives a most interesting account of three individuals of the species called the Hoolock (*Hylobates Hoolock*), which he had an opportunity of observing in that state. One of them, a male, showed a most amiable and docile disposition, and a young female, which died early, was equally gentle and pacific. The Siamang kept by Sir Stamford Raffles was, according to Dr. Horsfield, very tame and tractable, and was never happy unless it was in the company of some person. Mr. George Bennet gives a lively description of the affectionate manners of another of these apes towards those who made its captivity light by their kindness. We select, as an example of this form, the Wow Wow, or Active Gibbon (*Hylobates agilis*).

Description.—Forehead very low; orbitary arches very projecting; face blackish-blue in the male, and brown in the female; in the former a white band above the eyes, which unites with the whitish whiskers. Hair of the body fine, except about the neck, where it is longer and inclined

Hylobates agilis, male.

to be woolly and curled; upper part chocolate-brown; back and fore part of the thighs yellowish-brown, but the colour varies a good deal according to sex and age, the young being paler than the adults and aged, and the very young uniform yellowish-white. Height about 2 feet 7 or 8 inches. No guttural sac.

Habits.—Very agile as soon as they reach the forest, when they set pursuit at defiance, swinging, leaping, and throwing themselves from tree to tree with great rapidity. Notwithstanding the want of the guttural sac, they howl in a manner very nearly resembling the Siamang, which has one.

In captivity they are not very lively, as might be expected, from the impossibility of their exerting that freedom of motion on which their vivacity in a state of nature so much depends; but though timid they are soon reassured, take pleasure in being caressed, and become familiar and even playful.

Locality, Forests of Sumatra, where the species is named *Ungaputi.*

The *Siamang* of the Malays, *Simia syndactyla* of Sir Stamford Raffles's 'Catalogue of a Zoological Collection made in Sumatra' (*Linn. Trans.*, xiii. 241), *Pithecus syn-*

Hylobates agilis, female and young.

dactylus of Desmarest, *Hylobates syndactylus* of F. Cuvier, has a peculiar formation of the hands or feet of the lower extremities, the index and middle fingers being united as far as the middle of the second phalanx. This peculiarity would seem to indicate a generic distinction, notwithstanding the similarity of the teeth and skull to those of the rest of this tribe. These Sumatran Apes, sluggish and timid as they are, exhibit strong maternal affection; for though, if any of the troop are wounded, the rest abscond and leave them to their fate, the mother will remain with her little one if it is hurt, and will suffer herself to be captured rather than abandon it. The females are also generally very attentive to their offspring, according to the accounts given by MM. Diard and Duvaucel.

Fossil Gibbons (?).

M. Hermann Von Meyer, in his interesting 'Palæologica,' remarks that the Quadrumana (*Affen*) had never been found fossil; nor had they when he wrote. His work was published in 1832; but since that time the fossil remains of monkeys have been found in the north of India, in the same formation with the *Sivatherium*, &c. Fossil monkey bones have also been found in the strata below Calcutta. They were brought up while boring for water.

M. Lartet discovered in the tertiary formations of Simorre, Sansan, Auch, &c., in the department of Gers, in the southwest of France (Gascony), among the remains of several other animals, Apes (Singes), of a group having some relation, according to M. de Blainville, to that of the Gibbons, but not true Gibbons that might be compared to the Syndactyle Gibbon (Siamang) of Sumatra. (*Comptes Rendus*, 1837.)

The fossil bones discovered by M. Lartet are stated to belong to no less than thirty species of mammiferous animals, including *Dinotherium*, and were found in two deposits, viz. in the sands and sandstone of the upper tertiary formation of Simorre, Tournon, Lombez, &c., and in the lacustrine deposit of Sansan. There were also the remains of two species of birds of a genus not yet determined, a species of *Emys*, and some species of *Coluber* and *Rana*; as well as mollusks (*Planorbis*, *Helix*, &c.), and a conchifer bearing a great resemblance to *Unio margaritiferus*. The monkey-jaw appears to have been found at Sansan.

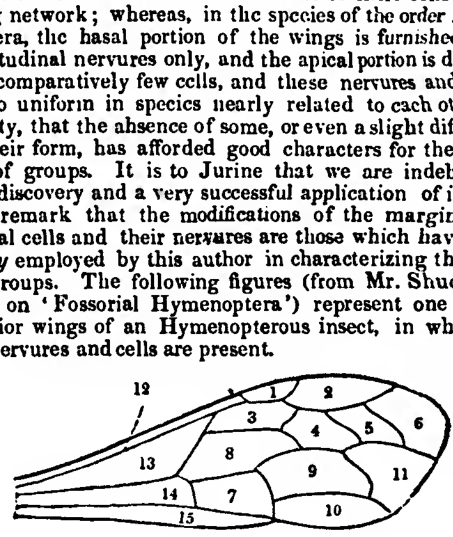
HYMENO'CERA, Latreille's name for a genus of macrurous crustaceans belonging to the tribe of *Alpheans* in the family of the *Salicoques*, or shrimps, according to the system of M. Milne Edwards, who places it between *Atya* and *Alpheus*, observing however that the unique specimen from which Latreille established and characterized the genus was found in the Asiatic seas, and formed a part of the collection of the museum; but M. Milne Edwards adds that the specimen appears to have been lost, for he had never seen it. [Shrimp.]

HYMENO'PTERA, one of the orders into which insects are divided. Hymenopterous insects possess four membranous wings, of which the anterior pair are the larger; they have all the usual parts of the mouth well developed, that is to say, they possess labrum, labium, mandibles, maxillæ, and two pairs of palpi; besides the ordinary compound eyes, they are furnished with three ocelli, or simple eyes, which are usually situated on the vertex of the head. Their tarsi are five-jointed. The females are provided with an ovipositor, consisting chiefly of three elongated slender processes, of which two serve as a sheath to the third. This ovipositor, in many species, is so organized that it can not only perform its ordinary function, but serve as a weapon of defence, and is the part which in bees and wasps is called the sting: in these insects it is barbed at the apex. The antennæ are generally filiform or setaceous. The mesothorax and metathorax are well developed; the prothorax is narrow.

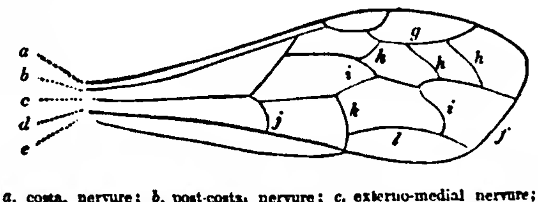
Insects of the order Hymenoptera undergo what is termed complete metamorphosis, *i.e.* the larva is unlike the perfect insect, and the pupa does not possess the power of locomotion. The larvæ of some of these insects very much resemble those of the order Lepidoptera (Butterflies and Moths), but differ in the number of their legs, &c.: these feed upon plants. [Securifera.] The larvæ however generally speaking are destitute of legs, and do not possess a distinct head, and these are for the most part fed by the parent insect, or, as in the case of Bees and Wasps, by the neuters. In the pupæ, all the parts of the perfect insect are visible, since they are enclosed only in a delicate semi-transparent membrane.

In the imago or perfect state most Hymenopterous insects live upon flowers, or at least often frequent them, some for the purpose of gathering honey, and others find them a convenient resort wherein they may prey upon the less powerful species of their own class.

The comparatively simple neuration of the wings will serve to distinguish insects of the present order from those of the order Neuroptera, where the wing is divided by minute nervures into an infinite number of little cells resembling network; whereas, in the species of the order *Hymenoptera*, the basal portion of the wings is furnished with longitudinal nervures only, and the apical portion is divided into comparatively few cells, and these nervures and cells are so uniform in species nearly related to each other by affinity, that the absence of some, or even a slight difference in their form, has afforded good characters for the definition of groups. It is to Jurine that we are indebted for this discovery and a very successful application of it. We may remark that the modifications of the marginal and cubital cells and their nervures are those which have been *chiefly* employed by this author in characterizing the various groups. The following figures (from Mr. Shuckard's work on 'Fossorial Hymenoptera') represent one of the anterior wings of an Hymenopterous insect, in which all the nervures and cells are present.



1, stigma; 2, radial or marginal cell; 3, first cubital cell; 4, second cubital cell; 5, third cubital cell; 6, fourth cubital cell; 7, first discoidal cell; 8, second discoidal cell; 9, third discoidal cell; 10, first apical cell; 11, second apical cell; 12, costal cell; 13, externo-medial cell; 14, interno-medial cell; 15, anal cell.



a, costal nervure; *b*, post-costal nervure; *c*, externo-medial nervure; *d*, anal; *e*, posterior margin; *f*, apical; *g*, radial; *h*, *h*, *h*, transverso-cubital *i*, *i*, recurrent; *j*, transverso-medial; *k*, discoidal; *l*, subdiscoidal.

The order Hymenoptera is divided by Latreille into two great sections,* to which he applies the name of *Terebrantia* and *Aculeata*. In the species belonging to the first of these sections the female sex possesses a distinct ovipositor, whereas in the second the ovipositor is replaced by a sting. Many of the ants however form an exception, since they do not possess a sting, and defend themselves by ejecting an acid liquid. In the Aculeata the antennæ are always simple, and composed of thirteen joints in the males and twelve in the females. The palpi are generally filiform; the maxillary, often the larger, have six joints, and the labial are four-jointed. The abdomen is composed of seven joints in the males, and six in the females. These two great sections, of which the principal characters have just been given, are again subdivided, the Terebrantia into two subsections, and the Aculeata into four.

The first subsection of the Terebrantia, to which Latreille applies the name of *Securifera*, is thus characterized by that author:—abdomen sessile, that is, it is closely joined to the thorax, of which it appears to form a continuation, and does not possess free motion. The females are provided with an ovipositor, which is most commonly serrated, and not only used to deposit their eggs, but to prepare a place for their reception. The larvæ have always six horny legs, and often others which are fleshy. This subsection contains two families, the *Tenthredinidæ* and *Urocerata*.

The second subsection, or the *Pupivora*, have the abdomen attached to the thorax by a slender stalk, which is often very long, and admits of free motion. The larvæ are always destitute of feet, and for the most part parasitical and carnivorous. This group is divided into six families: *Evaniales, Ichneumonides, Gallicolæ, Chalcidites, Oxyuri*, and *Chrysides*.

We now come to the subdivisions of the second great section, the *Aculeata*. These are four in number, the *Heterogyna, Fossores, Diploptera*, and *Anthophila*.

In the *Heterogyna* the species are many of them composed of three kinds of individuals (as in the Hive Bee), males, females, and neuters. They have the antennæ geniculated, and the ligula is small. Some live in society, and these possess the three kinds of individuals, of which the males and females are provided with wings, and the neuters are apterous. The Ants (*Formica*, Linn.) belong to this section. The remaining Heterogyna are solitary, and there are but two kinds of individuals; the males are winged and the females apterous. The antennæ are either filiform or setaceous. This section is composed chiefly of the Linnæan genus Mutilla.

The *Fossores* comprise those species, possessing a sting, of which all the individuals are furnished with wings; they do not live in society, and consequently there are but males and females; the legs are formed for running, and in very many for burrowing, and hence the name which has been applied to them. The tongue is always more or less widened at the extremity, and not slender and elongated. This group contains the families *Scoliadæ, Sapygidæ, Pompilidæ, Sphecidæ, Bembicidæ, Larridæ, Nyssonidæ*, and *Crabronidæ*.

The *Diploptera* contains those species which have the superior wings folded longitudinally when at rest. The antennæ are usually geniculated in this group, and thickened at the extremity. The eyes are emarginated, and the prothorax is prolonged posteriorly on each side to the origin of the wings. The anterior wings possess two or three closed cubital cells, of which the second receives two recurrent nervures. The body is smooth, or nearly so, and almost always varied with black and yellow colours. Many of the species live in society and have three kinds of individuals.

Latreille divides this tribe into two families, the *Masarides* and the *Vesparicæ*. The Wasp and Hornet are familiar examples of the section *Diploptera*.

The last tribe, the *Anthophila*, or the Bees, are distinguished by the greatly elongated maxillæ and labium, which form the proboscis used in collecting honey. They have the two posterior legs generally formed for collecting and conveying pollen. The first joint of the tarsi of these legs is very large and much compressed. The larvæ live upon honey and pollen collected by the parent insect. The perfect insect feeds upon honey [BEE.]

* It must not be imagined that these two sections constitute *natural groups*: all that can be said in their favour is, that they are *convenient* for the arrangement of the species.

HYMENO'PTERA, FOSSORIAL. This group, to which Latreille applies the name *Fossores*, and the characters of which are given in the article HYMENOPTERA, is divided into eight families:—1. Scoliadæ [SCOLIADÆ]; 2. Sapygidæ [SAPYGIDÆ]; 3. Pompilidæ [POMPILIDÆ]; 4. Sphecidæ [SPHECIDÆ]; 5. Bembicidæ, containing those species in which the prothorax is transverse and narrow, elongated laterally, and extending to the base of the anterior wings; legs moderate or short; head, when viewed from above, broader than long, the eyes extending to the posterior margin; abdomen conical; labrum distinct. Of this family three genera are characterized by Latreille:—*Bembex, Monedula*, and *Stizus*. Family 6, Larridæ [LARRIDÆ]; family 7, Nyssonidæ [NYSSONIDÆ]; and family 8, Crabronidæ. In the insects of this family the head is generally very large, nearly square when viewed from above; the antennæ are often thick near or at the apex, and the abdomen is oval. It contains the following genera: —*Trypoxylon, Gorytes, Crabro, Stigmus, Celia, Diodontus, Ceratophorus, Passalæcus, Pemphredon, Cemonus, Mellinus, Alysson, Psen, Arpactus, Mimesa, Cerceris*, and *Philanthus*.

HYMENOSO'MA, Dr. Leach's name for a genus of brachyurous crustaceans. [PINNOTHERIANS.]

HYMETTUS. [ATTICA.]

HYMN (ὕμνος), a song of praise and adoration, in honour of a Deity, and by the Hebrews, as well as the Greeks, accompanied on some musical instrument. The *Te Deum* and *Benedictus* are, in our liturgy, both called hymns: the former is supposed to have been written by St. Ambrose; though St. Hilary, bishop of Poitiers, is said to have been the first who composed hymns for the church. To Prudentius is ascribed most of those which appear in the Roman breviary. The hymn should be a song of joy, not of lamentation, as is too often the case in the present day. Such was the opinion of St. Isidore, who gave to the song of complaint and sorrow the name of *threna*, from threnos (θρῆνος), 'lamentation.'

The term is now applied to any short religious poem sung in places of public worship, not being a version of a psalm, or taken directly from any of the canonical books of Scripture.

HYOSCY'AMUS, a genus of plants belonging to the natural order Solanaceæ, among which it is distinguished by having an irregular corolla slit on one side, a 5-toothed permanent calyx, and a capsule opening by a transverse lid. It is to one of the species of this genus, Hyoscyamus niger, that the name of Henbane is given. Common Henbane is a biennial, hairy, clammy, branched, fetid plant, from 1 to 2 feet high, growing in waste and uncultivated places. It has oblong, stem-clasping, coarsely lacerated leaves, dull yellow flowers traversed with livid purple veins, and a large spiny calyx. When in fruit, the whole of the upper part of the plant is occupied by the large spreading spiny calyxes arranged in one-sided leafy spikes.

HYOSCY'AMUS NIGER (Henbane), an indigenous herbaceous annual or biennial plant, of which the leaves and seeds are officinal. The leaves should be collected when the plant is flowering. The lower leaves are large and have short petioles; the upper are smaller and sessile: they are more or less deeply sinuate, pinnatifid, or toothed, soft to the touch, hairy, slightly viscid, and of a greyish green colour. Odour disagreeable, stupifying; taste herbaceous, nauseous, somewhat acrid. Both odour and taste are much diminished by drying, which should be quickly performed, and the leaves preserved in well-closed vessels, in a cool dry place; 100 parts of fresh leaves dry into 14, and 10 pounds of fresh herb yield by careful management 9 ounces of inspissated juice, or extract, which is extremely apt to spoil and lose all its virtues; yet with proper attention it may be so prepared as to keep for several years with its qualities unimpaired. An insect, Cimex Hyoscyami (Linn.) is apt to attack the leaves, and render them useless. The virtues are dependent on the presence of Hyoscyamia, which however is more easily obtained from the seeds. The seeds are small, flattened, kidney-shaped, with minute dots and indentations on the surface: of a yellowish grey colour. When bruised they evolve an odour of henbane. Taste oily, bitter; by expression they yield a fat oil, and also furnish a very powerful extract, as well as Hyoscyamia. This alkaloid crystallizes in stellated acicular crystals, with a silky lustre; but it more generally occurs in a colourless transparent soft viscid mass. When properly dried it is devoid of odour, but when moist, and particularly in an impure and coloured condition, the odour is highly disagreeable, stupifying, and tobacco-like. Its action, even in very small quantity, is extremely narcotic and fatal, like nicotine. It kills more slowly than conia, and scarcely causes convulsions. Applied externally to the eye, even in very minute quantity, it causes great and enduring dilatation of the pupil. Cats to which it has been given have been observed to gnash the teeth and foam at the mouth.

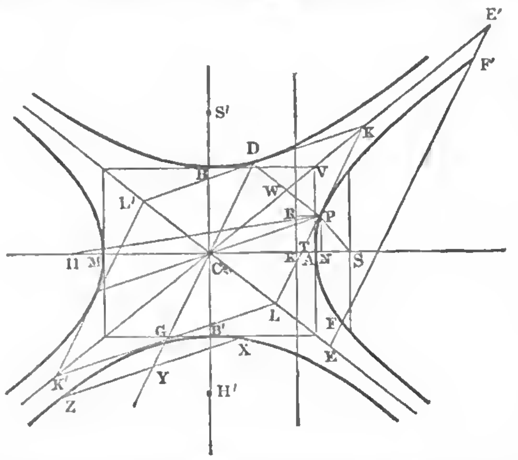
Hyoscyamus, when taken by a person in health, produces disorder of the nervous system, inducing symptoms greatly resembling hysteria, if the dose be moderate; but if large, it causes all the phenomena of narcotic poisoning, such as result from other solanaceous plants, particularly congestion of the vessels of the brain with coma. Administered in medicinal doses to persons with disturbance of the nervous system, it lessens the irritability, quiets the circulation, and when morbid wakefulness exists, disposes to sleep. It possesses a superiority over opium in many instances, as it does not constipate the bowels, but rather acts as a mild laxative. This circumstance often renders it a valuable agent in allaying pains and other distressing symptoms incident to females in particular states of their system. Tincture or a well prepared extract is a good form of exhibition; but probably some of the salts of hyoscyamia will be found the most eligible mode of administration, or a tincture of the seeds may be used.

In case of accidental poisoning, the stomach-pump should be used, or an emetic of sulphate of zinc be given; if the brain should appear much oppressed, venesection may also be resorted to.

HYPA'TIA. [Theon.]

HYPE'RBOLA. In connection with this article see Conic Sections, Ellipse, Parabola.

The hyperbola is one of the curves known by the name of conic sections. It is in the application of mathematics the least useful of the three; indeed so very rarely does the necessity of using it occur, that it may be a question whether the study of it should form a part of a course of practical mathematics. But there are in pure analysis so many analogies which are illustrated by distinctions existing between the properties of the ellipse and hyperbola, that the student who aspires to more than elementary knowledge cannot dispense with the comparison of the two curves.



The two branches passing through A and M form a complete hyperbola, derived from the cone, or from the general equation of the second degree. [Conic Sections.] There is a pair of straight lines passing through the centre C, namely, L′CL and K′CK, which are asymptotes to the curve. There are two foci (as in the ellipse) S and H, the position of which may be thus found when the principal axis AM and the asymptotes are given: from A draw AV perpendicular to the axis; then CS and CH are both equal to CV.

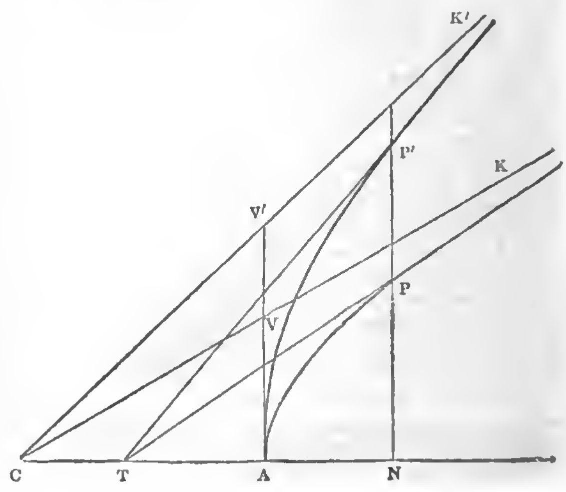
The difference of the focal distances HP and SP is always equal to the axis major AM: in the branch passing through A, HP is greater than SP, and *vice versâ*. The tangent PT always bisects the angle SPH; and PN, the ordinate perpendicular to the axis, being drawn, CA is always a mean proportional between CT and CN. There is also a *directrix*, as in the ellipse, found by taking on the line CS, CK, a third proportional to CS and CA, and drawing through K a perpendicular to the axis; and as in the ellipse, SP always bears the same proportion to PR, namely, that of CS to CA. And CS divided by CA is called the *excentricity*, the distinction between the ellipse and hyperbola being that in the former the excentricity is less than unity, and in the latter greater. The double ordinate drawn through S or H is called the *latus rectum* of the hyperbola, and its half the semi-latus rectum. Thus far the resemblance between the ellipse and hyperbola is very visible: at the same time it is obvious that there is nothing in the latter which answers to the minor axis of the ellipse, or to conjugate semidiameters. But if another hyperbola be described in the manner immediately to be pointed out, a figure will be obtained which will enable us to point out properties answering in all respects to those of the ellipse. Complete the rectangle CAVB, and describe another hyperbola of which CB is the semi-axis, and the same lines as before the asymptotes. This hyperbola is said to be *conjugate* to the former one; and its foci S′ and H′ are at the same distance from the common centre as S and H.

In the ellipse, CA was called the *major* semi-axis, as being greater than CB, the *minor* semi-axis. Let the words major and minor refer to the importance of the several axes, and not to their magnitude. Then CA is called the major semi-axis (or the semi-major axis) of the hyperbola passing through A and M, and CB its semi-minor axis. Conversely, CB is the semi-major axis of the hyperbola passing through B and B′, and CA is its semi-minor axis. Generally the major axis of an hyperbola is that which cuts it, and the minor axis that which cuts the conjugate hyperbola.

As in the ellipse, the square on the ordinate PN is to the rectangle of MN and NA (which is the excess of the square of CN over that on CA) in the proportion of the square on CB to the square on CA. If CD be drawn parallel to the tangent PT, D is said to be conjugate to P, and the semi-diameter CD to the semi-diameter CP. If the parallelogram PCDK be completed, the point K will always fall on the asymptote, and the other diagonal DP will be parallel to the other asymptote. And CP, any semidiameter falling in the acute angle of the asymptotes, always exceeds its semiconjugate CD; and the excess of the square on CP over that on CD is equal to the excess of the square on CA over that on CB. The area of the parallelogram CDKP always remains of one magnitude, namely, equal to CAVB. The rectangle of CW and WP always remains the same, namely, equal to the square on half the line joining A and B. Any part of a tangent KL, intercepted between the two asymptotes, is bisected by P, the point of contact; and if EE′ be drawn parallel to KL, the interceptions EF and E′F′ are equal, and the rectangle of EF and FE′ is always equal to the square on PK or PL. And the rectangle of the focal distances HP and SP is always equal to the square of the semiconjugate diameter CP.

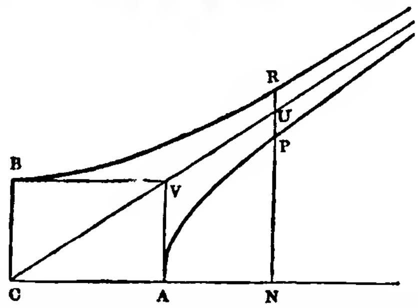
Any ordinate XZ drawn parallel to a tangent GL is bisected by the diameter CG drawn through the point of contact. And the square on YX is to the rectangle of DY and YG (or the difference of the squares on CY and CG) in the proportion of the square on CP to the square on CD.

A perpendicular let fall from a focus S upon a tangent PT meets the tangent in a point of the circle whose centre is C and radius CA.



If any number of hyperbolas be drawn having the samo centre C and tho same major axis CA, and ordinates NP, N′P′, &c., be drawn to the samo abscissa CN, the tangents at P, P′, &c., will all meet the axis CA in the same point T: and any two such ordinates PN, P′N, will always be to one another in the proportion of the minor axes of the hyperbolas to which they belong.

If it were not necessary to consider the hyperbola in connexion with the ellipse, perhaps the following way of describing it would be the most simple.



Let CA be the semi-axis major, and CU one of the asymptotes: and while the line NU moves parallel to AV, let P move upon that line in such a way that the square on NP shall always be less than the square on NU by the squaro on AV. Then P will trace out one branch of the hyperbola. But if at the same time the square on RN *exceed* the square on NP by the square on AV, the point R will trace out a branch of the conjugate hyperbola.

For a remarkable property of the area of an hyperbola see LOGARITHMS.

Among ellipses there is one sort which is conspicuous, namely, the ellipse in which the major and minor axes are equal, or the *circle*. The corresponding hyperbola, namely, that in which the major and minor axes are equal, is called the *equilateral* hyperbola; and though not so remarkable a curve as the circle, yet presents some peculiar simplification of properties. Its asymptotes are at right angles to one another, and the hyperbola and its conjugate are similar and equal. Any semidiameter CP is equal to its semiconjugate CD, and PD is at right angles to CW. Its excentricity is $\sqrt{2}$ or 1·4142 . . . . , and the square on CN always exceeds the square on NP by the square on CA. For a remarkable analogy between the circle and the equilateral hyperbola, see the 'Library of Useful Knowledge: Differential Calculus,' p. 120.

In the preceding article it will be observed that we have called the two branches passing through A and M *one* hyperbola. They are frequently called two *opposite* hyperbolas; but they form in fact only one curve, defined by one equation.

HYPE'RBOLE (ὑπερβολή, from ὑπέρ above, βάλλειν to throw) means literally an over-casting; in its common sense, a going beyond the truth in describing an object, not by the introduction of qualities which do not belong to it, but by the exaggeration of those which do. For example, it may be hyperbolical to say that the complexion of a fair woman is whiter than snow; hut to say so of a brown woman is either irony or simple falsehood. Poets in all nations have affected this mode of speech; but it is peculiarly characteristic of the Oriental nations, both in prose and verse.

HYPERICA'CEÆ, a natural order of Polypetalous Exogenous plants, with an imbricated calyx, polyadelphous stamens, and a many-celled, many-seeded ovary, with several styles, which are usually quite distinct. The leaves are often marked with pellucid dots, and there is in many species, in addition, a number of black dots which occupy some part, usually the margin, of both leaves and flowers. In all cases the latter belong exclusively to the Xanthic series of colour.

The species inhabit various parts of the world, both within and without the tropics; they are especially common in the Southern States of the North American Union. Many are objects of ornament, but they are little cultivated because they have frequently a disagreeable hircine odour. Thoy are generally astringent, and in some cases, as in the genus Vismia, yield a substance so much resembling Gamboge as to have acquired in commerce the name of American Gamboge.

Hypericum perforatum.

1, a flower expanded; 2, a peta. 3, a ripe fruit; 4, a longitudinal section of a seed.

HYPERI'DES or **HYPE'RIDES** (Ὑπερείδης or Ὑπερίδης), an Athenian orator, a contemporary of Demosthenes, and one of the ten from whose writings the Lexicon of Harpocration was formed. According to Arrian, Hyperides was one of the orators whom Alexander demanded of the Athenians after the destruction of Thebes: but the list which the author of tho 'Life of Demosthenes' (attributed to Plutarch) gives as the most trust-worthy does not contain the name of Hyperides. He was engaged in the Lamian war, which immediately followed the death of Alexander, B.C. 323, and he spoke a funeral oration over those who fell in the battle, which was highly commended by antiquity. A considerable fragment of this oration is preserved by Stobæus (*Serm.* 123). In the year B.C. 322, Hyperides, with Demosthenes and others, having fled from Athens, was condemned to death, and the sentence was carried into effect by Antipater. (Arrian, 'History of Alexander's Successors,' *Photius*, c. 92.) These two great orators, who had been in their lifetime both friends and enemies, died in the same year. There is no extant oration of Hyperides. The critics of antiquity unite in the highest eulogiums of Hyperides as an orator. Dionysius of Halicarnassus, in his remarks on Dinarchus (c. 5, &c.), characterizes his style as marked hy excellences of the highest order. For some further remarks on Hyperides, Ruhnken's *Historia Critica Oratorum Græcorum* may be consulted; and as to the oration of Hyperides against Aristogeiton, see Clinton, *Fasti Hellenici*, p. 355.

HYPERSTHENE (Labrador hornblende) occurs crystalline and massive. Primary form a rhombic prism; cleavage parallel to the lateral planes, and to both diagonals; fracture uneven; hardness 6; scratches glass, and is scratched by quartz; colour on the metallic-looking surface reddish, in other directions greyish or greenish-black; streak greenish-grey; lustre metallic in one direction, on the cross-fracture vitreous; in some varieties translucent on the edges; opaque; specific gravity 3·389; massivo varieties amorphous. Before the blowpipe alone, undergoes no change; on charcoal fuses into a greenish-grey globule; with borax fuses easily. Occurs at Labrador, and in the island of St. Paul.

Analysis by Klaproth:—

Silica	54·25
Magnesia	14·00
Alumina	2·25
Lime	1·50
Oxide of iron	24·50
Water	1·
	97·5

HYPERSTHENE ROCK. This is among the rarer varieties of those igneous aggregates which by many geologists are grouped together under the title of Trap. Dr.

MacCulloch, who first noticed Hypersthene rocks in Skye and Ardnamurchan, describes three varieties:—

Hypersthene with compact felspar,
" with common felspar,
" with glassy felspar.

In largeness of grain it varies from large-grained granite to ordinary greenstone, or is even as fine as basalt; the felspar is of various colours. It passes to common greenstone.

In Skye it forms the Cuchullin Mountains; part of the mountain of Carrock Fell in Cumberland is also formed of it; a dyke of Hypersthenic trap was noticed in Radnorshire; it occurs also in Cornwall. In the Valteline M. Necker has pointed out the passage from Hypersthenic sienite to granite.

HYPE'RTROPHY (from ὑπέρ, above, and τροφή, nutrition), a term in medicine signifying the enlargement of a part of the body from excessive nutrition. The hypertrophied organ contains no new solid or fluid substance, but one or more of its proper component tissues are in greater quantity than in the healthy state. The opposite condition of a part, namely, diminished bulk from defective nutrition, is termed atrophy. [ATROPHY.]

When hypertrophy attains such a degree as to interfere with the action of the organ in which it is seated, it constitutes an important and highly dangerous disease; such is frequently hypertrophy of the heart.

The immediate cause of the hypertrophied state is, as we have said, increased nutritive action in the organ or tissue. And since all parts of the body are formed and nourished from the blood circulating in them, it is natural to suppose that the production of hypertrophy would be accompanied by increase of the quantity of that nutritive fluid in the part. It is necessary however not merely that the blood should be collected in it in larger quantity, but also that it should circulate rapidly through the minute vessels, so as to bring constantly fresh portions of new nutritive matter into contact with the smallest component particles of the structure. This is illustrated by reference to the known exciting causes of hypertrophy which give rise primarily to this increased quantity and accelerated circulation of blood in the small blood-vessels. There are, it is true, instances of hypertrophy of which we cannot perceive any exciting cause: thus, in some persons the adipose tissue, or fat, in others the bones are more than ordinarily developed, without our being able to assign any other reason for it than that there was a predisposition in the constitution of the individual to such increased nutrition. But generally we can refer the hypertrophy either to excessive exercise of the part, or to the long-continued action of a stimulus upon it. When any part is in a state of activity, a greater flow of blood takes place towards it than when it is at rest; and it is well known that a stimulus such as friction applied to a part of the body causes it to become of a brighter red colour from its vessels being more injected with blood. If such a state be long kept up, over-nourishment is the result. A popular example of hypertrophy from increased exercise is afforded by the muscles of the arms of the blacksmith, or those of the legs of the opera-dancer. The heart also frequently becomes hypertrophied from this cause; for instance, in cases where an increased action of its muscular walls is rendered necessary by an obstacle to the passage of the blood which it propels into the body. Hypertrophy from the second cause, the long-continued operation of a stimulus, is seen in the thickened state of parts of the skin which have been subjected to friction. But hypertrophy from this cause is seldom simple; it is generally combined with the deposition of new matter of a different nature from the original tissue, the stimulus having excited inflammatory action as well as increased nutrition.

The treatment of hypertrophy consists in the removal of the exciting cause, if this can be effected; the part should be kept at rest as much as possible, all irritation prevented, and the supply of blood diminished. These means can however in very few cases be put into practice to such an extent as to be beneficial, except in arresting the progress of the affection. (For further information on the subject of hypertrophy the reader may consult Andral's *Pathological Anatomy*, and Dr. Carswell's *Illustration of the Elementary Forms of Disease*.)

HYPOCAUSTUM. [BATH.]

HYPOCHONDRI'ASIS. Hypochondriasis is a state of extreme sensibility of the nervous system, which leads patients to believe themselves worse than they really are, to detail their sufferings with exaggeration, to individualize all the painful sensations which they experience, and to consider them the symptoms of as many different diseases. Allied to this extreme sensibility there is a mental exaltation, which causes the patients to pay the most minute attention to what passes within themselves. The hypochondriac recounts, without a single omission, all the details of his animal and organic life; he relates the manner in which his digestion is effected; he numbers the minutes of his sleep; he describes his sensations, his passions, the succession of his ideas; and dilates on every thing that concerns himself with a copiousness that nothing can arrest. The story which he tells you to-day he will relate again to-morrow, and at all times whenever he can find you willing to listen to his tale of sufferings.

We have witnessed the case of a gentleman, who was so engaged in attention to himself as to occupy the intervals of the visits of his physician in writing a journal of his sensations. This journal was, at every visit of the physician, produced for his perusal. During a period of several years this gentleman was, without any adequate reason, almost daily in dread of immediate death, and was continually upbraiding his medical attendant and charging him with the greatest cruelty in coming so seldom to see a man in such imminent danger.

As we do not in general see in hypochondriacs any loss of flesh or any appearances of disease corresponding to the frightful picture which they draw of their sufferings, we take them for visionaries; and such, in most instances, they really are. M. Leuret relates the case of a hypochondriac, who, one day, among other symptoms of which he complained at great length, said that he could extend his leg slowly only and with difficulty, and to show to what an extremity he was reduced he lifted the limb with an appearance of great effort. 'Well! what can you wish more?' inquired M. Leuret. 'Zounds!' cried he abruptly, 'to do this;' and at the same time he extended his leg with great freedom and force. M. Leuret could not restrain his laughter; and his patient, on perceiving the mistake that he had made, laughed also most heartily.

The sufferings of hypochondriacs have been called imaginary, and, if it is meant that they are a product of the imagination, the appellation is just; but the appellation of 'imaginary' is false if it is pretended that they are not *really* felt. Of all patients, those whose diseases are *imaginary* probably suffer the most. In many cases however these persons are affected with a real disease, and the term hypochondriasis is applicable to them only in consequence of their having their attention constantly fixed on their complaint, and of their experiencing a degree of fear and sadness which their condition does not warrant.

Hypochondriasis is frequently witnessed in young men of studious habits, and is the result of intellectual application too much prolonged. There is a class of students who, from the nature of their studies, are frequently affected with it—we allude to students in medicine. The descriptions which they read and hear of diseases, and the continual observation of the sick, affect their imaginations. They learn that incurable diseases often arise in the most insidious manner. They apply to themselves the lessons they have just learned; but as these lessons are very incomplete, their application is false, and they discover in themselves a number of diseases of which there is no real existence. There are few physicians who, in recalling to their minds the period of their first studies, and the sick whom they first visited, do not at the same time remember the inquietude which they experienced respecting their own health. Persons in the habit of reading medical books run the same risk as medical students, and are similarly affected.

Another very fertile source of hypochondriasis is luxury, and the want of occupation and exercise. The hypochondriasis produced by this cause is the most obstinate of all, and is at once the despair of the patient and the torment of the physician. Happy are those whom the possession of a competence, earned by the labour of each day, preserves from such a malady. Poverty itself, with all its privations, is attended with less misery than the riches of the hypochondriac.

Hypochondriasis occasionally results from other causes, such as misfortunes, the excesses to which young men are addicted, and the prolonged and injudicious use of medicines.

The treatment of hypochondriasis must of course vary in some degree with its cause. We must endeavour to allay the groundless fears of hypochondriacs, and by a change in their mode of life, and by diverting their attention, to break the habit which they have formed of continually brooding over themselves. The first point, and which is quite essential, is that the patient should have an entire confidence in his physician. Confidence begets tranquillity, and banishes all those symptoms that originate in fear.

If hypochondriasis result from severe study, a relaxation from labour, and the distractions of society, with a country life, will prove the most efficacious remedies.

If it is occasioned by idleness and luxury, a solid and permanent cure can rarely be obtained except by a life of occupation, a moderate regimen, and bodily exercise long sustained. The field sports of this country are admirably adapted to the fulfilment of these conditions. Instances have been recorded of patients having been freed from the hypochondriasis to which they had been long a prey by the loss of their fortunes, or by some calamity which roused them from their state of apathy and rendered exertion imperative.

In all cases a remedy must be sought for in the banishment of their groundless fears, in a change in their mode of life, and in scenes that withdraw them from the continual contemplation of themselves.

HY'POGENE, a term in geology implying 'nether-formed' (from ὑπὸ, below, and γεν, the root of γίγνομαι, which signifies 'birth' or 'formation'), proposed by Mr. Lyell as a substitute for the word primary. Mr. Lyell affirms that 'the popular nomenclature of geology, in reference to the rocks called *primary*, is not only imperfect, but in a great degree founded on a false theory; inasmuch as some granites and granitic schists are of origin posterior to many *secondary* rocks. In other words, some primary formations can already be shown to be newer than many secondary groups—a manifest contradiction in terms.'

As far as granite is concerned, this remark is entirely true: its origin is proved to be independent of any particular epoch, and it has been long thrown out of the modern catalogue of primary rocks. As applied to granite, Mr. Lyell's emendation is exactly equivalent to the term Plutonic used in Brongniart's classification; but when the term Hypogene is used to include the primary stratified rocks, a particular hypothesis of their origin is tacitly assumed, which many geologists think not sufficiently established.

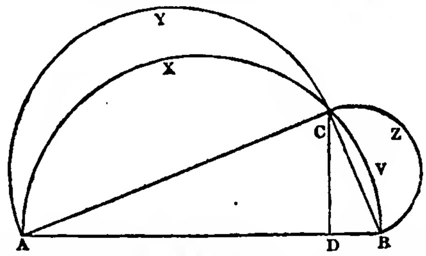
It is assumed in this hypothesis that the primary strata have acquired their present mineral aspect, not through any circumstances peculiar to their original formation, and supposed to be characteristic of the physical agencies exerted in the earlier æras of the world, but through the subsequent agency of heat and chemical forces in those regions, and under those circumstances where the Plutonic rocks are generated. The term primary implies only that the rocks so named are the earliest we can trace in the crust of our planet; and as geological classification is mainly founded on succession of time, and the relative antiquity of strata can be determined as a fact, it seems unlikely that the well-known designations of primary, secondary, and tertiary strata will be abandoned, though, as expressing the subterranean origin of certain properties and conditions of mineral masses, the word *hypogene* appears very suitable. (*Principles of Geology*, 5th ed., vol. iv., p. 379.)

HYPO'PION (from ὑπώπιον), a collection of purulent matter in the anterior chamber of the eye. Mr. Lawrence (*Treatise on Diseases of the Eyes*) shows that this should not be regarded as a separate disease, but as the result of inflammation of some part adjacent to the anterior chamber. The purulent matter is in some cases secreted by the membrane of the aqueous humour; in others it proceeds from the bursting of an abscess of the cornea or of the iris. The pus poured into the anterior chamber being heavier than the fluid which naturally fills that cavity, falls to the bottom, and produces an opaque spot which is visible through the cornea, and has its upper edge horizontal, and its lower edge, which is bounded by the margin of the cornea, crescentic. The affection is always accompanied by inflammation of part or of the whole of the tissues of the eye, and, like all other such cases, requires active antiphlogistic treatment.

HYPOTHENUSE or HYPOTENUSE (ὑποτείνουσα, subtending), is a term which has always been applied since the time of Euclid to the side of a *right-angled* triangle which subtends, or is opposite to, the right angle.

The property of the hypothenuse of a right-angled triangle being one of the most important elementary propositions in the whole of mathematics, it will be worth while to devote some space to its consideration. We shall proceed to give some demonstrations, derived from different principles.

The property in question, in a limited form, is this: that the *square* on the hypothenuse is equal to the sum of the *squares* on the sides. The introduction of the square however, in preference to any other figure, arises from the fact of the property of the hypothenuse with respect to the square being demonstrated before that with respect to any other figure. The general proposition is this: if three similar figures (that is, figures of the same shape, but differing only in size) be described upon the three sides of a right-angled triangle, the content of that which is described upon the hypothenuse will be equal to the sum of the contents of the figures described upon the sides. Thus, all



semicircles being similar figures, let AXCB, AYC, and CZB, be the semicircles described on the hypothenuse and sides of the triangle ACB, right-angled at C: then AYC and CZB are together equal to AXCB. Hence was obtained the first instance in which a curvilinear space was reduced to an equivalent rectilinear one. Take away the segments AXC and CVB from both sides of the preceding equation, and the remainders of the smaller semicircles, namely, the *lunules* YX and ZV, are together equal to the remainder of the larger one, namely, the triangle ACB. This proposition is attributed to Hippocrates. [GEOMETRY.]

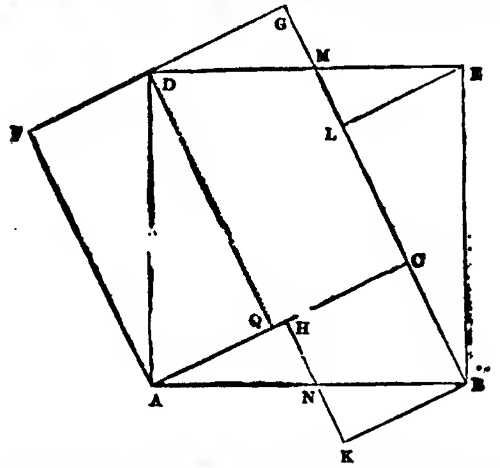
As soon however as the proposition is demonstrated with respect to squares, all the rest follows easily, after the doctrine of proportion has been established. It is the property of similar figures described on two lines to be in the same proportion as the squares on those lines; if then the squares on two lines be together equal to that on a third, then any two similar figures described on the first two lines are together equal to the corresponding figure described on the third.

We shall now sketch four different demonstrations of this fundamental proposition, desiring it to be remembered that we suppose the reader to have already become acquainted with it in an elementary course of geometry.

1. Let CD (in the preceding figure) be drawn perpendicular to AB. Suppose that (after the manner of some writers on geometry) the theory of proportion and of similar triangles is established before anything is proved relatively to the areas of figures. Then it is easily shown that ACD and CDB are triangles similar to one another, and to the whole ACB. Now in such a system of geometry, it can easily be shown, without the aid of our theorem, that any two similar figures, described on two straight lines, are to one another in the proportion of the squares on those lines. Consequently, ACB, ADC, BDC, being similar triangles described on AB, AC, BC, are to one another as the squares on AB, AC, BC. But the first triangle is evidently equal to the sum of the other two: consequently, the square on AB is equal to the sum of the squares on AC and CB. This demonstration may be objectionable in a geometrical point of view, but it contains one of the most useful modes of illustrating the proposition to a person unacquainted with geometry. Let such a one be made to remark the very visible fact, that two similar figures described on two straight lines are always of the same relative magnitude, each to the square described on the same line: he will then, seeing that the right-angled triangle is made up of two right-angled triangles similar to itself, each having one of the sides for its hypothenuse, be able to see that the square on the hypothenuse is equal to the sum of the squares on the sides.

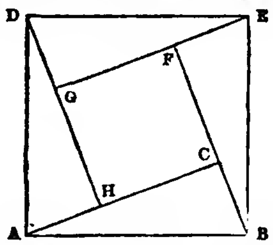
2. The next method shall be ocular demonstration, made by cutting the square on the hypothenuse into the squares

on the sides. Let ACB be the triangle, right-angled at C·



and on AB describe the square ADEB, and on AC and CB the squares AFGC and CHKB. From E draw EL perpendicular to BM, and from D draw DQ perpendicular to AC. It is easily proved that the triangles ACB, BLE, DQA, are equal in all respects: whence (1.) the square on AC must pass through D, since DQ = AC; (2.) EL = BC = BK. Hence, by the parallels, the triangles NKB and MEL are altogether equal, so that EM = BN, whence MD = NA, and, by the parallels, DGM and AHN are altogether equal. And AFD is in all respects equal to BLE. Out of the square ADEB take BLE, and remove it to AFD; remove MLE to NKB, and AHN to DGM. Then the square ADEB will be formed into the two squares AFGC and HCBK.

3. The next demonstration is derived from the Hindu treatises on algebra: not that it is actually found there, for the Hindu works demonstrate nothing; but attached to the statement of the proposition, in the margin of some copies, is the following diagram, which is no doubt that belonging to the demonstration, which is as follows —Let

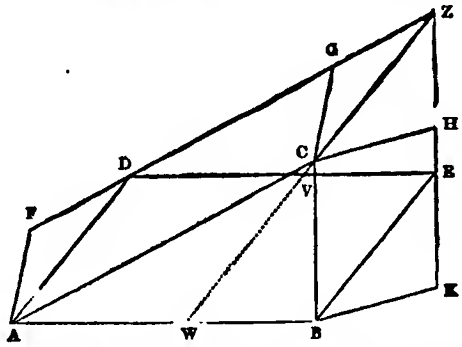


ACB be the triangle, and describe the square ABDE on the hypothenuse. Draw DH perpendicular to AC, and EG perpendicular to DH, and produce BC to meet EG in F. Then the square is made up of the four equal triangles ACB, BFE, EGD, DHA, and of the smaller square GFCH, which is the square on HC, the difference of AC and CB. But the four triangles make up twice the rectangle of AC and CB, and twice the rectangle on two lines, together with the square on their difference, is the sum of their squares: whence the square on AB is the sum of the squares on AC and CB. Judging by the general character of Hindu mathematics, it must be supposed that their demonstration was arithmetical, supposing the sides of the triangle to be represented by numbers, and using the equation

$$(a-b)^2 + 2ab = a^2 + b^2.$$

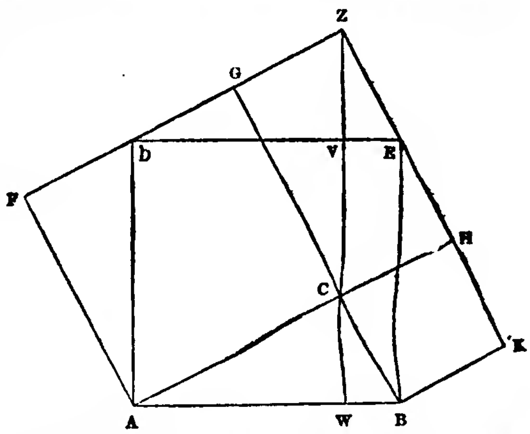
The following is the method of obtaining right-angled triangles, of which the sides shall be whole numbers. Take any two whole numbers whatsoever, x and y, of which x is the greater; then if $x^2 - y^2$ and $2xy$ be the two sides of a right-angled triangle, the hypothenuse is $x^2 + y^2$. For instance, let $x = 11$, $y = 7$; then $x^2 - y^2 = 72$, $2xy = 154$, and $x^2 + y^2 = 170$: whence 72 and 154 being sides of a right-angled triangle, its hypothenuse is 170. It is a remarkable property of any three numbers which represent the sides of a right-angled triangle, that one of them must be divisible by 5.

4. The last demonstration which we shall give is one which we prefer to any other, because it shows the property in question to be but one simple and prominent case of a property of great beauty and generality, common to all triangles This property was first noted by Pappus, and it shows that any parallelograms whatsoever being described upon the two sides of a triangle, a third parallelogram, equal to their sum, can immediately be drawn upon the third side.



Let ABC be a triangle, on two sides of which, AC and CB, let any parallelograms AFGC and BCHK be described. Produce FG and KH to meet in Z, and join ZC, and produce it to W. Through A and B draw AD and BE parallel to ZW, whence it follows that ADZC and CZEB are parallelograms, and, by equality of bases and altitudes, severally equal to AFGC and CHKB. And AD and EB are equal and parallel to ZC, and therefore to one another; whence ADEB is a parallelogram made up of the parallelograms ADVW and BWVE, which, by equality of bases and altitudes, are severally equal to ADZC and BCZE, that is, to AFGC and CHKB. Hence the parallelogram on the side AB is equal to the sum of those on the sides AC and CB.

Now let the triangle be right-angled at C, and let the parallelograms on AC and CB be squares, and repeat the preceding construction. Then GCHZ is a rectangle, and



GZC is in all respects equal to ACB, whence ZC = AB, and thence AD and BE are equal to AB, and the parallelogram DEAB is equilateral. But the angle DAC is equal to ZCH, which is equal to CBA, the triangles CZH and BAC being altogether equal. But CBA and CAB are together equal to a right angle; whence DAC and CAB are the same, or DAB is a right angle. Consequently, ADEB is an equilateral parallelogram, right angled at A, or it is a square; and the parallelogram ADEB, that is, the square on AB, is equal to the sum of the parallelograms AFGC and CHKB, that is, to the sum of the squares on AC and CB.

HYPOTHESIS (ὑπο-θεσις, *sub-positio*, supposition), literally, the act of placing one thing under another, that the latter may stand upon and be supported by the former; metaphorically, the assignment of any cause or reason why an observed event or phenomenon should have happened. For instance, the sun would disappear if it were deprived of its power of giving light, and also if an opaque body came between us and it: either of these circumstances would cause what we term a total eclipse, and either is therefore sufficient, as an hypothesis, to explain a total eclipse.

In the article CAUSE (in natural philosophy) will be found the discussion of several considerations connected with the use of hypotheses; and in the article ATTRACTION an instance of the important distinction between an hypothesis asserted because it is true, and one assumed because it is sufficient to explain observed phenomena. We suppose these articles to be known to the reader.

The following mode of argument is known in logic by the name of a hypothetical syllogism:—If A exist, Z exists; but A does exist, therefore Z does exist. Or, establish the absolute truth of an hypothesis, and the phenomena which necessarily follow may be asserted even without experiment. But this we are seldom in a condition to do. The preceding process cannot be converted: if A exist, let Z necessarily follow; Z has appeared, are we then entitled to say that A exists? By no means; for when we prove that Z necessarily follows from A, we do not therefore show that Z follows from nothing but A. But if we can establish the following:—If A exist, Z follows; if B exist, Z follows; if C exist, Z follows; and Z cannot happen in any other way: then from the arrival of Z we are entitled to assume that one of the three, A, B, or C, must necessarily exist, perhaps two, and perhaps all three. At the same time, if the existence of the consequence can be denied, the hypothesis is overthrown. If A exist, Z follows; but Z does not happen; then it is perfectly certain that A does not exist. The following summary of the four cases may be more worthy of our reader's consideration than many of them will suspect:—

1. When A is B, Y is Z. But A is B. } Therefore Y is Z.
2. When A is B, Y is Z. But A is not B. } Nothing can be concluded: Y may be Z on some other grounds, or Y may not be Z precisely because A is not B, or for some other reason.
3. When A is B, Y is Z. But Y is not Z. } Therefore A is not B.
4. When A is B, Y is Z. But Y is Z. } Nothing can be concluded: A may be B, and either because Y is Z, or for some other reason; and A may not be B, and there may be some other reason why Y should be Z.

The establishment of an hypothesis in natural philosophy may be considered as a process of which the following are the heads:—

1. The phenomenon observed is Z, and it is shown to be a necessary consequence either of A, B, or C, which seem natural and probable; also of D, E, &c., which seem altogether out of the question.
2. All the necessary consequences which can be shown to follow A, B, or C, are deduced as far as that can be done; and if all their consequences really happen, then there is no choice between A, B, and C; but if Z', a necessary consequence, say of C, should be found not to happen, then C cannot exist, and the choice can only lie between A and B.
3. Let A appear the more probable of the two, then A is assumed to be the cause of Z until something to the contrary appears. If A and B should be inconsistent with one another, then if one be assumed it must be to the exclusion of the other; but if both may be true, then the phenomenon Z may possibly be partly due to one and partly to the other.

An hypothesis thus assumed is obviously no more than a probable truth; and the existence of sects embracing different hypotheses is thus rendered not only natural, but even desirable. The consequence of such division is an ardour of investigation which would not otherwise be felt, in order to find out experiments or to make deductions decisive of the points in dispute. The rivalry between the emanatory and undulatory hypotheses on the nature of light has much increased our knowledge of that agent. But if at the same time it should seem that the idea which a reader entertains of physical science must be lowered by his learning to take such a view of a hypothetical foundation as that which has here been given, it should also be remembered that the exactness of natural philosophy does nothing but expose the uncertainty of human knowledge in general, at the same time that it reads a lesson to the cultivators of other branches of learning. The hypothesis of attraction, for instance, though established on much stronger grounds of probability than conclusions in connexion with which the word hypothesis is never mentioned, is always remembered as being an hypothesis.

At the same time the word hypothesis, like that of theory, has been frequently applied in a disparaging sense to speculations in which suppositions have been made for the purpose of drawing conclusions, and not, as in physics, with the view of supplying probable antecedents to conclusions which are already drawn from experiment. A notion is to be supported; it would be too obvious a fallacy to make the mere assertion of it an argument in its own favour, and thus some antecedent proposition, from which the one in question will follow, is assumed or attempted to be proved. To prove D, assume A, taking care that it shall be easy to show that from A follows B, from B follows C, and from C follows D. This is a use of hypothesis the direct converse of that which is made in physics, where D is supposed to be known and admitted, and it is asked which among all the As from which it might follow, is that from which it most probably does follow. [CAUSE.]

HYPSI'PETES. [LANIADÆ.]

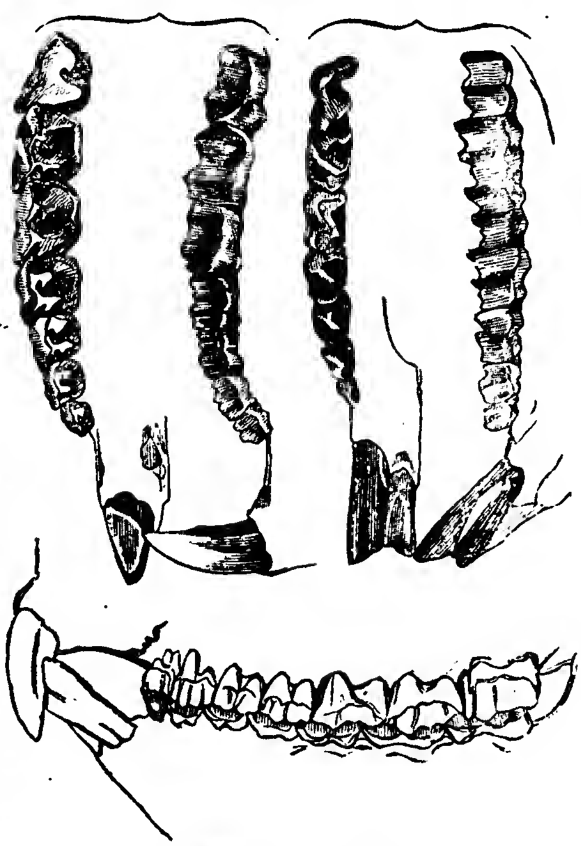
HYPSIPRYMNUS. [KANGAROO.]

HYPUDÆUS, the more correct mode of writing Hipudæus; but the latter form is generally used by the French zoologists.

HYRAX, the generic name for a form of quadrupeds of small size, but of great interest, in consequence of the peculiarity of their organization, which has led the more modern zoologists to assign them a place among the *Pachyderms*, though their external appearance, when cursorily examined, would seem to point out their relationship to the *Rodents*, among which they have been erroneously classed.

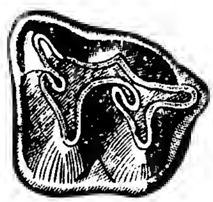
ORGANIZATION.

Dental Formula.—Incisors $\frac{2}{4}$; canines 0; molars $\frac{7-7}{7-7} = 34$.



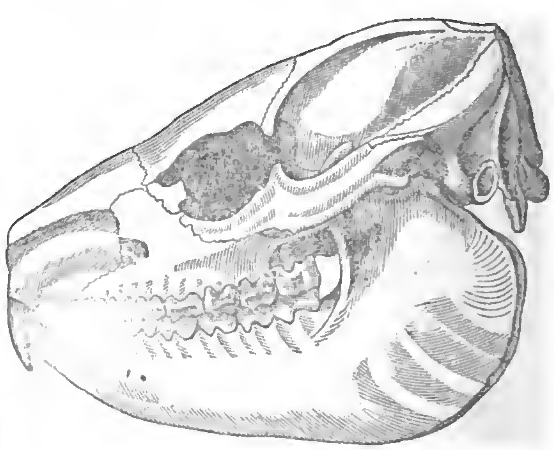
Teeth of Hyrax. (F. Cuvier.)

Cuvier observes that there is no quadruped which proves more completely than *Hyrax* the necessity of having recourse to anatomy for the determination of the true relations of animals. To that great zoologist we are indebted for the fact that the quadruped under consideration is a true *Pachyderm*, and, notwithstanding the smallness of its proportions, must be regarded as intermediate between the *Rhinoceros* and the *Tapir*. The resemblances which the *Hyrax* bears to the former of these may be traced, according to Cuvier, as far as the osseous structure is concerned, in the general form of the trunk, in the first place. The *Hyrax* has 21 ribs on each side, a number superior to that possessed by any other quadruped, the *Unau* excepted, which has 23; and those which, after *Hyrax*, have the most, belong precisely to the order of *Pachyderms*, in which Cuvier would arrange it. Thus, the *Elephant* and the *Tapir* have each 20; the *Rhinoceros* has 19; the *Solipeds* have 18. The greater part of tho *Rodents*, on the contrary, have only 12 or 13; and the Beaver, which has the most, has only 15. As regards the lumbar vertebræ, the resemblance begins to be more distant, for the *Rhinoceros* has only 3, followed hy 4 sacral and 21 or 22 caudal; while *Hyrax* has 8 lumbar, 7 sacral, and 5 coccygeal. The difference becomes more marked in the form of the pelvis; for the *ossa ilii* are very wide in the *Rhinoceros*, and sufficiently narrow in the *Hyrax*; but the analogy reappears in the *femora*, which exhibit a very marked commencement of a third trochanter, and is continued in many respects in the formation of the feet. But it is in the bony structure of the head that the *Hyrax* departs from the conformation of tho *Rodents*, and approaches the Pachyderms, particularly the *Rhinoceros*. It is true that as the nose of the *Hyrax* has no horn to support, the nasal bones have not received, as in the Rhinoceros, the thickness necessary for carrying that defensive organ; but the maxillary bones differ at once from those of the *Rodents* by the smallness of their extent, and the inferior size of the suborbital hole, which is generally very large in that order. In the number of the upper incisor teeth (2) the *Hyrax* resembles both the *Rodents* and *Rhinoceros unicornis*; but the number of lower incisors is 4. The upper incisors of *Hyrax* are not formed, like those of the Rodents, in the shape of a quadrangular prism, or in that of a cylinder curved and terminated by a truncation or a corner-edge. They are triangular and terminate in a point, recalling to the observer the canines of the *Hippopotamus*. Tho lower incisors are laid forward like those of the Hog; they are flat and dentilated in youth, but soon become worn by attrition against tho upper incisors. The molars represent those of the Rhinoceros, both in number and form, so that, were it not for the size, they might be mistaken for each other.



Molar tooth of Hyrax magnified. (Cuvier.)

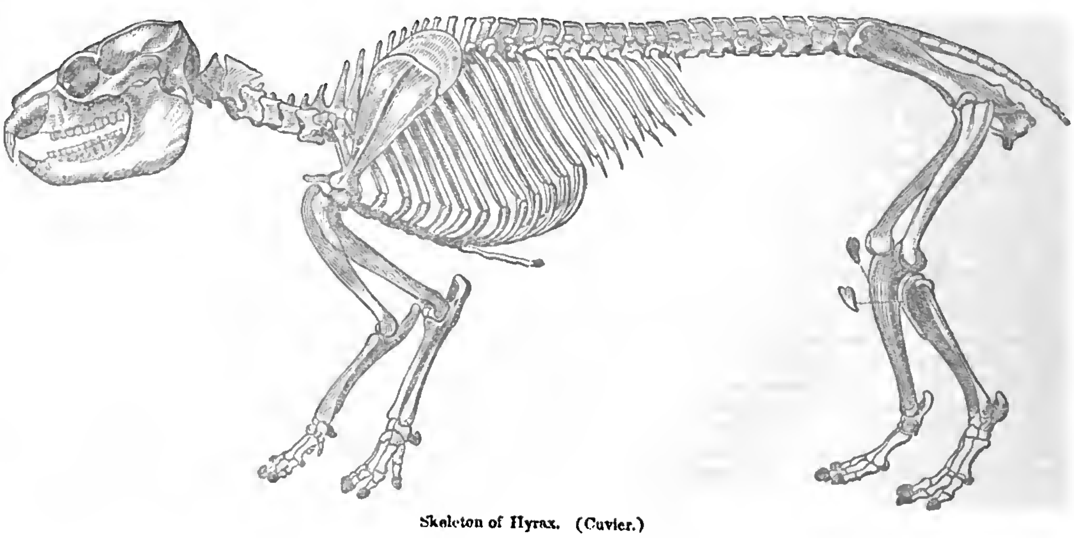
The condylo of the lower jaw is very different from anything observable among the Rodents, in which it is compressed longitudinally. In the *Hyrax* it is compressed transversely, as in the *Pachyderms*, and in all the other *Herbivora* which are not *Rodents*, being applied besides to a plane surface of the temporal bone, whereby a motion, more or less horizontal, from right to left, and from left to right, is permitted; and it is this that eminently distinguishes the articulation from that of all the *Carnivora*, where the condyle, although in truth transversal, enters into a deep hollow of tho temporal bones, and permits of no other motion to the jaw than upwards and downwards. After alluding to the form of the condyle and the dentition in the *Kangaroos* and *Phascolomys*, Cuvier goes on to remark that one of the most constant characters among the *Rodents* is the not having, at a certain age, more than a single parietal bone without suture, with two frontal bones, directly contrary to what occurs in man. In *Hyrax*, as in the *Pachyderms* and *Carnivora*, there are two frontal and two parietal bones. The zygomatic arch is constructed differently from that of the *Rodents*, and more conformably with that of *Rhinoceros*. In the molar teeth the construction and direction is rather that of the *Pachyderms* than of the *Rodents*.



Skull of Hyrax. (Cuvier.)

In *Hyrax* the number of toes (4 before and 3 behind) is precisely the same as in the *Tapir*. It is true, Cuvier observes, that some *Rodents*, and particularly the *Capybara* [HYDROCHŒRUS], have the same number, and that the last *phalanges* of the latter approach the flattened form of those of the *Pachyderms*; but their more elongated and free toes announce the family to which they belong. The *Hyrax* has the toes united by the skin down to the nail, as in the *Elephant* and *Rhinoceros*, and even more than in the *Tapir* and *Hippopotamus*.

Such are only a few of the leading points of agreement and disagreement in the bony structure of *Hyrax*, as considered relatively to the *Rodents* and *Pachyderms*. Our limits will not permit us to follow Cuvier through the whole of the details which he so minutely enumerates in the 'Ossemens Fossiles' in his usual masterly manner; and we must refer the reader to that work, with the remark that the general balance of resemblance, as far as the skeleton is concerned, is strongly in favour of the Pachydermic relationship of the animal.



Skeleton of Hyrax. (Cuvier.)

In 1832 Mr. Owen read to a meeting of the Zoological Society of London an account of the anatomical structure of *Hyrax Capensis*, which, whilst it was confirmatory of the anatomical description of Pallas generally, gave some additional facts, which will be readily appreciated by those who will compare his observations with the original description of *Cavia Capensis*, in the 'Spicilegia' and 'Miscellanea Zoologica' of Pallas. After alluding to the scientific history of *Hyrax Capensis* in the 'Ossemens Fossiles,' and in the 'Decas Mammalium' of Hemprich and Ehrenberg, he excuses himself for occupying the time of the meeting with the anatomical description of an animal already described by the most accomplished anatomist and zoologist of his age, inasmuch as no other original account of the structure of this animal has appeared since the time when the *Cape Hyrax* was dissected by Pallas; for he infers from the descriptions of some parts, the digestive organs for instance, which appear in several places of the 'Leçons d'Anatomie Comparée,' that Cuvier had not, at the period of his preparing that work for the press, himself dissected the *Hyrax*.

The specimen, which was a full grown male, belonging to Thomas Bell, Esq., F.R.S., had lived in the gardens of the Society through the greater part of the summer, and died in the winter repository there. The length (skeleton) from the anterior surface of the upper incisors to the vent was 1 foot 5½ inches. The whole account (*Zool. Proc.*, 1832) is well worthy of the attention of the comparative anatomist, but we shall chiefly select those points which bear upon the question as to the proper place of the animal in the system. The *duodenum* was not so loosely connected with the back part of the *abdomen* as in most of the *Rodents;* but it had throughout its course one entire investment of *peritoneum*. At its commencement it was not dilated, as in many *Rodents*. The *cœcum* seemed at first sight to have a great analogy to that of the *Hare* and other *Rodents*, being sacculated, and distended with a blackish pultaceous matter; but in form one would compare it rather with that of the *Tapir*, its magnitude arising more from its breadth than its length. The dilated part of the *colon* was bent in a sigmoid form, and the remainder was convoluted on a broad *mesocolon*, and at a distance of 2 feet from the dilated part (when unravelled) terminated between two conical *cœca* in a second dilated intestine. These singular *cœca* are minutely described by Mr. Owen, who then makes the following observations:—'In looking through the *vertebrata* for an analogous formation of the intestinal canal, we shall find the *Hyrax* standing almost alone in this respect: among the *Mammalia*, it is only in a few of the edentate species that the double *cœcum* is to be met with, as *e.g. Myrmecophaga didactyla*, Linn., and *Dasypus 6-cinctus*, Linn.; whilst in *Birds*, although the double *cœcum* more generally prevails, yet an additional single *cœcum*, anterior to these, has only been found in a few species. This structure however completes the analogy, *quoad* the number of *cœca;* but, with respect to function, the cases are widely different: the single anterior *cœcum* of *Hyrax* evidently performs an important part in digestion; while in the *Bird* it exhibits merely a trace of a structure peculiar to embryonic life. I should consider however the double *cœcum* of *Hyrax* as indicating an affinity to the group,* which intervenes, in the system of Cuvier, between the order it was originally placed in, and the one to which that great naturalist has transferred it. And it is interesting to find that while the *facies* of *Hyrax* so far simulates that of a *Rodent* as to have deceived the older naturalists, and to have concealed from them those unerring indications of its alliance with the *Pachydermata* which the osseous system exhibits; yet that Nature, as if in confirmation of her abhorrence to the *saltus*, had left in the internal structure of this singular animal an impression borrowed from the type of the *Edentata*.'

Mr. Owen further remarked that although the stomach of some of the *Rodents*, as the common *Rat*, and of the *Edentata*, as the *Manis*, exhibits a partial cuticular lining, yet it is among the *Pachyderms* that this structure is most prevalent. In the *Hyrax* two-thirds of the stomach, on the cardiac side, are lined with a thick white and wrinkled cuticle.

The liver had the same form and number of lobes as described by Pallas. The middle lobe had the usual two notches, into the left of which the coronary ligament entered; but the right contained no gall-bladder, which in the *Hyrax*, as in some of the *Rodents* and many of the *Pachyderms*, is deficient. Mr. Owen observed that a compensation for this deficiency was however in some measure apparent in this animal; for the hepatic ducts, immediately on leaving the lobes of the liver, dilated into three globular receptacles, the united capacities of which would have equalled a moderate sized gall-bladder. Mr. Owen also observed that in Pallas's *Spicilegia Zoologica* the peculiar insertion of the ureters is described with a note of admiration, and Mr. Owen stated that he was not aware that a parallel structure has since been discovered in any mammiferous animal possessing an urinary bladder. It is not however, he added, precisely in the *fundus* or summit of the bladder that the ureters open; they enter between the muscular fibres at the back part of the *fundus*, at the angles, analogous to the situation at which the *tubæ Fallopianæ* enter the human *uterus;* but they run obliquely downwards and inwards for two lines before they terminate, leaving however a full inch of space between them and the orifice of the *urethra*. For what purpose this structure is designed in the *Hyrax*, or whether the urine undergoes any change in consequence of it, Mr. Owen could not conjecture, but he alluded to the alleged medicinal qualities of this secretion noticed below (p. 419) as a curious fact. Leaving the reader to consult the other details in Mr. Owen's interesting memoir, we shall conclude our abridgment of it with the professor's closing remark. 'The chief peculiarity observed in the muscular system was a modification of the digastric muscle of the lower jaw, which arose, as in the *Armadilloes*, from the upper part of the sternum, instead of the *occiput* or temporal bone; and was inserted into the whole *ramus* and angle of the lower jaw; it was of remarkable strength, being as large as the *sterno-cleido-mastoideus* in man. It is this muscle which occasions the peculiar fulness of the neck in the *Hyrax*.'

In 1835 Mr. Martin read to the same society his notes of the dissection of the specimen of *Hyrax Capensis* presented to the society by Mr. Rudston Read. The anatomical details are given with minuteness and accuracy, but, as Mr. Martin himself remarks, the notes contain nothing absolutely new, though they may be of use as substantiating previous observations with regard to some very remarkable points of structure. The total length of the animal, which was a young male, was 1 foot 4 inches, that of the head being 3½ inches. The reader will find this dissection given at large in the *Proceedings of the Zoological Society* for 1835.

History.

Kolbe appears to be the first modern author who has noticed the *Hyrax* of the Cape; and he mentions it as a *Marmot*, a name adopted by Vosmaer and Buffon, the latter of whom also applies to it the term *Daman*, of which we shall presently have to speak. Blumenbach left it among the *Rodents;* and Pallas, who first gave a methodical and anatomical description of it, placed it under the genus *Cavia*, observing however that it differed remarkably from the congeners with which he arranged it. Linnæus gave the form the same place in his system, under the name of *Cavia Capensis*. Pennant does not mention the animal in his *Synopsis*, but in his 'History of Quadrupeds' he figures it as the *Bristly Cavy*, with the synonyms of *Agnus filiorum Israel*, Prosp. Alp. Ægypt.; *Daman Israel*, Buff.; *Ashkoko*, Bruce; *Hyrax Syriacus*, Gmel. and Schreb. Hermann however was the first who established the genus and gave it the name of *Hyrax*. Pennant also notices the form under the appellation of *Cape Cavy, Cavia Capensis*, Pallas. Gmelin makes *Hyrax* the last genus of the *Glires*, and records two species, viz. *Hyrax Capensis* and *H. Syriacus*. We have seen the place assigned to it by Cuvier. Dr. Fischer arranges *Hyrax* under the order *Belluæ*, between *Elasmotherium*, an extinct genus, and *Dicotyles;* he gives three species, *Hyrax Capensis, H. Syriacus*, and *H. Hudsonius*, Schreb. (*Lipura Hudsonia* of Illiger). The latter is not a *Hyrax*. Mr. Gray places the genus in his subfamily *Rhinocerina*, belonging to the family *Elephantidæ*, the third family of his order *Ungulata*, observing that *Hyrax* is allied to *Caviina*, and giving the form a position between *Rhinoceros* and *Lipura* and *Elasmotherium*. M. Lesson arranges *Hyrax* under the order *Pachyderms* or *Belluæ* of Linnæus, between *Elasmotherium* and *Dicotyles*. Mr. Swainson (*Classification of Quadrupeds*, 1835) places *Hyrax Syriacus*, 'the Rock Rabbit,' next to *Rhinoceros*, and, after quoting Cuvier, remarks that 'there

* *E. dentata*, placed in Cuvier's system between the *Rodents* and *Pachyderms*

is an obvious relation of some sort between this singular genus, of which three species are now known, and the *Glires;* but whether of analogy or affinity it is impossible to determine: for the present we place it as the gliriform type of the *Pachyderms,* upon the sole authority of what M. Cuvier has said of its feet.' In the next paragraph Mr. Swainson treats of *Megalonyx.* In the arrangement according to natural affinities, at the end of the volume, Hyrax is the last of the Pachyderms, the first 'tribe' of the order *Ungulata.* The next tribe is 'Anoplotheres' and the first genus of that tribe *Sus.*

Generic Character.—Conformation of molar teeth like those of *Rhinoceros.* Two strong incisors without recurved roots in the upper jaw (and two small canines in youth). Body covered with thick hair, and beset here and there with erinaceous bristles. A simple tubercle in lieu of a tail. Six teats, two pectoral and four ventral. Four toes on each foot before, and three behind. Dental formula given above.

Species.—We have seen that some authors describe three species of *Hyrax;* but others, and Cuvier is one of them, cannot find any certain difference between *Hyrax Syriacus* and *Hyrax Capensis.* Major Smith notices a third species under the name of *Hyrax arboreus,* which he says inhabits the hollows of decayed trees in many of the forests of South Africa. He describes the animal at length, and observes that its teeth differ a little from those of the *Cape Hyrax,* and more particularly the incisors; but as he had not found an opportunity of examining them minutely, he only mentions that the upper ones are more pointed, and that the lower ones stand in pairs, in consequence of the two intermediate ones being separated by a considerable interval. The latter, he adds, are also a little shorter than the lateral ones, and tridentated.

The *Hyrax* of Syria is brownish grey above, and has the lower parts white; a yellowish tint intervenes between the two colours: the head and feet are more gray than the body. The separate hairs are ringed with yellowish, black, and white. The skin, where it is exposed, is of a blackish violet. Length about a foot; height about 11 inches. Bruce, who describes the animal under the name of *Ashkoko* or *Askoko,* says that it is found in Ethiopia, in the caverns of the rocks, or under the great stones in the Mountain of the Sun, behind the queen's palace at Koscam. It is also frequent, he says, in the deep caverns in the rocks in many other places in Abyssinia; and he remarks that it does not burrow nor make holes, like the rat and rabbit, nature having interdicted this practice by furnishing the animal with feet, the toes of which are perfectly round, soft, and pulpy, the fleshy parts projecting beyond the nails, 'which are rather broad than sharp, much similar to a man's nails ill grown; and these appear to be given him rather for the defence of his soft toes than for any active use in digging, to which they are by no means adapted.'

Habits.—Bruce states that, 'in place of holes, the animal seems to delight in less close or more airy places, in the mouths of caves or clefts in the rock, or where one projecting, and being open before, affords a long retreat under it, without fear that this can ever be removed by the strength or operations of man.' He describes it as gregarious, and says that frequently several dozens of them sit upon the great stones at the mouth of caves warming themselves in the sun, and coming out to enjoy the freshness of a summer evening. 'They do not,' he continues, 'stand upright upon their feet, but seem to steal along as in fear, their belly being nearly close to the ground, advancing a few steps at a time and then pausing. They have something very mild, feeble-like, and timid in their deportment; are gentle, and easily tamed, though when roughly handled at first, they bite very severely.' The same author says that these quadrupeds are found plentifully on Mount Libanus, and that he has also seen them among the rocks at the Pharan Promontorium, or Cape Mahomet, which divides the Elanitic from the Heroopolitic Gulf, or Gulf of Suez. They seemed to him to be the same in all places; but if there was any difference, those of the Mountain of the Sun were superior in size and fatness. He kept one some time, and gives an interesting account of its habits in confinement.

The captive specimen noticed by M. F. Cuvier had the appearance and somewhat of the habits of the *Rodents,* resembling the Spermophili. It was quick, lively, active, inquisitive, and tried to get into narrow openings or holes for concealment. It delighted in heat, exposing alternately different parts of its body to the sun. In cold weather it wrapped itself up in its hay or litter.

We now must advert to the Cape Hyrax.

Habits, Food, &c.—The account given by W. H. Rudston Read, Esq., of the habits of the *Hyrax Capensis* appears to us to be one of the latest and best. It was read before a meeting of the Zoological Society of London, and well illustrates the manners of the animal both in a state of nature and a state of captivity. Mr. Read states that it is found at the Cape of Good Hope, inhabiting the hollows and crevices of rocks, both on the summits and sides of hills, as well as near the sea-shore, even a little above high-water mark. It appears to live in families, and is remarkably shy in its wild state. In winter it is fond of coming out of its hole, and sunning itself on the lee-side of a rock, and in summer of enjoying the breeze on the top; but in both instances, as well as when it feeds, a sentinel is on the look-out (generally an old male), which gives notice, usually by a shrill prolonged cry, of the approach of danger or even the least movement of any suspicious object. It lives on the young shoots of shrubs, the tops of flowers, herbs and grass, particularly of all those which are aromatic; which occasions the necessity of paunching the animal as soon as killed, in order to make it fit for eating. The stomachs of those shot by Mr. Hennah were always much distended with food scarcely masticated. 'A friend of mine,' continues Mr. Read, 'kept two young ones alive for some time, which became very tame; they would find him out when lying on the sofa or in bed (for they were suffered to run about the house), and climbing up, shelter themselves on his breast within his waistcoat, or creep under the bed-clothes at his back, and, lying quiet, enjoy the warmth. The one brought home by Mr. Hennah, when allowed to run unconfined about the room, was inclined to be sociable, but was restless and inquisitive, climbing up and examining every person or thing in the cabin, and startling at any noise, which caused it instantly to run and hide itself. But from confinement it became savage and snarling, and tried to bite when any thing was put near its cage. Both wild and in restraint it is remarkably clean in its habits, always frequenting and depositing its dung in one place. From its faintly crying in its sleep we may conclude that it dreams. I have also heard it chewing its food by night, when every thing has been quiet, and after going into its sleeping apartment. In its food it was pleased with variety, eating first a few leaves of one plant and then of another, and greedily licking salt when given to it. In its passage home its food was Indian corn bruised, bread, raw potato, and onion, with a small quantity of water, which in drinking it partly lapped and partly sucked up. It was very sensible of cold; for when a candle was placed near the bars of its cage it readily acknowledged the little warmth given out by turning its side and sitting still to receive the full benefit of the rays of heat. I am inclined to think that the female does not produce more than two young ones at a time, from having observed in several

Hyrax.

instances but two following the old ones. Its name at the Cape is the *Dasse*, which is, I believe, the Dutch for a badger.' In Mr. Steedman's 'Wanderings' the *Dasse*, or *Hyrax*, is stated to be an extremely quick and active little animal, skipping along the shelving ledges of the over-hanging cliffs, and darting with incredible swiftness into the holes and crevices of the rocks, by which it frequently eludes the grasp of its pursuers. It is said to be preyed upon by the *Lions*, *Hyænas*, and some of the birds of prey of Africa. The catalogue of the African Museum states that *Aquila vulturina* resorts exclusively to high rugged mountains, where it preys upon *Hyrax Capensis*, the *Dassie* of the Cape colonists.

Utility to Man.—Mr. Read says that the flesh of the *Cape Hyrax* is very like that of a rabbit in flavour. Hemprich states that both the natives of Arabia and the boors of the Cape regard the urine of the *Hyrax* as medicinal.

The term שפן (Shaphan, or Saphan) is to be found in the following parts of the Bible:—Levit., xi. 5; Deut., xiv. 7; Psalm civ. 18; Prov., xxx. 26. In our English translation now in use this word is rendered 'coney,' and 'conies' in all the passages quoted; and so it is in Robert Barker's Bible (1615). In the Tigurine version, as given by Scheuchzer, *Schaphan* is translated (*Levit.* xi. 5) '*cuniculus*,' and in the Vulgate, as given by the same author, 'Choerogyllus.'* In *Psalms*, civ. 18, the Tigurine version given is 'Celsos montes ibicibus, et petras (dedit) confugium *Alpinis muribus* (Alpine mice).' The vulgate is given—'Montes excelsi cervis: petra refugium *herinaceis*' (Hedgehogs). In *Proverbs*, xxx. 26, the Tigurine version is printed '*Cuniculi*, gens minimè potens, attamen in petra domicilium suum collocant,' with the following note to *Cuniculi*: 'Quidem murem montanum esse putant, et videtur hic quadrare.' The vulgate is printed '*Lepusculus*, plebs invalida, qui collocat in petra cubile suum.'

We have seen that the Hyrax has been termed *Daman* by the French zoologists. Dr. Shaw speaks of the *Daman Israel* as 'an animal of Mount Libanus, though common in other places of this country' (Palestine). 'It is a harmless creature of the same size and quality with the rabbit, and with the like incurvating posture and disposition of the fore-teeth; but it is of a browner colour, with smaller eyes and a head more pointed. The fore-feet likewise are short, and the hinder are nearly as long in proportion as those of the jerboa. Though this animal is known to burrow sometimes in the ground, yet, as its usual residence and *refuge* is in the holes and clefts of the rocks, we have so far a more presumptive proof that this creature may be the Saphan of the Scriptures than the jerboa. I could not learn why it was called *Daman Israel*, i.e. *Israel's Lamb*, as those words are interpreted.' Though there is error in this description such as might be easily made by a casual observer, there can be no doubt that Dr. Shaw, in the passage quoted, alluded to the *Hyrax*: the words *Daman Israel* are probably mistaken for *Ganam* or *Gannim Israel*, as we shall presently have occasion to notice; 'animal quoddam humile, cuniculo non dissimile quod *agnum filiorum Israel* nuncupant.' (Prosp. Alp. Ægypt.)

Dr. Harris states that Jerome, cited by Bochart, says that the שפנים are a kind of animal not larger than a hedgehog, resembling a mouse and a bear (the latter, Dr. Harris supposes, in the clumsiness of its feet), whence in Palestine it is called αρκτομυς (Arctomys), the bear-mouse; that there is a great abundance of this genus in those countries, and that they are wont to dwell in the caverns of the rocks and the caves of the earth.

The 'Seventy' translate 'Saphan' by 'χοιρογρύλλιοι' in all the places quoted. This term, compounded of χοῖρος, a hog, and γρύλλη, a grunting, points curiously enough to a pachydermatous form. Bruce, in his travels, describes the Syrian Hyrax, as we have seen. He adds:—'In Amhara this animal is called Ashkoko, which, I apprehend, is derived from the singularity of those long herinaceous hairs, which, like small thorns, grow about his back, and which in Amhara are called Ashok. In Arabia and Syria he is called Israel's Sheep, or Gannim Israel; for what reason I known not, unless it be chiefly from his frequenting the rocks of Horeb and Sinai, where the children of Israel made their forty years' peregrination. perhaps this name obtains only among the Arabians. I apprehend he is known by that of Saphan in the Hebrew, and is the animal erroneously called by our translators Cuniculus, the rabbit or coney.' Of this opinion are Pennant, Cuvier, and others among the zoologists; and though M. Lesson, in the introduction to his 'Manuel,' speaks of the rabbit (lapin), 'which is supposed to be the *Schaphan* of the Hebrews, although it is more probable that it was the Rat of Pharaoh (rat de Pharaon),'—on what grounds he does not state—as a prohibited animal (*Levit.*; *Deut.*), there can be little doubt that the *Shaphan*, the 'feeble folk' that 'yet make their houses in the rock,' belonged to the genus *Hyrax*.

* Perhaps a misprint for Chœrogryllus. See post.

HYRCA'NIA, a province of the antient Persian empire, lay at the south-eastern corner of the Caspian Sea, and was separated from Parthia on the south by a range of mountains called by Ptolemy Koronus, and which are a continuation of the Elburz mountains. Its boundaries on the west and north and north-east are not so clearly defined. They differed considerably at various times. According to Strabo, Hyrcania extended as far north as the Oxus, and was bounded on the east by the province of Margiana; though, according to the opinion of others, Nisæa, which was included by Strabo in Hyrcania, formed its eastern boundary. (*Casaubon*, p. 351.) Hyrcania was a plain sloping from the mountains towards the Caspian Sea, and was, according to Strabo, very fertile, producing grapes, figs, and corn in abundance; though the land was not much cultivated by the inhabitants. (p. 350.)

Previous to the Persian conquest Hyrcania appears to have been subject to the Chorasmii. (Herod. iii. 117.) It formed, together with the Parthi, Chorasmii, Sogdi, and Arii, the sixteenth satrapy of Darius Hystaspes, and contributed 300 talents. (Herod. iii. 93.) After the dissolution of the Persian empire Hyrcania became subject to the Macedonians; but it remained in their power for only a short time. (Strabo, p. 350.) It appears afterwards to have become independent; since Josephus (*De Bello Jud.* vii. 27) mentions a king of the Hyrcanians in the time of Vespasian, who had possession of the passes through the mountains, which are known by the name of the Caspian Gates.

Strabo informs us that there were several towns in Hyrcania, of which the most important were Talabroce, Samariane (the Samaranne of Ptolemy), Carta, and the Royal Tape; but it is impossible with our limited knowledge of the country to determine the position of any of these places. Arrian mentions (*Anab.* iii. 28) Zadracarta as the capital; and Ptolemy gives us as the capital a town Hyrcania, which he places in the eastern part of the province. The principal rivers, according to Ptolemy, are the Maxera (the Maxaras of Plin. vi. 16), which cannot be identified; and the Socanaa, which is perhaps the same as the modern Gourgaun.

HYRCA'NUS, JOHN, one of the Asmonæan rulers of Judæa, succeeded his father Simon in the high priesthood, B.C. 135. His father and his two elder brothers, Judas and Mattathias, were treacherously murdered at a feast by Ptolemy the son-in-law of Simon; and it was with great difficulty that Hyrcanus, who was not with them when they were murdered, escaped to Jerusalem. During the first year of his reign (B.C. 134) Jerusalem was besieged by Antiochus Sidetes; and after a long siege Hyrcanus was obliged to submit. The walls of Jerusalem were destroyed, and a tribute imposed upon the city. Hyrcanus afterwards accompanied Antiochus in his expedition against the Parthians; but returned to Jerusalem before the defeat of the Syrian army. After the defeat and death of Antiochus, B.C. 130, Hyrcanus took several cities belonging to the Syrian kingdom, and completely established his own independence. He strengthened his power by an alliance with the Romans; and extended his dominions by the conquest of the Idumæans, whom he compelled to submit to circumcision and to observe the Mosaic law; and also by taking Samaria, which he levelled to the ground, and flooded the spot on which it had stood. The latter part of his reign was troubled by disputes between the Pharisees and Sadducees. Hyrcanus had originally belonged to the Pharisees, but had quitted their party in consequence of an insult he received at an entertainment from Eleazar, a person of importance among the Pharisees. By uniting himself to the Sadducees, Hyrcanus, notwithstanding the benefits he had conferred upon his country by his wise and vigorous government, became very unpopular with the common people, who were for the most attached to the Pharisees. Hyrcanus died B.C. 106, and was succeeded by his son Aristobulus, who was the first of the Asmonæan princes who assumed the royal title.

(*The Five Books of the Maccabees, with Notes and Illustrations*, by Dr. Cotton; Josephus's *Jewish Antiquities;* Prideaux's *Connection;* Jahn's *Hebrew Commonwealth.*)

HYRCANUS II. [Asmonæans.]

HY'RIA, Lamarck's name for a genus of *Unionidæ*, a family of fresh-water conchifers, *Nayades* of that author.

HYSTASPES. [Darius.]

HYSTE'RIA (from ὑστέρα, the womb) is, in general language, understood to signify those paroxysms to which females are subject, and which are attended with convulsions, a sense of choking, and involuntary laughing or crying. But the term is used in medicine as a general expression to include a vast number of other symptoms known as 'nervous disorders,' all dependent on a peculiarly susceptible state of the nervous system.

We will first consider the different forms of hysteric affection.

The hysteric fit or paroxysm need scarcely be described, except for the purpose of pointing out how it may be distinguished from fits of other kinds; and this is a matter of no little importance, not only as regards the treatment required and the temporary alarm of the friends, but also with relation to the happiness and prospects of the sufferer. For it appears that in France, at least, young females labouring under mere hysteria have been separated from their families and society, and placed in confinement under the idea that they were the subjects of epilepsy, a disease which is thought to be hereditary, is but too often incurable, and leads to loss of intellect. The hysteric paroxysm generally commences with the sensation of a ball in some part of the abdomen or in the left side, which rises with a twisting vermicular feeling to the throat, where it induces a sense of suffocation. A temporary state of loss of sense and voluntary power succeeds, in which the patient either lies motionless, or is agitated with violent struggles of the limbs; the head is struck against the bed or floor, and the hair or the breasts are grasped and torn with the hands. Frequently the patient tries to bite herself or the bystanders. The involuntary expulsion of the contents of the bladder not uncommonly takes place during the fit. In the absence of convulsions there is often immoderate laughter, crying, or singing, and the paroxysm is frequently terminated suddenly by a burst of tears. More usually the patient lies quietly for some time after the convulsions cease, and when she recovers complains of headache. Frequently she proves that consciousness has not been entirely lost, by repeating what has been said by those around her. The attack of epilepsy differs from that of hysteria in not being preceded by any sensation of a ball rising to the throat; the epileptic patient falls suddenly to the ground, and is immediately violently convulsed; the eyes are distorted, and the tongue protruded and bitten. In hysteria the features are generally tranquil, and the face is flushed; whereas in epilepsy it is often of a ghastly paleness. The epileptic fit is in many cases ushered in by a short cry, but there is no laughing, crying, or singing during the paroxysm, or at its termination, as in hysteria. Lastly, the loss of consciousness is complete in epilepsy, generally not so in hysteria. These are the principal points of difference. It is well to remark in addition that hysteria is almost confined to women, and that the paroxysm is generally preceded by some strong mental emotion; while epilepsy is most frequent in men, and more usually attacks the patient during the night, or between the states of sleep and waking. Repeated attacks of epilepsy leave imprinted on the countenance a peculiar dull expression which is not seen in the hysterical.

'Nervous' females are very liable from the slightest causes to hurried respiration, sighing, sobbing, and palpitation; the irregular and hurried breathing may become occasionally so aggravated as to resemble asthma, from which it is to be distinguished by its occurring in young persons, and by its being accompanied by other hysterical symptoms, and a peculiarly irritable susceptible state of mind.

Merely from a disturbed action of the nerves, and quite independently of all real structural or inflammatory disease, females frequently become distressed by more or less painful sensations fixed in one spot or shifting from one part to another. Violent pain in the head, as if a nail were driven into the forehead, is a very common hysterical symptom. Another frequent seat of the uneasiness or pain is the left side, just below the breast, and this pain is often attended with palpitation of the heart, and the patient is unable to lie on that side. Sometimes excruciating pain occupies the whole abdomen. In all such cases it will be found that the disease, simulated by the hysterical affection (whether it be of the head, chest, or abdomen, or of one of the large joints), cannot exist, since other symptoms essential to constitute it are absent. The pain of hysteria too, besides being frequently transitory and unfixed in its seat, has generally the peculiarity of being aggravated by the slightest touch of the skin, which is not the case with pain arising from inflammation. Other symptoms of a decidedly hysterical or nervous nature will perhaps be present, or a true hysterical paroxysm may supervene. It is important to know that symptoms of almost every disease may be simulated by hysteria, which, though a troublesome affection for the sufferer, is unattended with danger. It is when real disease is present, and complicated with nervous or hysterical symptoms, that it requires the greatest acuteness of the physician to discern what proportion of the symptoms is of the latter kind, and what due to the more important affection.

Hysteria sometimes assumes the form of different paralytic affections: the power of moving the arm, or the voice, may be lost. These phenomena may be of considerable duration, but are ultimately, and often suddenly, recovered from. The state of long-continued stupor which has received the name of 'trance' is most commonly hysterical. Different spasmodic affections, as hiccough and spasm of the throat, preventing swallowing, not unfrequently occur in the hysterical state. Then again certain disordered states of the senses and mental faculties and feelings occur as the consequence of uterine or sexual irritation, and are to be referred to hysteria. Such are somnambulism, some kinds of transitory monomania, and those peculiar perversions of the mind manifested in the desire to feign various diseases. The occasional occurrence of hysterical paroxysms, the irritable state of mind, the knowledge that the mind has been acted on in a way calculated to excite the affections, and the presence of other phenomena decidedly hysterical, will assist in detecting the true nature of all these cases.

There is certainly a peculiar state of the system which predisposes to the affections which we have thus cursorily described, for the causes by which they are excited have nothing peculiar in themselves. All the phenomena indicate a disordered state of nervous system, and the exciting causes are such as act either through the medium of the body or the mind on that system. The susceptible state of the nervous system which predisposes it when thus acted on to give rise to the various hysteric phenomena, is without doubt frequently connected with or kept up by an excited condition of the uterine system and the sexual feelings; with no system of organs and no feelings of the mind does the nervous system of females so much sympathize. This conclusion is confirmed by the fact of hysteria occurring in a great proportion of cases between the age of puberty and that at which the catamenia cease; during which period the uterus is in a state of greater activity than before and after it; and by the circumstance of its being at the commencement and termination of that period, when the uterine organs are undergoing the greatest changes, and the feelings of the mind connected with them most disturbed, that the attacks of hysteria are most frequent and violent. It is from their supposed connection with particular states of the uterus that the attacks have derived their name. Other facts however show that a predisposed state of nervous system is necessary, for vascular excitement and structural disease of the uterus may exist without giving rise to hysteria; and that other functions, as those of the digestive organs, being disordered, may act on a susceptible person so as to aggravate the tendency to hysterical symptoms, or even excite them. In some females, having the requisite nervous susceptibility, a mere plethoric state of the body, without any affection of any special organ, will excite hysteria; the opposite state, deficiency of blood in the body, will have the same effect: anything in fact which throws the system of such irritable females out of the natural state, whether it acts primarily on the body or mind, may give rise to nervous symptoms or hysteria. The most frequent exciting cause of the hysterical paroxysm is perhaps a sudden and intense emotion of the mind.

Treatment.—During a fit of hysteria, care should be taken to prevent the patient receiving injury from her head or hands striking against the floor or hard bodies, and to guard against the propensity to bite, by placing a folded cloth between the teeth. If the fit be slight, it may frequently be arrested by dashing cold water over the face, or by filling tho mouth with something which has an unpleasant taste, as salt; or a stimulating scent may be held to the nostrils. If the paroxysm be more prolonged and violent, it will be proper, should the face be flushed and head hot, to apply wet cloths to the forehead, and to loosen all the dress about the neck and chest. If a continued stupor supervene, medical aid may be required. When there is less fulness about the head, small doses of stimulants, such as sal volatile in water, will be useful.

When the frequent return of the fits seems to depend on a full state of body, or on irritation, means calculated to remove these causes must be adopted. If an unnatural state of the uterine functions be suspected, those must be attended to. Frequently, the sufferer from hysteria is feeble and bloodless, and in a state of general nervous debility; in such persons, all measures likely to strengthen the general health, proper diet, regular hours, change of air, and tonic medicine, should be put into practice. The state of mind of the patient should, in these last cases, be particularly regarded.

For the treatment of the pains and other anomalous nervous symptoms, no rules can be laid down; they will frequently resist all modes of palliative treatment. The great principle however must not be forgotten of removing all causes which can react prejudicially on the nervous system or the general health.

The nervous susceptibility which predisposes to hysteria is without doubt frequently innate or constitutional, but it is certainly in many cases acquired; and it is often to be attributed, in a great measure, to the education of young females. 'A luxurious and delicate mode of living and of rearing' (says Dr. Copland); 'a neglect of whatever promotes the powers of the constitution, especially of suitable exercise in the open air, and of early hours as to sleeping and rising; an over refined mode of education, and the excitement of tho imagination and of the emotions, to the neglect of the intellectual powers and moral sentiments; too great devotion to music, and the perusal of exciting novels; the various means by which the feelings are awakened and acute sensibility is promoted, whilst every manifestation of either is carefully concealed; and studied endeavours to dissemble desires which struggle to be expressed,—all serve, especially at a period when the powers of the mind and the conformation of the body are approaching development, to produce that state of the nervous system, of which hysteria is one of the most frequent indications.' The prevention of hysteria cannot certainly be hoped for until the education of females is directed more towards strengthening their body and improving tho tone of their mind, so as to enable them to bear disappointments, and to control, not merely conceal, their passions.

HYSTRIX. [PORCUPINE.]
HYTHE. [CINQUE PORTS; KENT.]

INDEX TO THE LETTER H.

VOLUME XI.

VOLUME XII.

I.

I is a vowel which represents two very different sounds in different languages. In this country it denotes a rapid pronunciation of the diphthong *ai*. In French, Italian, and many other tongues, its sound is identical with that of the English *e*. In the series of the vowels established by the experiments of Mr. Willis [ALPHABET, p. 379], *i*, as denoting the latter sound, lies at one of the two extremes. It is pronounced with the lips retracted so as to shorten the vocal tube, whereas the same organs are protruded to produce the sound represented at the other extremity by *u*. The various forms which have heen used to represent the letter *i* may be seen in the article already quoted, pp. 382, 383. The character there given as used by the Phœnicians and early Greeks is somewhat complicated, and differs widely from the single stroke into which it eventually degenerated. In this last state it was the simplest of all the alphabetical characters, and was therefore well adapted to be the symbol of a small quantity. In this sense the terms a *jod* and an *iota* are still retained, *jod* being the Hebrew, *iota* the Greek name for the character.

The letter is interchangeable as follows :—

1. With the diphthongs *ai*, *oi*, *ei*. This may be seen most distinctly in the Latin language, where *alais*, *requairo*, *pueroi*, *puerois*, *nulloius*, *deico*, &c., were corrupted into *alīs*, *requiro*, *puerī*, *puerīs*, *nullīus*, *dīco*. In the same language when one *i* was followed by another *i*, it was not uncommon to denote them by a single long *i*, as *tibīcen*, *Chīus*, *alīus* (gen.), *inscītia*, for *tibiicen*, *Chiius*, *aliius*, *insciitia*. In such cases it was a common practice to give greater length to the letter, thus, CHIVS.

2. The short *i* was interchangeable with nearly all the short vowels, more particularly in the penult syllables of polysyllabic words, which are very indistinctly pronounced. Thus the Greek *mēchănē* is in Latin *māchĭna*. In the same manner the Nomad races of North Africa are called hy the Greeks *Nomades*, by the Romans *Numidae*. Again, ἄνεμος and *animus* are kindred words. *Bonitas* must have been originally *bonotas*, and would have been written in Greek with a termination -οτης. Lastly, in a large number of words a short *u* degenerated into an *i*: as *maxŭmus*, *decŭmus*, *recŭpero*, *maritŭmus*, *scribŭmus* (compare *sŭmus*), into *maximus*, *decimus*, *recipero*, *maritimus*, *scribimus*. Even Cicero wrote all these words with a *u*, though our editions give an *i*.

3. A short *i* before *n* or *m* is not unfrequently in French changed into *ai* or *a*. Thus the Gallic town *Inculisma* is the origin of the name *Angoulême*: *vincere* is in French *vaincre*, &c.

4. In the same language the vowel *i* is changed into *oi* very commonly, as *sitis*, *soif*; *mi*, *moi*; *fides*, *foi*; *Ligeris*, *Loire*, &c., and this though the *i* in Latin be short.

5. *I* is often insorted in French or Spanish words before the vowel *e*: *miel*, *bien*, *vient*, &c., from the Latin *mel*, *bene*, *venit*.

6. The vowel *i* is often inserted after the vowels *a*, o, and *u* in the French language, particularly when a contraction has taken place, as *aimer*, *connoître*, *reduire*, from *amare*, *cognoscere*, *reducere*.

7. When the vowel *i* in the Latin language has a vowel after it, and is preceded by one of the consonants *p*, *b*; *t*, *d*; *c*, *g*; the derived languages have often a sibilant in the place of the former consonant. Thus *sapiam* is in French *sache*; *rabies*, *rage*; *ratio*, *raison*; *medius*, in Italian *mezzo* (compare the Greek μεσος). The double sound of *c* and *g* in our own language appears to have originated in this way.

8. A similar change occurs even in other cases, as *simia*, Fr. *singe*; *vindemia*, *vendange*; *lineus*, *linge*.

IAMBICS, a species of verse composed of a succession of iambi (˘ ¯), or equivalent feet, was freely used both by Greek and Latin poets. According to Aristotle (*De Poetic.*) the iambic measure was first employed in satirical poems, called *iambi*, which appear to have been represented or acted; since Plato (*De Rep.*, vii. 17) forbids boys to be spectators of iambi and comedies. The iambic is the most common metre in the Greek tragic poets. We are informed by Aristotle (*De Poetic.*) that 'originally the trochaic tetrameter was made use of, as better suited to the satyric and saltatorial genius of the poem at that time, but when the dialogue was formed, nature itself pointed out the proper metre; for the iambic is of all metres the most colloquial, as appears evidently from this fact, that our common conversation frequently falls into iambic verse, seldom into hexameter, and only when we depart from the usual melody of speech.' (Twining's *Transl.*, part i., c. 7.)

In the following table a list is given of the feet which may be admitted in the iambic metre in the Greek tragic poets, which is usually called the tragic trimeter acatalectic, because it consists of three entire metres, or six feet.

1	2	3	4	5	6
˘ ¯	˘ ¯	˘ ¯	˘ ¯	˘ ¯	˘ ¯
˘ ˘ ˘	˘ ˘ ˘	˘ ˘ ˘	˘ ˘ ˘	˘ ˘ ˘	
¯ ¯		¯		¯	
¯ ˘ ˘		¯ ˘ ˘			
˘ ˘ ¯					

The anapæst in proper names is also introduced in every place of the verse except the last, with this general restriction, that the anapæst should be contained in one word. The comic trimeter admits the same feet as the tragic, and also a dactyl in the fifth place, and an anapæst in common words in every place but the last.

Much of the beauty of tho iambic trimeter depends upon the cæsura [CÆSURA], which usually occurs in the middle of the third or the middle of the fourth foot, as for example :—

οἱ μὲν θέλοντες | ἐκβαλεῖν ἕδρας Κρόνον.
ἱκτηρίοις κλάδοισιν | ἐξεστεμμένοι.

One of these cæsuras may be considered as generally necessary; the cæsura in the middle of the third foot is much more common than that in the middle of the fourth. There is also frequently a cæsura in the middle of the second or the middle of the fifth foot. When a line is divided in the middle of a verse with the elision of a short vowel, or of the little words δὲ, μὲ, σὲ, γὲ, τὲ, that division is *called by* prosodians the *quasi-cæsura*, as, for example—

γυναιξὶ παρθένοις τ' | ἀπόβλεπτος μέτα.

For an account of the other iambic metres employed by the Greek and Latin poets see Hermann, 'Elementa Doctrinæ Metricæ.'

In English poetry the iamhic metre is very common, as for example :—

'On Lin'den, whe'n the su'n was lo'w,
All bloo'dless la'y th' untro'dden suo'w,
And dar'k as win'ter wa's the flo'w,' &c.

IA'MBLICHUS (*Iamblichus Chalcidenus*), a celebrated neo-Platonist of the fourth century A.D., was born at Chalcis in Cœlosyria, and is distinguished by his birth-place from another of the same name and of the same school and century, born at Apamea in Syria, of whom however little is known. From his admirers and disciples Iamblichus received the flattering titles of 'most divine teacher' and 'wonderful' (διδάσκαλος θειότατος, θαυμάσιος), and enjoyed a reputation among his contemporaries which cast into the shade the fame of his teacher Porphyry, whom nevertheless he was far from equalling either in extent of learning or in powers of mind. The literary career of Iamblichus extends from the reign of Constantine the Great to that of Julian the Apostate, whose esteem and favour he obtained, not only on account of his general adherence to and defence of the old national religion, hut particularly for his 'Life of Pythagoras.' ('Iamblichi de Vitâ Pythagoricâ liber, Gr. et Lat., illustratus a L. Küstero. Accedit Malchus sive Porphyrius de vitâ Pythag.,' &c. &c., Amstelodami, 1740, 4to.; the same by Kiessling, Leipz., 1815, 2, Th. 8vo.) In this work Iamblichus ascribed to the Italian philosopher miraculous powers and acts which might rival, if not surpass, the signs and wonders on which the Christians not only founded the divine authority of their creed, but still laid claim to. ('Hebenstreit, Diss. de Iamblichi Philosophi Syri Doctrinâ Christianæ Religioni, quam imitari studet, noxiâ,' Leipz., 1704, 4to.) At this period indeed the philosophemes of the East were exerting a corrupt influence not only upon Christianity, but also upon philosophy; and a belief in magic and divination, in miraculous gifts and the operation of celestial agents, was universally prevalent, and found numerous and zealous adherents, as well among heathens as among Christians. An important element in the eclectical, or rather syncretistic, system of the neo-Platonists was the Oriental dogma of emanation, according to which the souls of all creatures, after passing through certain states and periods of purification, return unto God, from whom they originally emanated, and afterwards falling away, contracted a stain and pollution. Of such a doctrine it was a consequence to believe that a life of asceticism and self-denial would enable the sage even in this life to attain to an intimate union with immaculate deity. Consistently with these views Iamblichus made the perfection of man's moral nature to consist in a state of contemplative innocence. ('De Vita Pythagoræ et Protrepticæ Orationes ad Philosophiam,' lib. ii., Gr. et Lat., ed. Joh. Arcerius Theodoretus, Franeck., 1598, 4to.)

From the same source of mystical and visionary speculation Iamblichus drew his ontological system. He asserted the existence of several classes of spiritual essences, or demons, and attempted to determine the mode and occasions of their manifestation and operations, and lastly, the means by which man may subject them to himself, and employ their influence and agency in the execution of his own designs. Several legends are extant in which Iamblichus is described as actually exercising this power, and compelling the spirits to obedience. The work on the Egyptian mysteries ('De Mysteriis Ægyptiorum libri, seu Responsio ad Porphyrii Epistolam ad Anobonem Prophetam,' Gr. et Lat., prænissa ep. Porph. ad Anebonem; ed. T. H. Gale, Oxford, 1678, fol.) is an attempt to show the possibility of this intimate and actual union (δραστική ἕνωσις) with the Divine being, which gives a supernatural elevation to the powers of man, which however cannot be gained by the mere cultivation of the rational powers, but by the employment of certain secret symbols and forms (σύμβολα καὶ συνθήματα), which have been imparted by the gods themselves to their priests, from whom only they are to be learned. The epistle of Porphyry to Anebo the priest contains many doubts concerning the Egyptian mysteries, which Iamblichus refutes by the authority of the writings of Hermes and the philosophy of Plotinus. The genuineness of this work however seems justly doubted. (Meiner's 'Judicium de Libro qui de Myst. Ægypt. inscribitur,' in the fourth volume of the 'Commentatt. Soc. Scient.,' Gött., 1782, p. 50.)

Besides the works above noticed of Iamblichus, we have the following fragments from his ten books on the Pythagorean school and doctrines:—Lib. iii., 'De Generali Mathematum Scientia,' Gr., ed. Villoison in 'Anecdott. Gr.' t. ii., p. 188, &c., coll. Friisii; introd. in lib. iii. 'Iambl. de Gen., &c.,' Kopenh., 1790, 4to.; lib. iv., 'In Nicomachi Geraseni Arithmeticam,' introd. et 'De Fato,' Gr. et Lat., ed. Sam. Tennulius, Arnheim, 1668, 4to.; lib. vii., 'Theologumena Arithmetices,' Par., 1543, 4to., of which the treatise 'De Fato' is a portion.

(Consult *Eunapii*, *Vit. Soph.*, pp. 20-32, Heidelberg, 1596-98; Buhle, *Gesch. d. Philos.*, 4er Theil; and Ritter's *History of Philosophy*, vol. iv.)

IA'NTHINA. [JANTHINA.]

IANTHOCINCLA. [MERULIDÆ.]

IAXT. [JAXT.]

I'BACUS. [SCYLLARUS.]

IBE'RIA was the antient name given by the Greek writers to Spain. The Iberi are said to have occupied also Southern Gaul as far eastwards as the Rhone, where they bordered upon the Ligurians. (Strab., Casaub., 166.) They were a distinct race from the Celtæ, who at a remote but unknown period had crossed the Pyrenees, and occupied the central parts of the Peninsula, and from whose admixture with the Iberi the Celtiberi sprang. [CELTIBERI.] The aboriginal Iberi however seem to have retained possession of the south-east part of the country from the Straits of Calpe to the Pyrenees, until the epoch of the Carthaginian invasion. The Lusitani were probably also of Iberian race. (Mannert, *Geographie der Griechen und Römer*.) The Aquitanians, who were a distinct people from the Celtic Gauls, are supposed to have been of Iberian extraction. Wm. Humboldt (*Prüfung der Untersuchungen über die Urbewohner Hispaniens*) asserts that the Basque language is the remains of the old language of the Iberian race which at one time spread over Spain, Southern Gaul, part of Italy, and the islands of Corsica, Sicily, and Sardinia, and he attempts to prove this by the affinity between the proper names in those countries. [BASQUES, LES; BASQUE LANGUAGE.] Strabo observes that the Romans used the names Iberia and Hispania indifferently to denote the whole peninsula.

Iberia was also the name given by the Greeks and Romans to a country south of the Caucasus, having Albania to the east, Colchis to the west, and Armenia to the south, and corresponding to the central or principal part of modern Georgia. Lucullus and Pompey first carried the Roman arms into Iberia. Eutropius (lib. viii.) says that the king of the Iberi paid allegiance to Trajan, who at the same time gave a king to the neighbouring country of Albania. The country of the Iberi is described by Strabo (Casaub., 499) as well peopled, and the inhabitants as having made some progress in civilization. The central part was a plain drained by the Cyrus (Kur) and its branches.

IBE'RIS is a genus of cruciferous or brassicaceous plants, consisting of annual, perennial, and slightly shrubby species, chiefly inhabiting Europe, and particularly the northern shores of the Mediterranean Sea. Two are found in the north of Europe, one of which, *I. amara*, is British. They are remarkable, among other things, for their flowers growing in close corymbs, and being much more developed on one side than the other, next the circumference of the corymb. This irregularity, connected with either a pure white or a rich purple of varying tints, gives the plants a strikingly beautiful appearance; and hence they are in many cases cultivated in gardens as objects of ornament, under the name of Candy-tuft, in allusion doubtless to their having been first procured from Candia. *Iberis sempervirens* and *Gibraltarica* are particularly well suited for beautifying rock-work.

IBEX. [GOAT.]

IBIS. [ABOU-HANNES; TANTALIDÆ.]

IBYCTER. [FALCONIDÆ, vol. x., p. 167.]

ICE. [FREEZING; WATER.]

ICELAND (ISLAND, in the native language), a large island in the North Atlantic, extends from 63° 24′ to 66° 30′ N. lat., and from 13° 15′ to 24° 40′ W. long. Its shape resembles somewhat that of a heart, with the point looking towards the south. Cape Nord, at its north-west extremity, is about 200 miles from the east coast of Greenland. Its area is vaguely reckoned at 40,000 square miles. The coasts of Iceland, especially the western part, are deeply indented with fiords, or inlets of the sea, which are the æstuaries of the rivers which flow from the numerous mountains and glaciers of the interior. The island is crossed from east to west by ridges of rugged and irregular mountains, which run nearer to the south than to the north coast, the longer rivers flowing towards the north. From these ridges numerous offsets branch out in all directions towards the coast, run through the various peninsulas, and terminate in high and steep promontories. Between these offsets in the vicinity of the fiords are fine valleys, in which the inhabitants have erected their dwellings; and many of the low mountains are covered with a coarse grass, which affords summer pasture to their cattle. The best inhabited spots are on or near the banks of the fiords, where factories are built for the purpose of trade and shipping. But the majority of the inhabitants live in detached cottages or farms, a certain number of which constitute a parish, having a church and an incumbent of the episcopal Lutheran communion as in Denmark. The interior of the island is a dreary desert, through which one may travel 200 miles without meeting any trace of human existence. It consists partly of snow mountains, called Yökuls, many of which are also volcanoes, and partly of vast tracts covered with lava, scoriæ, and volcanic sand. There are also several lakes, the largest of which, called Myvatn, is about 40 miles round; its banks are barren and gloomy, and infested by clouds of gnats. The most extensive mass of icy mountains is that called Klofa Jökul, in the south-east part of the island, which lies behind another range of mountains that line the coast, and forms a mass of ice and snow estimated to cover no less than 3000 square miles. Magnificent glaciers cover the sides of the mountains, beginning at a great height, and sloping with a very rapid descent towards the plains. These icy masses are often rent by the internal heat and eruptions of the volcanoes, and fall down in terrible avalanches upon the plains. The glaciers present the same phenomena of progressive and sometimes retrograde motion as those of Switzerland, and they throw out before them their moraines of large fragments of rocks. Vast agglomerations of basaltic pillars are seen in many places, as well as of tufa, and some mountains are covered with thick incrustations of sulphur.

There are numerous boiling springs, such as the Geysers in the south district of the island, which throw up, at periodical intervals, columns of boiling water more than 10 feet in diameter and above 200 feet in height, preceded by a loud report like that of artillery: the Reykium and the sulphur springs of Krisuvik are near the south-west coast; those of Reykiadal in the west district; and those of Reykiahwerf and Krahla in the north. There are also floods or bogs of boiling mud, numerous cones and craters of volcanoes now quiescent, and columns of dense smoke and steam issuing from many spots. The whole island appears to be of volcanic formation, and there are still numerous volcanoes in full activity. In the year 1755 an eruption from the volcano of Katlegia, near the east coast, destroyed 50 farms. In 1783 a still more terrible eruption from the Skeidara and other volcanoes of the Klofa Jökul ridge covered several fertile districts with lava; the ashes and the effluvia corrupted the water and the atmosphere all around, the fishes were driven away from that part of the coast, and famine and pestilence followed, which in two years carried off 9000 people, and destroyed thousands of horses and cattle. The eruptions of Mount Hecla are frequent, but not so violent or destructive. The highest mountain in Iceland is believed to be the Snæfell Yökul, which rises in one of the western peninsulas near the village or factory of Stappen, and is reckoned to be 6862 feet high. Mount Hecla is 5210 feet.

Formerly there were many forests in Iceland, but they have been destroyed through the waste and improvidence of the inhabitants. The trees that now exist appear stunted in their growth, and seldom rise above 10 feet, and wood has become very scarce. It is alleged that the climate has become colder, and is less favourable to vegetation; and some attribute this increased severity of the climate to the accumulation of ice on the eastern coast of Greenland. Dr. Henderson however found the winter which he passed in Iceland to be as mild as the mildest which he had experienced in Southern Sweden or Denmark. It often happens in the spring that vast masses of floating ice drifted from the coast of Greenland are impelled by the wind and current against the western coast of Iceland, where they do considerable mischief and affect the temperature of the atmosphere. Polar bears are carried on these masses to Iceland, and commit depredations among the cattle, and even attack men; they are however soon hunted down and destroyed. It appears that corn was once cultivated to a considerable extent, but the inhabitants find it more to their advantage to attend exclusively to the rearing of cattle. Hay is the great harvest of Iceland. Those who live on the coast attend to fishing, which is very productive. In 1804 there were on the island 4751 farms, with 20,325 head of horned cattle, 218,818 sheep, and 26,254 horses. The common food of the people is butter, milk, and fish; fresh meat and rye bread are holiday fare. The lichen Islandicus, or Iceland moss, is a common article of food. Coffee, wine, and other luxuries are obtained in the factories on the coast, and are used by the wealthier class. The exports consist of cod and other dried fish, whale oil, salted mutton, eiderdown, and sulphur, which is abundant. Turf is the common fuel of the inhabitants; fossil wood impregnated more or less with bitumen abounds on the island, but they make little use of it. Iron and copper are also found, but are not worked for want of fuel. The reindeer, which were at first introduced from Norway, have greatly multiplied, and live in a wild state.

By the census of 1801 the population of Iceland amounted to 47,207 persons, but since then it has increased, and is probably now above 50,000. It is said to have been much greater in former ages, and to have exceeded 100,000; pestilence, famine, and the destruction caused by volcanic eruptions have at various times reduced the numbers. In 1707 and 1708 no less than 16,000 persons were cut off by the small-pox. The Icelanders are the genuine descendants of the old Scandinavians or Norsemen; they are tall, but not generally corpulent, with a florid complexion, flaxen hair, and an open frank countenance. The women are shorter and more inclined to corpulence than the men; a certain degree of beauty is not rare among the girls. Longevity is not common among the Icelanders: they are subject to cutaneous disorders and also to pulmonary diseases, owing to the climate, to their want of cleanliness, the nature of their food, and their remaining often with their wet woollen clothes on. Leprosy of the worst kind is indigenous in the country: it is contagious, and ends in most cases fatally. Hospitals for lepers have been established, but they are deficient in funds.

The Icelandic language is the standard of the northern or Scandinavian dialect of the Gothic language. The Swedish, Danish, and even the Norwegian, have been more or less subject to the influence of the Teutonic or German branch of the Gothic, whilst the Icelanders have preserved theirs pure as they imported it from Norway in the ninth century. This was the language called Dönsk Tunga in the middle ages [Danes], and was called by the Icelanders at first Norræna, which word corresponds to Nairn or Norse, the corrupt dialect spoken till lately in part of the Orkneys. Since the language has been no longer spoken in Scandinavia, it has been styled exclusively Icelandic. The first colonists of Iceland were Norwegians, many of them of distinguished families, who fled in the second part of the ninth century from the dominion of Harold Harfagra, tyrant of Norway. They established a republican government, appointed magistrates, and had their annual Althing, or national assembly, which was held at Thingvalla in the south part of the island. In this state they remained for nearly four centuries. About the year 1000 Christianity was established in Iceland. In the year 1057, Isleif, bishop of Skalholt, introduced the art of writing with the Latin alphabet; the Runic characters having been used till then only for inscriptions on stone, wood, or metal. Oral lessons however had kept up the historical traditions, and the feats of their ancestors were recorded in songs. Icelandic literature began to be cultivated immediately after the introduction of writing. Literary societies were formed for the purpose of mutual instruction and education. The historical compositions called Sagas have been since published, as well as many of their songs and other poetry. In 1120 the Icelanders framed their code of laws called Grágás, which has been lately published at Copenhagen by F. W. Schlegel. Snorro Sturleson, a native of Iceland, and an extraordinary personage, was one of the writers or compilers of the *Edda*, and he also wrote a history of Norway. Several monks, especially the Benedictines of the Thingeyra monastery, contributed largely to Icelandic literature. In 1264 the Icelanders, partly through intrigue and partly through fear, submitted to Haco, king of Norway, on the condition however of their laws and privileges being maintained. Still their subjection had a deteriorating influence upon their literary spirit, as well as on their commercial enterprise. In 1387 Iceland, together with Norway, became subject to Denmark. About 1529 the art of printing was introduced into Iceland, and printing-presses were established at Holum and Skalholt. In 1550 the Lutheran Reformation was introduced into Iceland, and led to the overthrow of the convents, and to the loss of many valuable national MSS. In the middle of the following century Olaf Worms, seconded by Frederic III., king of Denmark, succeeded in awakening some interest for long neglected Iceland and her literary remains.

In 1760 a literary society was formed in Iceland under the name of 'the Unseen.' It published the 'Konungs Skuggsia, or Speculum Regale,' Copenhagen, 1768. Another society of twelve Icelanders was formed at Copenhagen in 1779, called 'Hit Islenzka Lærdoms-Lista Felag,' or 'Icelandic Literary Society,' of which Jon Ericksen, a distinguished and learned Icelander, was appointed president. His object was the diffusion of learning and useful knowledge in Iceland, especially as connected with agriculture, manufactures and the arts, and the preservation of the purity of the Icelandic, or old Northern tongue. He published in succession fourteen octavo volumes of very valuable matter. After the death of Ericksen in 1787 this society became extinct. An account of its labours and other interesting information concerning Iceland are contained in an article on the 'Literature and Literary Societies of Iceland,' in No. XVII. of the *Foreign Quarterly Review*, January, 1832. Another society was formed in Iceland itself, and, we believe, still exists, called 'Islands Konunglega Lands Uppfradangar Felag,' or 'Royal Society for

General Icelandic Instruction,' which reckoned at one time no less than 1200 subscribers. The head-quarters of the society were established at Leirargördum, whither the printing-press from Holum has been since removed. In 1816 Professor Rask established at Copenhagen the 'Islands Bokmenta Felag,' or 'Icelandic Library Society,' with a branch in Iceland, which has published a number of useful works. Mr. J. Heath, an Englishman, printed at his own cost in 1828, at Copenhagen, a spirited Icelandic translation of Milton's 'Paradise Lost,' by Jon Thórlakson, an Icelandic poet, who is mentioned by Henderson in his Journal.

Elementary education, and even a certain degree of superior information, is very generally spread among the Icelanders. Children are educated by their parents, with the assistance of the parish clergyman. There is but one superior school in the island, at Bessasted, near the capital Reikjavik. There were formerly two schools at Holum and Skalholt, where instruction was given in mathematics, geography, history, philosophy, and theology, but they have merged in the school or college of Bessasted. Most of the clergy have been educated in those schools, but a few visit Copenhagen to complete their studies.

Iceland is divided for administrative purposes into four large fiordnungs, or districts, north, east, south, and west. Of these the southern and western are the most inhabited. These districts are divided into syssels, or sheriffdoms, a sysselman being a magistrate and receiver of the king's taxes in each of them. There is a governor-general, called stiftamtman, appointed by the king for five years, with a salary of about 300*l.* sterling, who resides at Reikjavik. He has under him two amtmen, or deputy-governors, one for the western, and the other for the north and eastern districts. Reikjavik is a town containing about 600 resident inhabitants, and is built on the south side of an inlet of the Faxefiord, on the south-west coast of the island. It consists of two streets: one built only on one side, fronting the shore, and entirely occupied by merchants and tradespeople; the other, striking off at an angle with it, contains the houses of the bishop of Iceland, of the Landfoged, or receiver-general, and other persons not engaged in trade. The house of the governor, the house of correction, and the church, stand by themselves at the back of the town. The houses, with two or three exceptions, are constructed of wood, after the Norwegian fashion, with a storehouse and a small garden attached to them. To the south-west of Reikjavik is the peninsula of Alftaness, adorned with the church and school of Bessasted, and a number of pretty cottages. Gardé, in the same neighbourhood, is the residence of the archdeacon of Iceland, and at Hafnarfiord there is a dry dock. The population of Reikjavik may be considered to be more Danish than Icelandic.

In the northern district there is a kind of town or village, called Eyafiordur, and a factory, called Husavik, on the Skialfiandafiord, from which sulphur from the neighbouring mines is shipped. Holum has dwindled into insignificance. Other factories are scattered about the coast, especially in the west. Those factories generally consist of one or two merchants' houses, with warehouses, and perhaps a shop; and they are built at the most convenient places for shipping the produce of the district, and also for the fisheries, which constitute one of the principal resources of Iceland. (Henderson's *Journal;* Sir George Mackenzie's *Travels.*)

ICELAND MOSS is, properly speaking, a lichen (Cetraria Islandica), common in the mountainous districts of the north of Europe and North America. The thallus is foliaceous, spreading out on the ground; the surface and margins irregular; the colour varying from whitish-grey to olive; the shields (scutellæ, or reproductive spots) marginal, orbicular, brown. It is devoid of odour, but possesses a very bitter taste: by mastication, or maceration in water, it dissolves into a jelly.

It consists of a kind of starch, lichenic acid, and a bitter principle, which has been designated *cetrarin.* By repeated washings in cold water the bitter principle can be removed; and the remaining portion, when dissolved in warm water, is as insipid as a solution of common starch: it then possesses all the nutritive properties of starch, and is used in Iceland to form bread and a kind of gruel. it may also be formed into a chocolate paste.

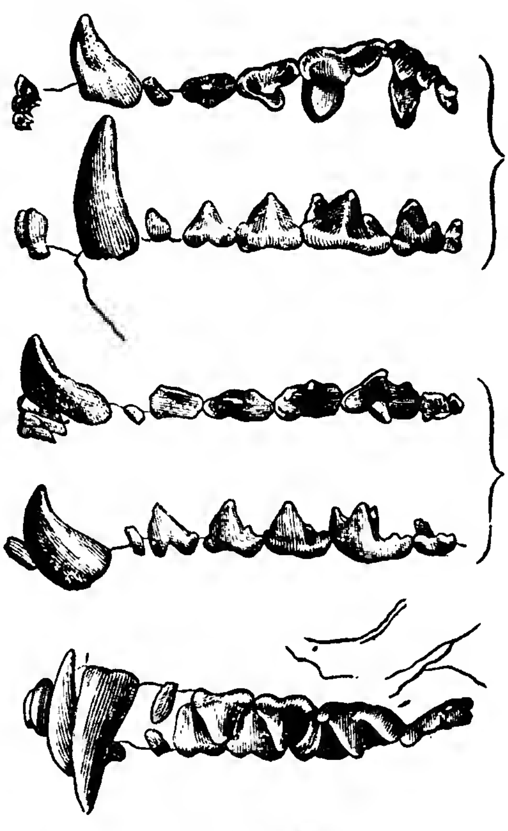
From its demulcent qualities it has been thought useful in consumption and other diseases, in which it is extensively employed as a decoction, either alone, or as a vehicle for other medicines. The bitter principle at the same time renders it tonic; and being eminently nutritious, it may be regarded as a dietetical as well as therapeutic agent. Various other lichens may be employed in a similar way particularly the Sticta pulmonacea, or lungwort, which is often of great service in asthma.

ICELAND SPAR. [CALCAREOUS SPAR.]

ICE'NI. [BRITANNIA.]

ICHNEUMON (Mammalogy), the name applied by Lacépède, Geoffroy, and others to a genus of digitigrade carnivorous quadrupeds allied to the civets. It is the *Mangusta* of Olivier and others, *Herpestes* of Illiger and others, *Mangouste* of the French.

Generic Character.—Feet short, with five demipalmated toes, armed with claws which are slightly retractile. *Tongue* furnished with horny papillæ. *Ears* small. A voluminous, simple *pouch,* which does not contain odoriferous matter, and at the bottom of which the vent is pierced. *Body* very much elongated; tail long, strong at its base. *Hairs* of the fur annulated. Dental formula:—Incisors $\frac{6-6}{6-6}$; Canines $\frac{1-1}{1-1}$; Molars $\frac{6-6}{6-6} = 40$.



Teeth of Ichneumon.

The above cut (F. Cuvier) exhibits the dentition, generally, of the *Civets, Ichneumons, Gennets,* and *Paradoxuri;* for, though there are particular differences which will be noticed under the article VIVERRIDÆ, they are not sufficient, in the opinion of M. F. Cuvier, to demand separate illustrations of the dental system of those groups.

Mr. Bennett, at a meeting of the Zoological Society (1835), noticed some peculiarities in the dentary system of these animals. In *Herpestes fasciatus* and *Herpestes Gambianus* he found the following arrangement:—Incisors $\frac{6}{6}$; Canines $\frac{1-1}{1-1}$; Molars $\frac{5-5}{5-5}$. The incisors were small, simple, and regular; the canines of moderate size; the first two false molars of the normal form; the third carnassier of rather small size compared with its analogue in genera more decidedly carnivorous; and the last two, in both jaws, tuberculous. The rudimentary false molar, mentioned by M. F. Cuvier, was, Mr. Bennett observes, wanting in both these species; nor could its absence be owing to the age of the specimens examined, as he remarks, for he tells us that some were evidently young animals, though arrived at adult age. Its entire absence was further confirmed by the situation of the teeth respectively, in the reciprocal position of the jaws, the first inferior false molar filling up the entire vacant space between the corresponding superior tooth and the canine of the same jaw. 'This system,' writes Mr. Bennett in continuation, 'differs considerably from that ascribed to *Herpestes* by M. F. Cuvier (*Dents des Mammifères*, i. 99), but agrees in all respects with the description of M. Desmarest. The following however is equally foreign to the accounts of both these authors, and, were not all the other characters so perfectly accordant with those of *Herpestes*, would decidedly indicate a new genus. Indeed, it so stands in my notes, under the name of *Mungos*, but with a note of interrogation, as I have only been able to examine a single specimen.

Mungos ? vitticollis. (*Herpestes vitticollis*, Benn.) Teeth, $\frac{6}{6}$; $\frac{1-1}{1-1}$; $\frac{6-6}{7-7}$. The incisors and canines have nothing remarkable either in form or number. The first false molar in either jaw is tuberculous; the second and third consist of one large conical fang in the centre, and a smaller tubercle on each side of it; then follows the carnassier, and after it two tuberculous teeth in the upper, and three in the lower jaw. The first of these in the upper jaw is large and triangular; the second short and broad, its latitudinal dimensions more than doubling its longitudinal; the three of the lower jaw are small, simple, rather distant from each other, and of cylindrical form. This is a system of dentition which, as far as I am aware, is altogether peculiar, and if confirmed by the examination of other specimens, will undoubtedly form the type of a new genus. Perhaps further and more rigid examination may even detect different species from the different localities, as specimens have arrived for the Society from Travancore and Bombay, and one from Madras, at the British Museum.'

Geographical Distribution of the genus.—Asia and Africa. Our limits do not allow us to particularize all the localities, but we may notice that Mr. Hodgson mentions *Herpestes griseus* as occurring in the lower region of Nepâl (*Zool. Proc.*, 1834); and Dr. Andrew Smith, who describes a new species, *Herpestes badius*, says that the first specimen was killed near Old Latakoo, and that several others were seen between that and Kurichane, which lies about 120 miles more to the eastward. In addition to this, and another new species which Dr. Smith says he shall figure hereafter, he states that five others inhabit the south of Africa, namely, *Herpestes Pharaonis*, Desm.; *H. griseus*, Desm.; *H. urinator*, Smith; *H. tænianotus*, Smith; and *H. albicaudis*, Smith. He adds that, before long, there is every reason to expect that additional species will be added to the preceding, as the Bechuanas described several little quadrupeds clearly differing from any of the foregoing, yet doubtless belonging either to this genus or *Cynictis* of Ogilby. (*Illustrations of the Zoology of South Africa*, No. II., now in the course of publication.)

Habits, Food, &c.—The habits of this genus, to which several new species have of late been added, will be collected in the course of this article, especially in that part of it which treats of *Ichneumon Pharaonis*. Dr. A. Smith, in the work above quoted, says that *Herpestes badius* appeared restricted to sandy districts abounding in brushwood, and in these was occasionally seen running from one copse to another. He states that it is extremely shy, and flies on the approach of man to its hiding-places with great rapidity. Nothing except the remains of insects were found in the stomachs of those which were procured by the Expedition; but Dr. Smith adds, that if the natives are to be believed, *H. badius* feeds with avidity also upon lizards, snakes, mice, &c. Lucan and Rumphius both notice the skill of the Ichneumon in seizing serpents by the throat, so as to avoid injury. The poet, who names it *Pharias*, describes its attack on the Egyptian asp elegantly and at length (iv. 724).

Arrangement and Natural History.

Linnæus, in his last edition of the 'Systema Naturæ,' gives one species of *Ichneumon* under the name of *Viverra Ichneumon*, his genus *Viverra* being placed between the Cats (*Felis*) and Weasels (*Mustela*). It stands as the first species of the genus, and three varieties are noticed, one of them with a query whether it may not be a distinct species. The first of these varieties is evidently the celebrated Egyptian Ichneumon, *Ichneumon Pharaonis* of Geoffroy, *Herpestes Pharaonis* of Desmarest and others.

Gmelin gives three species, viz. *Viverra Ichneumon* (the Egyptian), *V. Mungo*, and, apparently, *V. cafra*.

Pennant places it among the 'Weesels.'

Cuvier gives the form (*Les Mangoustes*) a position between *Paradoxurus* and *Ryzæna* (the Suricates).

Mr. Gray arranges the Ichneumons (*Herpestes*, Illig.) under the *Felidæ*, in his fourth subfamily *Viverrina*, between *Genetta*, Cuv., and *Crossarchus*, F. Cuv.

Dr. Fischer places the form, under the name of *Mangusta*, between *Mephitis* and *Crossarchus*: he enumerates nine species.

M. Lesson, in his 'Manuel,' arranges it, under the name of *Ichneumon*, between *Genetta* and *Crossarchus*.

Mr. Swainson's 'Viverinæ,' *Musk-Weasels* (Viverrinæ), form the first subfamily of his family *Mustelidæ*. *Herpestes* which is placed between *Cynictis* and *Viverra*, Linn., is the second genus of that subfamily.

The species are not few. M. Lesson and Mr. Swainson mention eight, and there is reason for supposing that there are more. We select as an example *Ichneumon Pharaonis*, *Viverra Ichneumon*, *a*, of Linnæus.

Description.—*Fur* a mixture of chestnut-brown and yellow, each hair being annulated with those two colours; *feet* and *muzzle* black or deep chestnut; *tail* terminated by a tuft of long hairs.

This appears to have been one of the sacred animals of the antient Egyptians; and we read in Herodotus (ii. 67) that the Ichneutæ (*ἰχνευταί*) which the best critics consider to be synonymous with *Ichneumons*, were, as well as dogs, buried 'in holy repositories.' There is no good reason to doubt that it is the Ichneumon (*ἰχνεύμων*) of Aristotle (*Hist. Anim.*, ix. 6; vi. 20; vi. 35), Diodorus Siculus, Strabo, Ælian, and others; and as little that it is the *Ichneumon* of Pliny. Aristotle (ix. 6) relates, that when the Ichneumon sees the serpent called the Asp or Aspic (ἀσπίς), he does not attack it till he has called to his assistance other Ichneumons, and in order to defend themselves from the venomous bites of the snake, they cover themselves with mud by rolling on the earth after having dipped themselves in the water. Pliny (*Hist. Nat.*, viii. 24) gives a somewhat similar account. Diodorus and Strabo relate a much more marvellous feat, nor is Pliny slow to lend his aid in spreading the wonderful tale, how, when the crocodile is lulled asleep with opened jaws, the Ichneumon darts like a weapon down his throat and gnaws his entrails ('erodit alvum:' *Hist. Nat.*, viii. 25). It may be thought hardly worth while to refute such a fable; but it was long entertained as credible, and it may not be amiss to turn to Sonnini's observations on this point, more especially as they contain some interesting remarks on the habits of the animal. 'Much,' says Sonnini, who speaks of the Ichneumon as one of those animals which the Egyptians have domesticated, 'has been written concerning it, and much of this writing has been fabulous. It was one of the animals held sacred in antient Egypt. Honours were rendered to it on its death; it was maintained with the greatest solicitude during life; funds were set apart for its support; they served up to it, as to cats, bread steeped in milk, or fish of the Nile cut down into morsels; and it was generally forbidden to kill any of the race. Object of the worship of a celebrated people, the pretended protector of the most singular country in the world against a scourge the most grievous to an agricultural nation, a stranger and unknown in our climates,—what a field for the production of the marvellous? Accordingly it has not been spared. The greater part of travellers have seen the *mungouste* without examining it; and with their minds prejudiced by the stories which the antients and the moderns have spread respecting it, they have successively copied their relations.' Sonnini then, after a compliment to Buffon, and a statement that he had had it in his power to observe the *mangouste* in its native country and in its state of liberty, proceeds as follows:—'With very great dispositions to familiarity, the *mangoustes* are not altogether domestic in Egypt. Not only do they now rear none in their habitations, but the inhabitants have not even the recollection that their ancestors reared any. Most probably then those which Belon and Prosper Alpin assert that they had seen domesticated were merely a few individuals preserved rather as objects of curiosity than for any useful purpose; for if they hunt away rats and mice, they likewise seize upon the poultry, and this appetite would more than overbalance the good which they could do in purging the houses of noxious animals, which cats would destroy more certainly and with less inconvenience. Having some resemblance in their habits to weasels and polecats, they feed upon rats, birds, and reptiles. They ramble about the habitations of men; they even steal into them, in order to surprise the poultry and devour their eggs. It is this natural fondness for eggs which prompts them frequently to scratch up the sand with the intention of discovering those which the crocodiles deposit there, and it is in this manner that they prevent, in reality, the excessive propagation of these detestable animals. But it is absolutely impossible to abstain from laughing, and not without reason, when we read of their leaping into the extended mouths of the crocodiles, of their sliding down into their belly, and not returning till they have eaten through their entrails.* If some *mangoustes* have been seen springing with fury on little crocodiles presented to them,† it was the effect of their appetite for every species of reptiles, and not at all that of a particular hatred, o of a law of nature, in virtue of which they would have been specially commissioned to check the multiplication of those amphibious animals, as many people have imagined.‡ It had been equally reasonable to say that nature placed *mangoustes* on earth merely to prevent the too great propagation of chickens, to which they are far more hostile in reality than to crocodiles. And what proves more clearly that men have been mistaken in ascribing such intentions to nature respecting *mangoustes* is this—in more than half of the northern part of Egypt, that is to say, in that part comprised between the Mediterranean Sea and the city of Siout, they are very common, although there are no crocodiles there; whilst they are more rare in Upper Egypt, where the crocodiles are, in their turn, more numerous. The *mangoustes* are nowhere more multiplied than in Lower Egypt, which, better cultivated, more inhabited, more humid, and more shaded, presents also more abundantly the means of supplying them with prey and with food, and, I again repeat it, crocodiles never appear there.'

That Belon saw this Ichneumon in Egypt there can be no doubt. That accurate observer, in the 'Portraits,' gives a figure of it superscribed 'Portrait de l'Ichneumon, que les Egyptiens nomment Rat de Pharaon.' Beneath is the following 'quatrain:'—

'Voy le portrait du Rat de Pharaon.
Qui chasse aux Rats, comme fait la Belette:
Au demeurant fort cauteleuse beste.
Qui autrement est nommée Ichneumon.'

Hasselquist mentions the *Viverra Ichneumon*, the *Ichneumon of the Nile*, as met with in Upper and Lower Egypt, living, during the inundation of the Nile, in gardens and near the villages, but, in the dry season, as dwelling in the fields and near the banks of the river. He says that it creeps slowly along, as if ready to seize its prey, and that it feeds on plants, eggs, and fowls, killing the latter in the night, when it frequents the villages. He states that in Upper Egypt it searches for the eggs of the crocodile, which lie hid in the sand on the shore, and eats them, preventing by that means the increase of that dangerous animal. 'The Ichneumon,' he continues, 'may easily be tamed, and frequently goes about the houses like a cat. Mr. Barton, who has been the English consul nineteen years in Egypt, has kept a tame one for several years. It makes a growling noise, and barks when it is very angry. The Arabians call it *Nems*. The French in Egypt, who give everything they don't know names of their own making, have called this *Rat de Pharaon*, which Alpin and Belon have followed, and called it *Mus Pharaonis* (the Mouse of Pharaoh). The resemblance it has to a mouse (*mus terrestris*) in regard to the colour and hair might have induced ignorant people who know nothing of natural history to call it a mouse; but I cannot conceive why they should call it Pharaoh's Mouse. The Egyptians were too intelligent in the time of Pharaoh to call it a mouse, having knowledge enough to give true descriptions and significant names to all natural bodies; nor is it at this day called *Phar* § by the Arabs, which is the name for mouse, but they call it *Nems*. What is related concerning its entering the jaws of the crocodile is fabulous.' Hasselquist travelled during the years 1749-50-51-52: Sonnini's travels commenced in 1777, and terminated in 1780. In the Arabic used in the neighbourhood of Tangier, whence two specimens were sent by Mr. Drummond Hay to the Zoological Society of London *Herpestes Pharaonis* is called *Sĕrro*.

* Sonnini's notes. See almost all the antient authors, and, among the moderns, Maillet, Jauna, and others.
† Maillet, 'Descr. de l'Egypte.'
‡ Maillet, &c.
§ But Lucan, as we have seen, alludes to it under the name of *Pharias*.

Ichneumon Pharaonis.

Mr. Bennett, in his account of a specimen of *Herpestes griseus* kept in the Tower, says that on one occasion it killed no fewer than a dozen full-grown rats, which were loosed to it in a room sixteen feet square, in less than a minute and a half.

The story of the *Ichneumon Mungo*, or *Mungos*, *Viverra Mungo* of Gmelin, having recourse to the plant *Hampaddu Tanah*, or *Mungo root*, as an antidote when bitten by serpents in its encounters with them, will be found in the 'Amœnitates Exoticæ' of Kæmpfer, who says (p. 574) that he had one of these animals which slept with him and followed him about like a dog through the city and fields.

ICHNEUMON. (Entomology.) [PUPIVORA.]

ICHTHYOLOGY (from ἰχθύς, a fish, and λόγος, a discourse). [FISH.] In the article Fish, where mention is made of the scales, it is said that M. Louis Agassiz has proposed a new classification of fishes, which is founded upon the structure and form of the scales. The object of the present article is to give a brief outline of the views of that naturalist, such in fact as will be found in his 'Recherches sur les Poissons Fossiles.' M. Agassiz divides fishes into four orders, each of which contains fishes having a cartilaginous skeleton; in each there are genera the species of which have spinous rays in the dorsal fin, and other genera where all the rays of the dorsal fin are soft. There are likewise in each order both apodal and abdominal genera; and in two of the orders there are in addition certain species in which the ventral fins are thoracic, and others in which they are jugular. These four orders are named by M. Agassiz *Placoïdes*, *Ganoïdes*, *Ctenoïdes*, and *Cycloïdes*.

The name *Placoïdes* was applied to the first of these orders on account of the irregularity which the solid tegumentary parts present. They consist of masses of enamel, which are often of considerable size, and sometimes minute. To this family belong the *Cestracionites*, of which there is but one existing genus (the genus *Cestracion*), the *Squalidæ*, *Raidæ*, and *Cyclostomi*.

The second order, *Ganoïdes*, are distinguished by the angular form of the scales; these are composed of layers of corneous or osseous substances disposed one upon the other and covered by a thick coat of enamel, and consequently resemble teeth in their structure. This order contains the following families: *Lepidoïdes*, all the species of which are fossil; the *Sauroides*, which are also fossil, with the exception of two genera, *Lepisosteus* and *Polypterus*; the *Pycnodontes*, likewise fossil; the *Sclerodermi*, *Gymnodontes*, *Lophobranchii*, *Goniodontes*, *Siluridæ*, and *Sturiones*.

In the third order, *Ctenoïdes*, the scales consist of laminæ whose posterior and free margin is pectinated. A structure very evident in the chætodons and flat-fishes (*Pleuronectidæ*) which M. Agassiz thinks ought to be placed close together. In this order are also arranged the *Percidæ*, *Polyacanthes*, *Sciænidæ*, *Sparidæ*, *Scorpænidæ*, and *Aulostomes*.

Order four, *Cycloïdes*. The families which belong to this order have the scales formed of simple laminæ, with the posterior margin smooth. The scales of the lateral line are formed like the others, but instead of flat laminæ they consist of ducts placed one within the other, of which the retiring portion, which is applied against the disc of the scale, forms the tube through which flows the mucous secretion which covers the fish. This tube is sometimes bifurcate, or even ramified. The *Labridæ*, *Mugilidæ*, *Atherinæ*, *Scombridæ*, *Gadidæ*, *Gobiadæ*, *Murænidæ*, *Lucioïdes*, *Salmonidæ*, *Clupeidæ*, and *Cyprinidæ*

ICHTHYOSAURUS, literally *Fish-Lizard* (Ἰχθὺς : Σαῦρος), the generic name given by Mr. König to the extinct fossil animal noticed by the late Sir Everard Home, under the appellation of *Proteosaurus*, and by Wagler under the name of *Gryphus*.

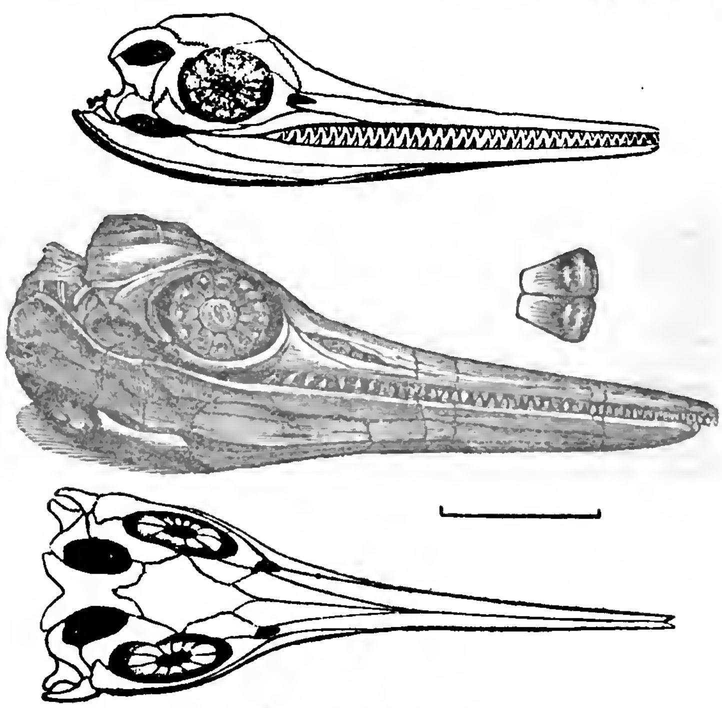
Organization.

We are indebted to Mr. De la Beche and the Rev. W. D. Conybeare principally for pointing out and illustrating the structure of this extraordinary creature; and that at a time when the materials were far more scanty than they are at the present day. Dr. Jæger, Mr. Hawkins, Dr. Buckland, Sir Philip de Malpas Grey Egerton, and Mr. Owen, have all contributed to throw light on the organization of a being that has long ceased to exist; and the anatomy and animal economy of this tyrant of the seas of former ages is now nearly as well known as that of the porpoise which revels in the ocean that washes the shores of our existing continents and islands.

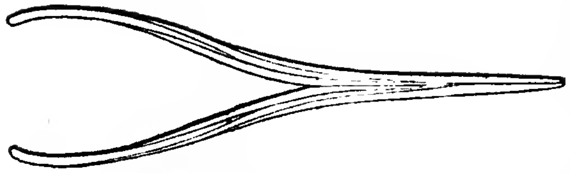
'If,' writes Dr. Buckland, in his 'Bridgewater Treatise,' 'we examine these creatures with a view to their capabilities of locomotion, and the means of offence and defence which their extraordinary structure afforded to them, we shall find combinations of form and mechanical contrivances which are now dispersed through various classes and orders of existing animals, but are no longer united in the same genus. Thus, in the same individual, the snout of a porpoise is combined with the teeth of a crocodile, the head of a lizard with the vertebræ of a fish, and the sternum of an *Ornithorhynchus* with the paddles of a whale. The general outline of an Ichthyosaurus must have most nearly resembled the modern porpoise and grampus. It had four broad feet or paddles, and terminated behind in a long and powerful tail. Some of the largest of these reptiles must have exceeded thirty feet in length.' We shall now endeavour to give a sketch of the organization of these *Enaliosaurians*.

Skeleton.—The osteology of the head agrees in many points with that of the crocodile, but the orbit of the eyo is much larger, and the nostril is not, as in that genus, placed near the point of the snout, but near the anterior anglo of the orbit, as in some other lizards. The teeth, which in some cases amount to a hundred and eighty, are not incased in deep and distinct sockets as in the crocodiles, though the rudiments of an alveolar separation may be traced in the small ridges between the teeth running along the furrow of the maxillary bone in which they are set. The succession of teeth is managed much after the same manner as that which obtains in the crocodiles [Crocodile, vol. viii., p. 162], the young tooth budding up at tho base of the old tooth, where, as it grows, its lateral pressure sets the absorbents at work; the base of the old tooth is thus partially removed, and, as the new tooth advances, is finally displaced to make room for its more efficient successor. The elongated jaws in which these instruments of destruction are ranged are made up, as in many of the crocodiles and the other lizards, of many thin bony plates, so as to produce a union of lightness, elasticity, and strength. 'It is obvious,' says Dr. Buckland, in the interesting work above quoted, 'that an under jaw so slender and so much elongated as that of a Crocodile or Ichthyosaurus, and employed in seizing and retaining the large and powerful animals which formed their prey, would have been comparatively weak and liable to fracture if composed of a single bone. Each side of the lower jaw was therefore made up of six separate pieces, set together in a manner which will be best understood by a reference to the figures. This contrivance in the lower jaw to combine the greatest elasticity and strength with the smallest weight of materials, is similar to that adopted in binding together several parallel plates of elastic wood or steel to make a crossbow; and also in setting together thin plates of steel in the springs of carriages. As in the carriage-spring or compound-bow, so also in the compound-jaw of the Ichthyosaurus, the plates are most numerous and strong at the parts where the greatest strength is required to be exerted; and are thinner and fewer towards the extremities, where the service to be performed is less severe. Those who have witnessed the shock given to the head of a crocodile by the act of snapping together its thin long jaws, must have seen how liable to fracture the lower jaw would be were it composed of one bone only on each side: a similar inconvenience would have attended the same simplicity of structure in the jaw of the Ichthyosaurus. In each case therefore the splicing and bracing together of six thin flat bones of unequal length and of varying thickness, on both sides of the lower jaw, affords a compensation for the weakness and risk of fracture that would otherwise have attended tho elongation of the snout. Mr. Conybeare points out a further beautiful contrivance in the lower jaw of the Ichthyosaurus, analogous to the cross-bracings lately introduced in naval architecture.'

Hitherto the structure of the skeleton of Ichthyosaurus is, as we have seen, sauroid; but we now come to a part of its bony frame, and a very principal part, which *is formed* on the ichthyoid or fishy type. The *vertebral column*, consisting of more than one hundred vertebræ, each of which is hollow and fashioned after the manner of those of fishes, to facilitate the progress of the animal through the watery medium in which it existed, is constructed for a swimming,



Head and sclerotic plates of Ichthyosaurus.
The scale represents one foot.



Lower jaw of Ichthyosaurus. (Dr. Buckland.)

not a walking animal; and the sauroid type is here departed from in favour of a conformation demanded by the habits of the animal. A peculiarity in this part of the structure is noticed by Sir E. Home, the annular part of the vertebra being neither consolidated with its body, as in quadrupeds, nor connected by a suture, as in crocodiles; but remaining always distinct, and articulating by a peculiar joint, resembling a compressed oval ball and socket-joint. Mr. Conybeare observes, in addition, that this mode of articulation co-operates with the cup-shaped form of the intervertebral joints in giving flexibility to the vertebral column and assisting its vibratory motions; for had these parts been consolidated, as in quadrupeds, their articulating processes must have locked the whole column together, so as to render such a motion of its parts impossible; but by means of this joint every part yields to that motion. (Buckland's *Bridgewater Treatise*, and the illustrations there collected.)

Sir Philip Egerton, in his paper 'On Certain Peculiarities in the Cervical Vertebræ of the Ichthyosaurus, hitherto unnoticed' (*Geol. Trans.*, June, 1836), has demonstrated that the first and second cervical vertebræ (in some species at least) are anchylosed; and he further notices a very remarkable feature which at once distinguishes these vertebræ from the other bones of the spinal column. He shows that on the under surface of each bone there exists an unusual enlargement in the form of a solid wedge-shaped process, placed transversely to the smaller diameter of the vertebræ. By this arrangement four triangular planes are produced. 'The first and largest is based upon the lower anterior margin of the atlantal socket, having its apex directed downwards and backwards until it meets the apex of a similarly shaped though smaller plane proceeding downwards and forwards from the posterior margin of the atlas. The third, of like shape and size with the second, extends from the anterior margin of the axis, and joins the apex of the fourth, which inclines forwards from the posterior portion of the same bone. This fourth plane is considerably smaller than the others, and corresponds in size with a fifth, placed on the anterior border of the third cervical vertebra. When therefore the three anterior vertebræ are in their natural position, the arrangement of the five planes is as follows:—the first and largest occupies the lower front of the atlas; the second and third, by the union of their bases, produce a triangular socket on the under surface of the atlas and axis; and a second smaller socket is formed between the axis and the third vertebra by a similar disposition of the fourth and fifth planes.' Sir Philip adds that the second bone of the series is frequently found with the atlas and axis, and is not uncommonly fixed in its position by anchylosis. The third bone he states to be of rare occurrence, in consequence of its diminutive size, and he thinks that in some species it is probably altogether wanting. He designates these bones as *Subvertebral Wedge-Bones.* The reader will find in the same interesting memoir many valuable observations on the structure and articulation of the cervical vertebræ, the combined result of which, and of the reduction of the intervertebral cavities, must, as Sir Philip remarks, have been a considerable increase of power in this part of the spinal column; and he further states that proceeding from the lumbar vertebræ towards the head, the column attains its minimum diameter about the fifth cervical vertebra, from which point to the occiput it increases in size very rapidly.

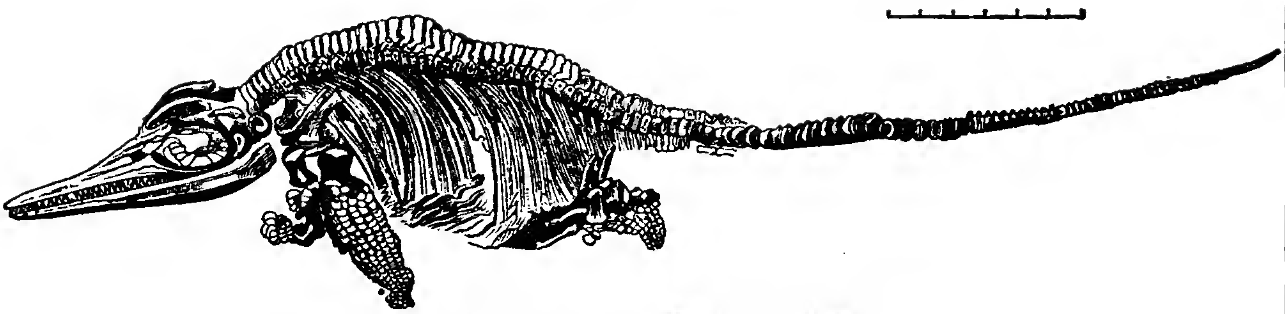
The *ribs* appear to be constructed more upon the sauroid type, for they are continuous along the vertebral column from the head to the pelvis; they are slender and mostly bifurcated at the end, and many of them are united in front across the chest. Intermediate bones, analogous to the sternal and intermediate costal cartilages in the crocodiles and the sterno-costal arcs in Plesiosaurus, united the ribs of the right side to those of the left. Dr. Buckland is of opinion that this structure was probably subservient to the purpose of introducing into their bodies an unusual quantity of air, the animal being by these means enabled to remain long beneath the water without rising to the surface for the purpose of breathing.

In the *sternum* we find a combination of bones admirably adapted for resistance. Of this part of the bony framework Mr. Conybeare says, 'The form of the sternal arch and the broad surfaces of the clavicles is such as to impart great strength to the chest, enabling the animal to breast the most disturbed waters, and affording an extensive surface for the attachment of powerful muscles to assist in moving the anterior extremities;' and Dr. Buckland remarks that the bones composing this arch are combined nearly in the same manner as in the Ornithorhynchus of New Holland, which seeks its food at the bottom of lakes and rivers, and is obliged, like the Ichthyosaurus, to be continually rising to the surface to breathe air. To this sternal arch the *anterior paddles* are articulated; they are nearly one-half larger than the posterior paddles, and in this part of the structure the cetaceous type appears to have been followed. The short and stout humerus is followed by the bones of the fore-arm; and these are succeeded by numerous regularly-disposed polygonal bones, exceeding, in some species, the number of one hundred, which form the paddle or fin. In *form* these bones differ both from the phalanges of lizards and whales.

Sternal arch and anterior paddles of Ichthyosaurus. (Dr. Buckland.)

The bones of the *pelvis* closely resemble those of the crocodile, and, as Mr. De la Beche and Mr. Conybeare observe, the femoral bone and *posterior paddle* are altogether analogous to the humerus and anterior paddle; but, contrary to the development of the posterior extremities of quadrupeds in general, they are very considerably smaller, nearly in the proportion of one to two.

Dr. Buckland, with reference to the posterior extremities, or paddles, observes, that these are wanting in the cetaceans, and that they possibly compensate for the absence of the flat horizontal tail with which those animals are furnished. In a paper, 'On the Dislocation of the Tail, at a certain point, observable in the Skeletons of many Ichthyosauri,' by Richard Owen, Esq., F.G.S., Hunterian Professor to the



Ichthyosaurus communis. (Dr. Buckland.) Scale 6 inches.

Royal College of Surgeons, London, read before the Geological Society of London, March 21, 1838, the author commenced his observations by referring to the skeleton of the existing cetacea, and pointing out how slight is the indication afforded by the caudal vertebræ of the large terminal fin, which forms, in that class, so important an organ of locomotion; and the improbability that its presence would have been suspected, had the cetacea been known only by their fossil remains, in consequence of the fin having consisted entirely of decomposable and unossified material.

He stated that the depressed flattened shape of the terminal vertebræ, which gives the only indication of the horizontal fin—and which character is not present in all the cetacea—is not recognisable in the skeletons of the Ichthyosauri and Plesiosauri; but he proceeds to describe a condition of the tail in the skeletons of the Ichthyosauri which, he conceives, affords an indication of a structure in the extinct animal analogous to the tegumentary fin of the cetacea, and which has not been suspected by the authors of the conjecturally-restored figures of the Ichthyosauri already published. The condition alluded to is described as an abrupt bend of the tail, about one-third of its whole length distant from the end, and at the thirtieth caudal vertebra in the *Ichthyosaurus communis;* the broken portion continuing, beyond the dislocation, as straight as in the part which precedes it. As there is no appearance of a modification of structure in the dislocated vertebræ, indicative of the tail having possessed more mobility at that point than at any other, and as the dislocation has taken place at the same point in seven specimens examined by the author, he conceives that it must be due to some cause operating in a peculiar manner on the dead carcass of the Ichthyosaurus, in consequence of some peculiarity of external form, while it floated on the surface of the sea.

A broad tegumentary fin, composed of dense but decomposable material, he observed, might have been attached to the terminal portion of the tail; and such a fin, either by its weight, or by presenting an extended surface to the beating of the waves, or by attracting predatory animals of strength sufficient to tug at, without tearing it off, would occasion, when decomposition of the connecting ligaments had sufficiently far advanced, a dislocation of the vertebræ immediately proximate to its point of attachment. The two portions of the tail, with the rest of the skeleton, would continue to be held together by the dense exterior integument, until the rupture of the parietes of the abdomen, at some yielding point, had set free the gases generated by putrefaction; and the skeleton, having undergone certain partial dislocations, from the decomposition of the more yielding ligaments, would subside to the bottom, and become imbedded in the sedimentary deposits, exhibiting the fracture of the tail alluded to.

With respect to the relative position of this conjectured caudal tegumentary fin of the Ichthyosaurus, Mr. Owen could not perceive any indication of its horizontality in the forms of the vertebræ which he supposes to have supported it; and he regards the superaddition of posterior paddles in these air-breathing marine animals as a compensation for the absence of that form of fin which is so essential in the cetacea, for the purpose of bringing the head to the surface of the sea to inhale the air. On the other hand, a vertical caudal fin seems especially required by the short-necked and stiff-necked *Ichthyosauri*, in order to produce, with sufficient rapidity, the lateral movements of the head, which were needed by those predatory inhabitants of the antient deep; while in the *Plesiosaurus* such a fin would be unnecessary, in consequence of the length and mobility of the neck; and Mr. Owen concluded by stating, that in those skeletons of *Plesiosauri* in which the tail is perfect it is straight, and presents no indication of the partial fracture or bend which is so common in the tails of *Ichthyosauri.*

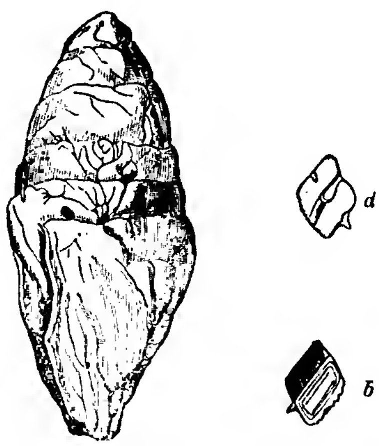
Figures of the tails of five specimens of *Ichthyosauri*, belonging to the species *Ich. communis, Ich. tenuirostris*, and *Ich. intermedius*, now in London, accompanied the Note; the subject of which was also illustrated by a sixth skeleton of an *Ichthyosaurus* on the Table, the property of Sir John Mordaunt, Bart. (*Geol. Proc.* 1838.)

Mr. Owen informs us that he has since procured detached terminal caudal vertebræ of the *Ichthyosaurus*, and finds them compressed or flattened from side to side, in a remarkable degree; a circumstance, he observes, confirming the accuracy of the conjecture of the verticality of the caudal fin, and the best proof perhaps of its actual presence in the living animal.

Senses.—That the Ichthyosauri enjoyed the sense of smelling in a considerable degree can hardly be doubted from the structure and position of the nostrils, nor is there any reason for supposing that they were not gifted with the sense of taste; but their power of vision must have been great, and indeed Dr. Buckland justly speaks of the enormous magnitude of the eye as very much exceeding that of any living animal, and as being the most extraordinary feature of the head. He alludes to a skull of *Ichthyosaurus platyodon* in the collection of Mr. Johnson at Bristol, and remarks that in this specimen the longer diameter of the orbital cavity measures fourteen inches. The eye has, as Mr. Conybeare remarks, its sclerotica composed of a bony or rather scaly substance, subdivided into thirteen plates, as will be seen in the cut (p. 430), where two of these plates are represented separately. Mr. Conybeare, in the passage to which we have referred, goes on to state that he had then before him the eye of a middle-sized lizard from Germany, which has a structure exactly similar, excepting that the plates were more numerous: this, he states, was pointed out to him by the late Mr. Miller, and he adds that the chameleon, iguana, and tupinambis have similar osseous laminæ, as has the tortoise, but that in this latter animal they form, as in birds, the anterior disk. This conformation was highly important to the adjustment of an organ whose functions were demanded both above and below the surface of the water. [Birds, vol. iv., p. 428.] The sense of hearing appears to have been sufficiently developed, and that of touch was probably about upon a par with the sensations of the modern cetaceans.

Digestive Organs.—An enormous expansion of the jaws, which were so constructed as to bear the shock of the most violent collision, and were furnished with a constant succession of teeth, formed an organ of seizure well fitted to the voracity of an animal that not only preyed upon fishes and other marine animals, but, like the ravenous pike of our fresh-waters, fed upon its own congeners and even species. The prey was transmitted into a stomach which must have been nearly coextensive with the cavity of the body, and the contents were thence made to pass through an intestinal canal which appears to have resembled, as Dr. Buckland observes, the spiral intestines of some of the swiftest and most voracious of our modern fishes.

The evidence upon which this assertion is made is to be found in various specimens, like that in the Oxford Museum, from the lias at Lyme Regis, and figured by Dr. Buckland in his 'Bridgewater Treatise' (pl. 14), which shows a large mass of fish scales, chiefly referrible to the *Pholidophorus limbatus*, intermingled with coprolite throughout the entire region of the ribs, and in the more matured coprolites themselves. Dr. Buckland, to whom we are indebted for the history of these curious bodies, says, speaking of the intestinal canal of the *Ichthyosauri*, 'Besides the spiral structure and consequent shortness of the small intestine, we have additional evidence to show even the form of the minute vessels and folds of the mucous membrane by which it was lined. This evidence consists in a series of vascular impressions and corrugations on the surface of the coprolite, which it could only have received during its passage through the windings of this flat tube. If we attempt to discover a final cause for these curious provisions in the bowels of the extinct reptile inhabitants of the seas of a former world, we shall find it to be the same that explains the existence of a similar structure in the modern voracious tribes of sharks and dog-fishes. As the peculiar voracity of all these animals required the stomach to be both large and long, there would remain but little space for the smaller viscera; these are therefore reduced, as we have seen, nearly to the state of a flattened tube, coiled like a cork-screw around itself; their bulk is thus materially diminished, whilst the amount of absorbing surface remains almost the same as if they had been circular. Had a large expansion of intestines been superadded to the enormous stomach and lungs of the Ichthyosaurus, the consequent enlargement of the body would have diminished the power of progressive motion, to the great detriment of an animal which depended on its speed for the capture of its prey. The above facts, which we have elicited from the coprolitic remains of the Ichthyosauri, afford a new and curious contribution to our knowledge both of the anatomy and habits of the extinct inhabitants of our planet. We have found evidence which enables us to point out the existence of beneficial arrangements and compensations, even in those perishable yet important parts which formed their organs of digestion. We have ascertained the nature of their food and the form and structure of their intestinal canal; and have traced the digestive organs through three distinct stages of descent, from a large and long stomach, through the spiral coils of a compressed ileum, to their termination in a cloaca, from which the coprolites descended into the mud of the nascent lias. In this lias they have been interred during countless ages, until summoned from its deep recesses by the labours of the geologist to give evidence of events that passed at the bottom of the antient seas, in ages long preceding the existence of man.' (*Bridgewater Treatise.*)



Coprolite of Ichthyosaurus. (Dr. Buckland.)

a, Magnified scale of Pholidophorus limbatus embedded therein (internal view); *b*, External view of the same.

External Integument.—This appears to have been a simple naked skin unprotected by any defence; it probably resembled in some degree the dermal covering of the cetaceans.

We have thus endeavoured to give a sketch of the organization and structure of a form blotted out from the catalogue of existing beings. Admirably adapted to its wants, its conformation enabled it either rapidly to pursue its prey, to dive far beneath the sea, or to ascend to the surface, and, in short, to execute with precision and quickness all the motions necessary to its mode of life.

The species are already numerous. Hermann Von Meyer gives six by name, and notices other nameless specimens. The time is now come for a well-digested monograph of this genus, and we are not without hopes that Mr. Owen will be induced to draw one up. There is a good collection of these extinct animals in the British Museum, and if, as we hope, that of Mr. Hawkins shall be added to it, the collection will be the finest in the world.

Geological Distribution of the Genus.—Ichthyosauri abound throughout the lias and oolitic formations. The chief repository has been hitherto considered to be in the lias at Lyme Regis, but, as Dr. Buckland states, they abound along the whole extent of this formation throughout England, from the coasts of Dorset, through Somerset and Leicestershire, to the coast of Yorkshire. The lias of Germany and France contains them. 'The range of the genus Ichthyosaurus,' says Dr. Buckland, 'seems to have begun with the Muschelkalk, and to have extended through the whole of the oolitic period into the cretaceous formation. The most recent stratum in which any remains of this genus have yet been found is the chalk marl at Dover, where they have been discovered by Dr. Mantell: I have found them in the gault near Benson, Oxon.' (*Bridgewater Treatise.*) [Plesiosaurus.]

ICHTHYOSIA'GONES (Rüppell), one of the many names (as *Aptychus*, Von Mayer; *Solenites* and *Tellinites*, Schlotheim; *Trigonellites*, Parkinson; *Lefadites*, Germar) which have been given to the pair of shelly bodies found in many of the oolitic rocks, and not unfrequently in the mouths of ammonites at Solenhofen, so as to prove their connexion with the animal which inhabited that shell. By Rüppell and Voltz they were conceived to form an operculum. The two valves meet on a straight toothless hinge-line, their free edges forming the remaining two sides of a triangle rounded at its apex. The substance of the shell is transversely fibrous; its inner surface concentrically striated with lines of growth. (Parkinson's *Org. Rem.*, pl. xiii., figs. 9, 10, 12.)

ICOLMKILL. [Iona.]

ICO'NIUM. [Asia Minor.]

ICONONZO, Bridge of. [Granada, p. 353.]

ICOSAHEDRON. [Solids, Regular.]

ICOSA'NDRIA, one of the classes in the sexual system of botany invented by Linnæus. The name literally means 20 stamens, but it was only applied by Linnæus to plants having an indefinite number of stamens inserted into the calyx.

I'CTERUS. [Sturnidæ.]

ICTERUS. [Jaundice.]

I'CTIDES, a name given by M. Valenciennes to the *Benturongs*, a genus of plantigrade mammifers which M. F. Cuvier had previously referred to the genus *Paradoxurus*. It is the *Arctictis* of Temminck.

M. F. Cuvier, in his *Dents des Mammifères*, states that he published, under the name of *Paradoxurus albifrons*, in the 9th vol. of the *Mémoires du Muséum*, the figure of an animal which had been sent to him from Calcutta by M. Alfred Duvaucel; and that he conjectured, from the external characters and the general physiognomy, that the animal which it represented belonged to the genus *Paradoxurus*. Having subsequently examined the teeth (an examination which he states he owed to M. Valenciennes, who had found the skin and the head of the animal in the cabinet of Brussels, and had obtained them through the complaisance of the Director, M. Drapier), M. F. Cuvier states that there is much resemblance in the dentition to that of *Paradoxurus*. *Ictides* belongs, he thinks, to the family of Civets, which is characterized by a tubercular molar tooth in the lower jaw, and by two similar molars in the upper jaw, and he thinks that it is 'sans contredit' most approximated to *Paradoxurus*, though it approaches *Procyon* nearer than that genus, that is to say, the teeth of *Ictides* show an increase of thickness, and have become more tuberculous. He places it between the Civets, &c., and the Suricates.

Cuvier, who gives *Ictides* a position between *Ailurus* [Panda] and the Coatis (*Nasua*), says that it still bears some resemblance to *Procyon* in its dentition; but he remarks that the three last molars of the upper jaw are much smaller and less tuberculous, and that this is especially true of the last of all in each jaw, which is very small and nearly simple.

Mr. Gray places *Ictides* as the last genus of his subfamily *Viverrina*, the fourth of his family *Felidæ*, following Paradoxurus and immediately preceding his fifth subfamily *Canina*.

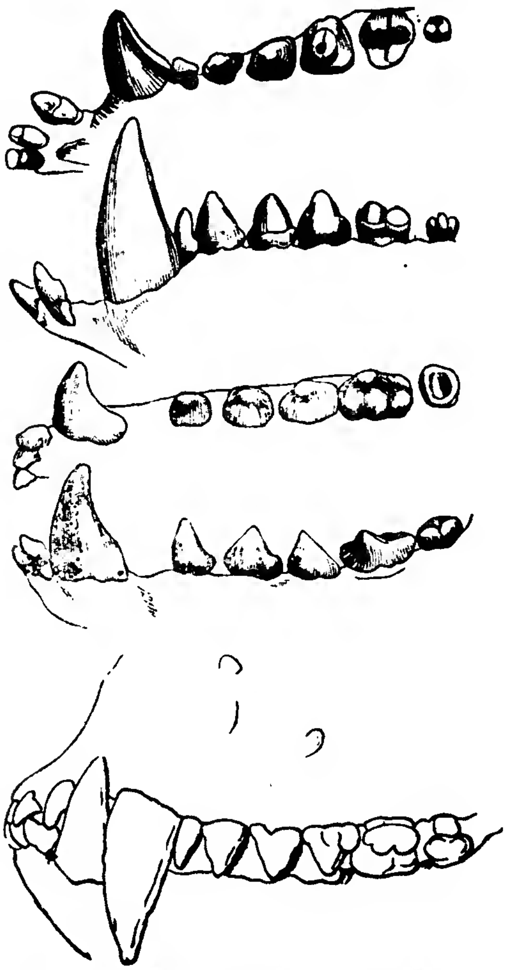
M. Lesson thinks that the genus approaches nearer to

Procyon than to *Paradoxurus*, but he arranges it between *Ailurus* and *Paradoxurus*.

Mr. Swainson, adopting Temminck's name, which, if it appeared first with a generic description, ought to be retained, makes the form the first genus of his family *Didelphidæ*, or *Opossums*, observing that it is not marsupial.

Generic Character.—*Head* rather short, muzzle pointed, ears, which are small, tufted with long hairs; *tail* long, hairy, prehensile; *Feet* with five toes on each foot.

Dental Formula:—Incisors $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 36$.



Teeth of Ictides. (F. Cuvier.) One-sixth larger than nature.

The author of the 'Analytical Notice of Books' (*Zool. Journ.*, vol. ii.) says, when reviewing the *Histoire Naturelle des Mammifères*, Nos. XLI.—L., that between the Viverrine family and that which is composed of the racoons and bears there had existed a considerable gap, which is now in a great measure filled up by the newly discovered forms, the Benturong and the Panda. The external appearance, he remarks, of the *Ictides* corresponds in some degree with both that of the civets and racoons, having the plantigrade motion of the latter and the slender snout of the former. It is indeed completely plantigrade, and has on each foot five toes armed with strong compressed claws, apparently adapted for climbing. 'Its tail, the thickness of which at its commencement is almost monstrous, is prehensile beneath, without being terminated by a naked skin, like that of *Ateles*, but resembling entirely the tail of the Sajous. The eye, like that of the domestic cat, has the pupil vertically elongated; the habits of the *Ictides* are consequently nocturnal. The ears are small and rounded; and the nostrils are surrounded by a muzzle, which is divided into two portions by a deep sulcus. The hairs are long and thick, and a peculiar character is given to the physiognomy by the moustaches, which are very voluminous on the lips, the eyes, and the cheeks, and by the pencil of long and numerous hairs which terminates the ears. The cry is intermediate between those of a cat and a dog.'

Geographical Distribution of the Genus.—India.

Three species are recorded: we select *Ictides albifrons*.

Description.—Fur gray; hairs long, silky, black at the base, and white in their extreme third, shorter on the head and limbs; sides of the snout, forehead, pencils of the ears (which are edged with white) black; upper part of snout and forehead white; iris yellow; belly gray, with shorter hairs than those on the upper parts of the body. Size, that of a very large domestic cat. In another specimen the sides of the snout, and the tail, its extremity excepted, were gray.

Locality.—Bootan, Nepaul (Kâchar: though they occasionally occur in the central region of Nepaul. Hodgson).

Habits, Food, &c.—Sir Thomas Stamford Raffles describes the gait of this *Benturong* as low and couching, the body being long and heavy, and the legs short. The tail, thick at its insertion, gradually tapers to the extremity, where it curls upwards. In climbing trees the animal is assisted by this tail, which is strong. One that was kept alive many years by Major Farquhar partook both of animal and vegetable food. Slow in motion, and timid in disposition, the animal sleeps much during the day: the night is the season of its comparative activity.

IDA. [Candia.]

IDA. [Troad.]

IDEA (ἰδέα, from the root ἰδ, to see), in its widest and now generally received acceptation, is employed to indicate every representation of outward objects through the senses, and whatever is the immediate object of thought. Like many other terms of mental philosophy, it is derived from the most eminent of the senses, that of vision. In the Platonic philosophy, the word idea possessed a higher import, and signified, primarily, the archetypes of all created things as they subsist in the divine intellect; and, secondarily, the conceptions of the human understanding, by means of which the essence of a thing is conceived. According to another, though a more questionable definition, the Platonic ideas denoted certain absolute qualities, which are regarded as real because they are capable of becoming objects of true knowledge. Plato's own definition is very extensive: 'an idea may be attributed to whatever, as a plurality, may be indicated by the same name' (εἶδος γάρ πού τι ἕκαστον εἰώθαμεν τίθεσθαι περὶ ἕκαστα τὰ πολλά, οἷς ταὐτὸν ὄνομα ἐπιφέρομεν. *De Rep.* x. 596 a). For in Plato's loose phraseology the terms εἶδος and ἰδέα are employed indifferently in the same sense. This being remembered, there is little objection to Plutarch's historical account of these ideas, which we here give in the English of Holland. 'Idea is a bodiless substance, which of itself has no subsistence, but giveth form and figure to shapeless matters, and becometh the cause that bringeth them into show and evidence. Socrates and Plato supposed that these be substances separate and distinct from matter, howbeit subsisting in the thoughts and imaginations of God, that is to say, of mind and understanding. Aristotle admitteth verily these forms and ideas, howbeit not separate from matter, as being patterns of all that God hath made. The Stoics, such at least as were of the school of Zeno, have delivered that our thoughts and conceits are the ideas.' (Plutarch, ch. x., fol. 666; *Opinions of Philosophers*.)

Those ideas by means of which perception is obtained were commonly supposed to be really images or resemblances of external objects. By the Peripatetics however they were held to be immaterial, while Epicurus and his followers made them to partake of the matter as well as of the form of their originals (tenuia rerum simulacra). (See Cic. *ad Att. Ep.*, ii. 3.) For the term idea the schoolmen employed the word *species*, by which, Cicero tells us, it was usually rendered in Latin (*Top.* 7), although he himself proposed '*form*,' which has been in later times adopted by Kant and his followers to designate that constant element in the perception of outward objects which is independent of matter, and which the mind presents to itself in accordance with its own laws. These species the schoolmen divided into sensible and intelligible, of which we shall here extract Hobbes's clear and succinct account. 'The philosophy schools teach that for the cause of vision the thing seen sendeth forth on every side a visible species, (in English) a visible show, apparition, or aspect, or a being seen, the receiving of which into the eye is seeing. . . . . Nay for the cause of understanding also the thing understood sendeth forth an *intelligible* species, that is, an intelligible being seen, which coming into the understanding makes it understood.' (*Of Man*, part i., c. 1.)

The term idea was again introduced into philosophy by Des Cartes, with whom and his followers it is nearly synonymous with the species of the schoolmen. According to Locke, 'Ideas are whatever is the object of the understanding, whatever a man thinks, or whatever it is the mind can be employed about thinking.' (*Letter to the Bishop of Worcester*, vol. iv., p. 376.) In this large sense the word is generally employed by English and French writers, and also by the Germans before the time of Kant, for the father of the critical philosophy ascribes to idea a higher but limited signification. By idea Kant eminently designated every conception formed by the reason (as distinct from the understanding), and raised above all sensuous perception. These *ideas* he subdivides into, 1st, empirical, which have an element drawn from experience, for instance, organization, a state, a church; and 2nd, pure, which are totally free from all that is sensible or empirical, such as liberty, immortality, holiness, felicity, deity. Another division of the Kantian ideas is into theoretical and practical, according to a similar division of the reason itself. Thus the idea of truth is a theoretical, that of morality a practical idea.

(Trendelenburg, *De Id. Platonis;* Richter, *De Id. Pl.;* Dugald Stewart's *Philos. Essays*, Appendix ii.; Ritter's *History of Philosophy;* Royer Collard's *Leçons*, in the 3rd vol. of Jouffroy's *Œuvres de Reid;* and Kant's *Kritik der reinen Vernunft.*

IDEAL has two uses, philosophical and critical. In the former it signifies, 1. whatever belongs or relates to ideas generally. It is in this sense that the word is employed in the phrase 'Ideal theory,' in the controversy between Reid and Priestley. According to this theory, the understanding does not perceive external objects themselves by means of the sensuous organs, but the organs of sight and touch transmit to the mind certain ideas or images of sensible objects, which it perceives within itself. Locke, who received the term idea from Des Cartes, seems unconsciously to have adopted, with the use of the word, the scholastic doctrine which it involved. For he expressly declares that our ideas of the primary qualities of bodies are resemblances of them, but that those produced by secondary qualities are no resemblances at all. From this explanation of the means of perception Locke has, on the one hand, been represented as the origin of modern Idealism; while on the other, in consequence of the superior value which he evidently gives to the testimony of sensation, his authority has been claimed by the opposite school of Ideology, as founded by the disciples of his French commentator Condillac. The second sense of the word is more limited, being confined to a peculiar class of ideas created by and solely subsisting in the imagination. Connected with this especial signification is its usage in the science of criticism, or æsthetics. Here Ideal signifies a something which, although not existing in the reality of sensible things, subsists actually in thought—the joint creation of the reason and the imagination, the archetype and pattern of supreme and perfect beauty. Although unreal in nature, this ideal is not unnatural; it is the absolute sum and unity of those scattered beauties which nature, with a lavish but impartial hand, has scattered among her myriad phenomena. This type of faultless beauty is indeed unapproachable by the artist; yet the more perfect the ideal which kindles his enthusiasm and animates his fancy, the higher will his efforts tend, the nobler will be the energy of his art, and the nearer his approximation. An ideal of the sublime is impossible, for sublime objects are singular in their nature, and as there can be no science of singulars ('singularium nulla est scientia,' Bodin), so too there can be no ideal of the sublime. The statue of Jupiter Olympius, by Phidias, is indeed often cited as an ideal of the sublime, but as it observes all those rules of beauty from which the Greek artists never deviated, in spite of its colossal dimensions, the sense of proportion is mingled in the emotions it excites, and there is wanting that feeling of the inadequacy of our sentiments which is awakened by vastness and immensity in objects, and which constitutes the emotion of sublimity.

IDEALISM, the designation of many and different systems of philosophy, which only agree in the common principle from which they originate. This principle is the opposition of the ideal and the real, that is, of ideas and things—the contrariety of mind and body, or of spirit and matter.

1. As the essence of the mental lies in free activity and vital motion, as opposed to the invariable mechanism and inertness of the corporeal, the name of Idealism is rightly applied to those systems of physiology which make the primal substance and original of all things to be certain forces invisibly working throughout the universe. To the idealists of this class belong the dynamical philosophers of the Ionian school, Thales, Anaximenes, Diogenes of Apollonia, and Heraclitus. The fundamental position of their several doctrines was the assumption of a living energy which as it develops itself undergoes continuous alteration both of form and quality—a transmutation which is the cause of all generation in nature. For water, the primary substance of Thales, was not the simple element, but water pregnant with vitality; the infinite air of Anaximenes was an animated and animating energy; and the intellectual primary of Diogenes was not merely the atmospheric air, but a warm and perfect breath of life which pervades and ensouls the universe. While however in these philosophers the philosophical idea is more or less mixed up with divers sensible conceptions, Heraclitus seems clearly conscious of speaking figuratively of the primary substance. With him a universal and absolute life is the cause of all phenomena, which indeed is most strongly and openly manifested in the vitality of fire and the rational soul, which is like to fire, while in other phenomena it is inherent, although not so obvious and immediately cognisable. In this class of idealists among moderns we must reckon Boscovich and Leibnitz. The former explained matter to be a system of forces; while, according to the latter, all beings are of the same nature. Activity and simplicity are the essential characters of all, and are so many forces or causes which he terms *monads*. All these monads possess the faculty of *perception*, or of reflecting within themselves, as in a mirror, the universe. These images however of perception cannot become the objects of knowledge, unless in these monads, which possess also what Leibnitz calls apperception, by which they are enabled to distinguish and see in themselves these images. It is therefore this faculty of apperception which constitutes the difference between the so-called material and spiritual; and as the faculty itself admits of different degrees, there are corresponding orders of intelligences. Lastly, we must include in this class, if anywhere among the idealists, the system of Spinoza, who asserts the identity of matter and spirit, making them to be but different aspects of one and the same substance; and Schelling, whose philosophy may be regarded as the complement of that of the Jewish philosopher.

2. Another species of Idealism considers the real as simply ideal, and assumes that our representations of a material world correspond to nothing actually existing, but that by contemplating these as objective, we transmute the merely ideal into the real. The fundamental axiom of this idealism is the priority of the ideal and the subsequence of the real ('ideale prius, reale posterius'). Accordingly, the real only exists so far as it is necessarily conceived by us, so that the external world is purely a creation of our conceptions, or, in other words, the real is a product of the ideal. To this class is referred the Platonic attempt to account for the existence of the sensible world by his *ideas* alone, without recourse to any other nature alien and foreign to them. By some, even the Aristotelian philosophy is designated as ideal in this sense, at least so far as regards its fundamental principle. This they make to be the assumption of a universal mundane intelligence (νοῦς), which, as the principle of all things is a force (ἐντελέχεια), self-active, all-perfect, and absolutely free. The manifold manifestations of this entelechy are forms before and beside which matter exists only potentially, while the forms are determined and distinguished by privation (εἶδος, ὕλη, στέρησις). But the most perfect of idealists in this class is Fichte, who derives not merely the form, but also the matter, of the conception of external things out of the mind itself, or, in his terminology, out of the *ego* (Ich).

3. A third system of idealism proceeds to the absolute denial of all material existences. This species of idealism was impossible among the ancients, who did not oppose mind so sharply to matter as to deny the possibility of their interaction, but tacitly supposed their similarity, opposing only corporeity, as composite, to incorporeity, as simple. Of this idealism Bishop Berkeley is the author, although Des Cartes gave occasion to it by his position, that nothing extended

can enter the unextended soul, and Locke afforded, by his doctrine of ideas, the arguments for its support. The system of Berkeley is briefly this: matter does not exist independently of our sensations, but conceptions of a material world are produced by the operation of the deity upon our understanding, and the material world exists only in the divine intellect, who awakes in us certain sensuous conceptions in a definite order, which order is what we call the course of nature.

4. The last species of idealism is more philosophical, and, without denying or asserting the existence of a material world, is content with confessing an ignorance of its nature. It pretends not to a knowledge of things themselves, but is content with employing the ideas which the mind forms, according to the laws of its own nature, upon the occasion of the excitement of its sensuous organs, without determining whether these ideas correspond or not to the exciting cause or causes, whatever they may be. To this class belong Malebranche and Kant. According to the former, mind and matter cannot act upon each other, and the sensations of the mind are so many occasional causes operating by a constant miracle of divine agency. (*Deus ex Machinâ.*) According to the latter, all that we know of outward objects is that they furnish the material part of our conceptions, to which the mind furnishes the form agreeably to its original and connatural laws; while of things themselves, which he calls phenomena, we absolutely know nothing, but note only the modes under which they appear to us.

IDEOLOGY (the science of ideas or mind) is the term by which the later disciples of Condillac, under the Directory and the Empire, have designated the history and evolution of human ideas considered as so many successive modes of certain original or transformed sensations. Proceeding from this exclusive and partial view, nothing perhaps can equal the logical simplicity of the writings of this school, the subtlety of its abstraction, the boldness of its generalisations, or its analytical dexterity in reducing an idea to its simplest expression. Among the most celebrated members of this philosophical school are Cabanis as its physiologist, Garat and Volney as its moralists, while its metaphysical aspect is ahly exhibited in the 'Idéologie' of Destutt de Tracy. With him we should also class Main de Biram and Laromiguière, but for the many traces in their writings of dissent from the system, so that they may more properly be considered as forming the transition to the new and less exclusive development of philosophy in France which has been opened by Royer Collard and his disciples, Cousin, and Jouffroy.

(See Damiron, *Histoire de Philosophie en France au XIX. Siècle*, 2 vols., Paris.)

IDENTITY designates in philosophical language the sameness of a substance under every possible variety of circumstances. In this sense it is employed in the phrase *personal identity*, where it signifies the invariable sameness of the thinking subject, or *ego*. In a secondary sense it denotes a merely relative identity, which may also be called logical or abstract. Thus, in logic, whatever things are subjects of the same attribute or collection of attributes are considered the same; *e.g.* dog and lion are the same relatively to the common notion Quadruped, under which they are both contained. Again, in physics, a tree may be asserted to be the same in relation to all the rights of property, notwithstanding the physical change it undergoes from the constant segregation of old and aggregation of new particles. Lastly, it is only in this logical use of the term that we can be said in memory to be conscious of the identity of the reproduced and the original idea, for if they were absolutely identical it would be impossible to distinguish between the first appearance and the recurrence of an idea. (Ancillon.)

According to Butler it is impossible to define the idea of personal identity, but it is easily ascertained; for a comparison of one's self in any two moments of our existence suggests immediately the idea, and at the same time the identity of ourselves. (*Essay on Personal Identity.*) Reid's view is nearly similar: 'I cannot remember a thing that happened a year ago, without a conviction, as strong as memory can give, that the same identical person who now remembers that event did then exist.' (*Essays*, ch. vii.) To the objection that consciousness, being successive, cannot be the same in any two moments, and that therefore, as consciousness constitutes personality, there cannot be any identity of person, Butler answers, that consciousness presupposes and consequently cannot constitute personal identity, and that the object perceived may be the same notwithstanding that the perceptions by which it is discerned are distinct and different. Locke's opinion on this subject appears to have been undecided. 'The identity of the same man consists,' he says, 'in nothing but a participation of the same life, by constantly fleeting particles of matter in succession vitally united to the same organised body.' But personal identity he defines to be the sameness of a rational being. (Locke, *On the Understanding*, p. 2, c. xxviii., s. 6.)

With respect to identical propositions, it is rightly observed 'that the greatest assurance and most certain knowledge we can have of any thing is of such propositions as in the schools are called identical.' (Sir Kenelm Digby, *On Man's Soul*, c. ii., p. 28.) For in deductive reasoning the proposition and assumption which make the major and minor premises of the regular syllogism are only logical transmutations of the identical position in physics, that the whole is equal to its parts. Things which are logically identical may be conceived to be so many parts constituting a whole (genus); and the principle, 'de omni et nullo' is rightly expanded thus: whatever belongs, or not, to a constituted whole, does or does not belong to all its constituent parts. In the same manner all mathematical propositions are identical; and Aristotle rightly teaches that in these equality is identity (*ἐν τούτοις ἡ ἰσότης ἑνότης*, *Metap.* x., c. 3): the ultimate form to which all equations are reduced being $a = a$. It is the want of this identity that constitutes the difference between demonstrative and probable reasoning, although this difference is rather one of degree than of kind; for the inferior certainty in the latter arises from the difficulty of determining, in matters which fall within its domain, what really are all the constituent parts in any whole, or general term; whereas in the former every whole consists of certain determinate and limited parts, so that the procedure to a knowledge of the parts is easy.

By the system of absolute identity is meant the doctrine which teaches the oneness of the subject and object (spirit and matter) as merely different aspects of one substance.

IDES. [KALENDAR.]

IDIA, Lamouroux's name for a genus of recent Polyparia, allied to Sertularia, Linn.

IDMO'NEA, a genus of Polyparia, described by Lamouroux as closing the group of Milleporidæ. It *is ramose*, the branches triquetral in section, celluliferous *on two faces*, cells prominent in transverse rows. From the oolite of Caen (*Exposition des Polypiers*). A recent species has been found at Japan; and two fossil in the calcaire grossier (Bronn).

IDOCRASE, Vesuvian, Pyramidal Garnet, &c. This mineral occurs crystallized and massive; the crystals are either attached or imbedded. Primary form a square prism. Cleavage parallel to the primary planes, distinct, and less so parallel to the diagonals of the prism. Fracture uneven, slightly conchoidal, or rather undulated. Hardness 6·5. Scratches glass readily, and even quartz. Colour various shades of brown, black, grey, blue, green, and yellow. Streak white. Lustre vitreo-resinous. Translucent and transparent. Refraction double. Specific gravity 3·08 to 3·4. By the blowpipe is fusible with ebullition into a yellowish transparent globule, and with borax gives a glass tinged green with oxide of iron.

The massive varieties are amorphous; the structure is fibrous, granular, or compact.

Idocrase is met with both in primitive and volcanic countries. It occurs in the masses ejected from Vesuvius; the crystals are sometimes of large dimensions.

It was found originally in the neighbourhood of Vesuvius, and since in many other parts of the world. Different varieties have been called by different names; thus Cyprine is cupreous or blue idocrase; Loboite, greenish yellow. Egeran, found near Eger, in Bohemia, is of a liver-brown colour.

Analysis.

	Klaproth.		De Kobell.
Silica	35·50	42	35
Alumina	33·00	16·25	22
Lime	22·25	34	36
Oxide of Iron	7·50	5·50	5
" Manganese	0·25	Trace.	
	98·50	97·75	98
	Vesuvius.	Siberia.	Mussa.

IDOTEA. [Isopoda.]

IDRIA. [Illyria.]

IDRIALIN. [Hydrogen, p. 397.]

IDUMÆA (Ἰδουμαία), usually called **EDOM** (אֱדוֹם) in the Old Testament, included, in the time of Christ, a considerable portion of the southern part of Palestine, and extended on the south-west as far as the Lake Serbonis (Pliny, *Nat. Hist.*, v. 14); but in the writings of the Old Testament it was used to designate the mountainous district in the north of Arabia which extended from the south of the Dead Sea to the bay of Ælana in the Red Sea. (1 *Kings*, ix. 26; 2 *Chron.*, viii. 17.) The Edomites, who were descendants of Esau, the son of Isaac (*Gen.* xxxvi. 9, 43), originally dwelt on Mount Seir (*Gen.* xxxii. 3; *Ez.* xxxv. 15), in the neighbourhood of the Moabites (*Judg.* xi. 18; *Is.* xi. 14). They were governed by kings from the earliest times (*Gen.* xxxvi. 31, 32; *Numb.* xx. 14); and appear to have possessed considerable power when the Israelites invaded Canaan (*Numb.* xx. 14-21; xxi. 4; *Judg.* xi. 17). They were defeated by Saul (1 *Sam.* xiv. 47); and were made tributaries of the Jews during the reign of David (2 *Sam.* viii. 14). The conquest of Edom was of great importance to the Jews, since it enabled Solomon, by obtaining possession of the ports of Elath and Ezion Geber on the Red Sea, to participate in the advantages of the trade with India.

After the division of the Jewish kingdom during the reign of Rehoboam, the Edomites continued subject to Judah till the reign of Joram, when they revolted, and again established their independence. (2 *Kings*, viii. 20-22.) They were subdued again during the reigns of Amaziah (2 *Kings*, xiv. 7; 2 *Chron.*, xxv. 11) and Uzziah, called also Azariah (2 *Kings*, xiv. 22; 2 *Chron.*, xxvi. 2); but in the reign of Ahaz the Syrians seized upon Elath, and drove the Jews out of Edom. (2 *Kings*, xvi. 6.) Edom, in common with the rest of Syria, appears to have been subdued by Nebuchadnezzar (*Jer.*, xxvii. 2-7); but after the downfall of the Babylonish empire, the Edomites are again mentioned as an independent people, who had obtained possession of the southern part of Judæa as far north as Hebron. (1 *Macc.*, v. 65.) They appear about this period to have been driven from their original settlements between the Dead Sea and the Bay of Ælana by the Nabathæi, who are supposed to have been descended from Nebajoth, the eldest son of Ishmael. (*Gen.*, xxv. 13.) The Edomites were constantly at war with the Jews after the return of the latter from Babylon (1 *Macc.*, v. 3, 65; 2 *Macc.*, x. 15; xii. 32), till they were entirely subdued by John Hyrcanus, who compelled them to submit to circumcision and to observe the Mosaic law. (Josephus, *Antiq.*, xiii. 9, sec. 1.) From this time the Edomites were regarded as a part of the Jewish nation, and were governed by a prefect appointed by the Asmonæan princes of Judæa. (Joseph., *Antiq.*, xiv. 1, sec. 3.) One of these governors, Antipater, a native of Idumæa, was appointed by Julius Cæsar procurator of Judæa (Joseph., *Antiq.*, xiv. 8, sec. 5); and was succeeded by his son, the celebrated Herod, who afterwards became king of the whole country, and put an end to the dynasty of the Asmonæan princes.

The Idumæans marched to the assistance of Jerusalem when it was besieged by Titus, and entered the city; they did not however continue till it was taken, but returned to their own country laden with plunder. (Joseph., *Bell Jud.*, iv. 4; vii. 8, sec. 1.) We have no further mention of the Idumæans in history. Origen, in his 'Commentary upon Job,' informs us that the name of Idumæa did not exist in his day; and that the inhabitants of the country were called Arabs, and spoke the Syriac language.

Ptolemy is the only author who applies the name of Idumæa to the country west of the Jordan. The whole of Judæa was frequently called Idumæa under the Roman emperors. (Ælian, *De Hist. Animal.*, vi. 17; Virgil, *Georg.*, iii. 12; Juvenal, viii. 160; Statius, *Silv.*, i. 6, v. 2; Martial, ii. 2, x. 50; Valerius Flaccus, *Argonaut.*, i. 12.)

The wisdom of the Edomites is celebrated in the Old Testament. (*Jer.*, xlix. 7; *Ob.*, 8, 9.)

(Relandi *Palestina;* Vincent's *Periplus of the Erythrean Sea*, vol. i., pp. 234-251, in which a history of Idumæa is given; Michaelis, *De Antiquissima Idumæorum Historia;* Winer's *Biblisches Realwörterbuch*, art. 'Edomiter.')

IDYA, Oken's name for those *Beroes* which are formed after the manner of *Beröe ovata*. [Ciliograda, vol. vii., p. 164.]

IDYIA, Rafinesque's appellation for a genus of crustaceans, to which Desmarest alludes, among other such genera, as knowing nothing of them beyond the names.

IDYLL (Greek, εἰδύλλιον; Lat. *Idy'llium* or *Edy'llium*) is a poem 'descriptive chiefly of the processes and appearances of external nature; or of characters, manners, and sentiments; or of these in conjunction with the appearances of nature. The epitaph, the inscription, the sonnet, and most of the epistles of poets writing in their own persons, belong to this class.' (*Preface* to Wordsworth's *Poems.*) In Greek the bucolic poems of Theocritus are called idylls; and all bucolic poetry [Bucolics] may be included under this name; though the antients did not, any more than ourselves, confine the name to bucolic poetry, as may be seen by referring to the 'Idylls' of Ausonius. In English poetry, the 'Seasons' of Thomson, Shenstone's 'Schoolmistress,' the 'Cotter's Saturday Night' of Burns, the 'Allegro' and 'Penseroso' of Milton, Beattie's 'Minstrel,' Goldsmith's 'Deserted Village,' &c. belong to this class.

IEREA, the generic name of a fossil Polypifer from the blue clays of the Vaches Noires (Calvados), described by Lamouroux, who is doubtful of its affinities, but ranks it among his Polyparia actinaria. Bronn places it among the Siphoniæ.

IGLAU. [Moravia.]

IGNA'TIUS, one of the earliest of the apostolic fathers. [Apostolic Fathers.] Antioch was a great seat and centre of Christianity from the very earliest times. St. Paul resided there many years, and brought the Christian community into regular church order. Ignatius was one of the earliest successors to St. Paul (if not the next) in the presidency over this church, or in the office of minister, superintendent, bishop, or by whatever name the connexion which the Apostles and the more eminent of the early Christians bore to the churches may be designated. His connexion with the church at Antioch begun as early as A.D. 67, that is, before Jerusalem was destroyed, and while still there were innumerable persons living who remembered our Saviour and the circumstances of his life, teachings, and death. This is inferred from what is related of him, that he had been forty years connected with that church when, in A.D. 107, the emperor Trajan visited Antioch. It is a pitiable sight to see a man wise and respectable as Trajan instituting a violent persecution against the Christians. Of course Ignatius, occupying the most prominent station, would be among the first to suffer from it. They first tried to induce him to abandon his opinions and his charge, but the old man was inflexible. The issue was that he was sent to Rome, and there put to death in a very cruel manner, being thrown to the lions in a public spectacle. The mind is shocked at a sight like this, and instantly perceives how much better are these times than those which are past, how valuable the political institutions of modern times, and how important the diffusion of moral and political truths among a people. What little was left of the feeble old man was gathered by a few friends and followers, and, in the spirit which prevailed so generally in the early ages of the church, removed to Antioch, and preserved there as sacred relics. It seems scarcely to have occurred to the Reformers when they set themselves to defame and destroy the relics of saints and other holy men enshrined in the antient churches of Christendom, that they were abolishing one of the most valuable evidences of the reality of many facts in the early history of Christianity.

However better remains of St. Ignatius are preserved to us: four short epistles addressed to the Romans, the Philadelphians, the Smyrnæans, and to Polycarp. There is also a relation of his martyrdom by some who were present. It is this relation from which the facts of his history are chiefly, if not wholly, drawn. An English translation of it, as also of his four epistles, may be found in Archbishop Wake's *Genuine Epistles of the Apostolic Fathers*, London, 8vo., 1693.

IGNA'TIUS LOYOLA. [Jesuits.]

IGNITION. [Heat.]

IGUA'NA, the name given by Laurenti to a genus of Saurians, in which he included various forms, such as *Agama*, *Lophyrus*, *Calotes*, &c. Daudin separated from this heterogeneous collection *Agama*, *Draco*, and *Basiliscus;* and Wagler, striking out the word *Iguana* from his nomenclature, divided the genus *Iguana* as left by Daudin into the genera *Hypsilophus*, *Metopoceros*, and *Amblyrhyn-*

chus. MM. Duméril and Bibron restore the name; the genus *Iguana*, as adopted by them, includes *Hypsilophus* and *Amblyrhynchus* of Wagler, and is thus characterized:—

A very large thin *dewlap* (fanon) under the neck. *Cephalic plates* polygonal, unequal in diameter, flat or carinated. A double row of small *palatal teeth*. Maxillary *teeth* with their edges finely dentilated. A *crest* on the back and tail. *Toes* long and unequal. A single row of *femoral pores*. *Tail* very long, slender, compressed, covered with small equal, imbricated, carinated scales.

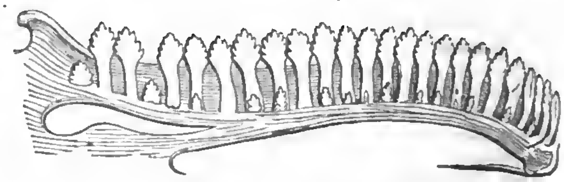
MM. Duméril and Bibron give the following description of the genus as thus modified:—

The species composing this generic group are principally remarkable for the cutaneous prolongation which constitutes over the whole extent of the lower part of the head and neck a very deep and very thin dewlap or pouch, the free border of which describes a curved line, and is dentilated at the part nearest the chin. The skin is irregularly folded on the sides of this dewlap, behind which there is another transversal fold which is obliquely prolonged upon each shoulder. There are also cuticular folds on the lateral regions of the neck and trunk. The head of the Iguanas is moderately long, and has the form of a pyramid with four faces. The neck is slightly compressed. The upper part of the body is convex and rounded, the under part flattened. The limbs are long; the toes unequal, and sometimes denticulated on their edges. The five toes of the posterior feet are graduated; the third and the fourth of the hand are equal in length. The tail, which is very long and very slender, is flattened slightly from right to left from its origin. The top and sides of the head are protected by polygonal scales varying in size, among which some are convex, some flat, some carinated, and some even strongly tuberculous. The subocular regions however are only furnished with small angular roundish scales with a slightly convex surface. It is worthy of remark that the part of the skull which is situated between the orbits is protected by two longitudinal series of large angular plates, whilst in *Metopoceros* and *Cyclurus* this same part of the cranium is paved with small polygonal scales. A row of strong, angular, oblong, and often carinated scales adheres to the lower edge of the orbital circle. The lips are furnished with large scaly plates, which are ordinarily quadrangular. There is also on each branch of the lower jaw a row of large scales, the last of which is enormous in some cases, presenting a diameter the quadruple of that of the others. The scales which cover the upper part of the neck and the body are slightly imbricated. They are small, square, or lozenge-shaped, surmounted by a keel which does not divide them in the middle, but which extends from their infero-posterior angle to their supero-posterior angle. In stuffed individuals, the skin of which has been distended, there is around the scales of the upper part of the body a circle of small grains which recals in a degree the mode in which the scaly covering of the *Varanians* is formed. The lower part of the neck is paved with scales, which are smooth and multifaced. There are rhomboidal and imbricated scales on the dewlap. On the other parts of the body are rhomboidal tile-like scales (entuilées), and those among them which are not carinated are found upon the thighs, the soles of the feet, and the under side of the toes. The inferior region of these is protected by a band of enlarged scutellations which are imbricated, and surmounted with three keels, of which the middle one is weak and the lateral ones very prominent. The upper part of each toe is covered by a single row of scales; but each side of the lateral parts of the anterior toes has two rows, whilst the external side of the posterior toes has three, making six rows of scales on each anterior toe, and seven on each posterior toe. Besides being imbricated, the scales of the tail form verticillations, or complete rings, which cease to be distinguishable when they reach towards the extremity.

All the Iguanas have femoral pores, the number of which varies according to the sex, as MM. Duméril and Bibron suppose; and they think that the number would in that case be less in the females than in the males. These pores, which are placed in a single row, are surrounded by small scales disposed as the petals of a flower are disposed round its disk.

The *Iguanæ* have the upper parts of the body surmounted by a paleaceous crest of some height, which is continuous from the nape to the extremity of the tail. This crest is composed of strongly compressed scales, which are pointed, and sometimes curved backwards, gradually diminishing in height as the end of the tail is approached. The nostrils are situated on the sides of the muzzle, and very near the extremity; their aperture is large, and opened in the middle of a large scale, which forms a convex circle around them, and gives them a tubulous appearance. The tympanal membrane extended over the auditory opening is very large and circular.

The teeth of the *Iguanæ* vary according to the ages of individuals; and MM. Duméril and Bibron state that they are assured that fewer exist in young subjects than in adult individuals. The twelve or fourteen first maxillary teeth, both above and below, are nearly rounded, pointed, and a little arched; all the others are narrow and compressed, with an angular summit, which is very finely dentilated on its edges. They are not, Dr. Buckland observes, lodged in distinct sockets, like the teeth of crocodiles, but fixed along the internal face of the dental bone, to which they adhere by one side of the bony substance of their root.



Teeth of Iguana.* (Dr. Buckland.)

There is a double row of small teeth on each side of the vault of the palates.

Habits, Food, &c.—MM. Duméril and Bibron state that the Iguanas are herbivorous, and indeed the structure of their teeth would lead to the conclusion that herbs formed their staple. Never, say those learned zoologists, have we found any thing but leaves and flowers in the stomachs of those individuals which we have opened. Mr. Broderip saw a living Iguana about two feet long, in a hothouse at Mr. Miller's nursery-gardens near Bristol. It had refused to eat insects and other kinds of animal food, until happening to be near some kidney-bean plants that were in the house for forcing, it began to eat their leaves, and was from that time forth supplied from these plants. Dr. Buckland, who quotes this, states, in addition, that in 1828, Captain Belcher found in the island of Isabella swarms of Iguanas that appeared to be omnivorous; they fed voraciously on the eggs of birds and the intestines of fowls and insects. The Iguanas live a great deal in trees, and will take to the water, swimming with ease. Mr. Broderip saw an Iguana enter and cross a small pond in the Zoological Gardens at the Regent's Park. The fore-feet were motionless during the passage of the animal across the water.

Geographical Distribution of the Genus.—Mexico, South America, and the Antilles.

Utility to Man.—Some of the species are considered as very delicate food.

There are only three species admitted by MM. Duméril and Bibron, and of these we select *Iguana tuberculata* as an example. A multitude of synonyms are collected by these zoologists, from which it appears that this species has been described by a great many names. Thus they point out that Spix, in his work on the 'Reptiles of Brazil,' has, under the names of *Iguana squamosa*, *Ig. viridis*, *Ig. Cœrulea*, *Ig. emarginata*, and *Ig. Lophyroides*, represented *Iguana tuberculata* of Laurenti, *L'Iguane Ordinaire d'Amerique* of Cuvier, *The Common Iguana*, at five different epochs of its life.

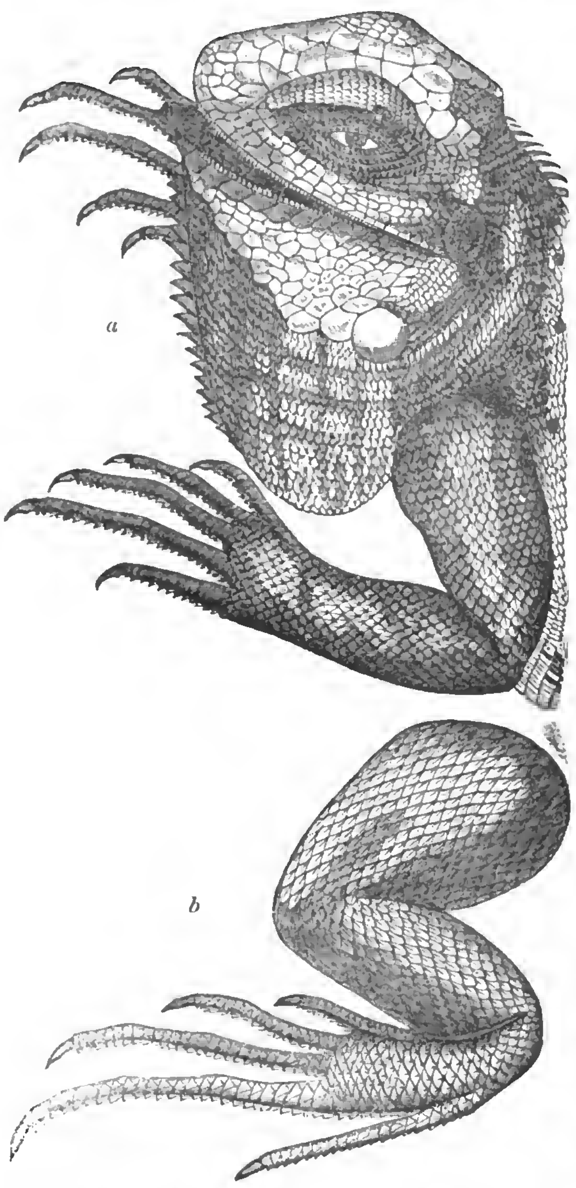
The figures will give some idea of this animal, which is yellowish-green below, and above of a green more or less deep, becoming sometimes bluish, and at others of a slate colour. In general there are on the sides of the body brown stripes or zigzags edged with yellow. There is frequently a line of the latter colour traced obliquely on the front of the shoulder. Some individuals are sprinkled with brown; others have the limbs spotted with brown on a black ground. The tail is surrounded with large brown rings, which alternate with others of green or yellowish. Length seldom exceeding five feet.

Locality, Great part of South America; the Antilles.

Utility to Man.—This species is considered excellent for the table. *Delicatissima* and *sapidissima* are among the specific names that have been assigned to it. It is not how-

* Some of the young teeth are seen forcing their way upwards so as to cause absorption at the base of the older teeth which they were to replace.

ever deemed very wholesome, and is even considered injurious to those who have suffered from certain diseases.



Iguana tuberculata. *a*, Head and anterior extremity, two-fifths of the natural size; *b*, Hind foot, same size. A view of the entire animal, much reduced, is given in the opposite column.

Wagler makes this species the type of his genus *Hypsilophus*.

IGUA'NIDÆ, an extensive family of Saurians, of which the genus *Iguana* may be considered the type. MM. Duméril and Bibron, in their *Erpétologie* (1837), treat of these reptiles under the name of *Lézards Iguaniens, ou Sauriens Eunotes*. They divide the family into two subfamilies, the *Pleurodontes* and the *Acrodontes*.

Under the first of these subfamilies they arrange the following genera:—*Metopoceros* (Wagler), *Aloponotus* (Duméril and Bibron), *Cyclura* (Harlan), *Iguana* (Laurenti), *Amblyrhynchus* (Bell, being the *Amblyrhynchus* of Gray and Wiegmann, but not of Wagler), *Brachylophus* (Cuvier), *Phrynosoma* (Wiegmann), *Callisaurus* (De Blainville), *Polychrus* (Cuvier), *Tropidolepis* (Cuvier), *Hypsibatus* (Wagler), *Plica* (Gray), *Ophryoessa* (Boié), *Tropidogaster* (Dum. and Bib.), *Holotropis* (Dum. and Bib., *Tropidurus* of Fitzinger in part, *Leiocephalus* of Gray), *Microlophus* (Dum. and Bib., *Tropidurus* of Wiegmann in part), *Basiliscus* (Laurenti, *Basiliscus* of Wiegmann, *Corythæolus* of Kaup, *Œdicoryphus* of Wagler), *Corythophanes* (Boié, *Corythophanes* of Wiegmann and Gravenhorst, *Chamæleopsis* of Wiegmann, Gravenhorst, and Gray), *Stenocercus* (Dum. and Bib.), *Strobilurus* (Wiegmann), *Oplurus* (Cuv., *Tropidurus* of Wiegmann, Fitzinger, and Gray in part), *Enyalius* (Wagler, *Ophryoessa* of Gray and Wiegmann in part), *Uperanodon* (Dum. and Bib., *Plica* of Gray in part, *Hypsibatus* of Wagler in part), *Ustrophus* (Dum. and Bib.), *Norops* (Wagler), *Læmanctus* (Wiegmann), *Ecphymotes* (Cuvier, *Tropidurus* of Prince de Wied, of Wiegmann, and of Wagler in part, *Oplurus* of Gray in part), *Proctotretus* (Dum. and Bib., *Tropidurus* (*Leiolæmus*) Wiegmann), *Leiosaurus* (Dum. and Bib.), *Trachycyclus* (Dum. and Bib.), *Doryphorus* (Cuvier, *Urocentron* of Kaup, Wagler, and Wiegmann), *Anolis* (Daudin, *Anolis* of Merrem, *Anolius* of Cuvier, *Dactyloa* of Wagler, *Draconura* of Wagler and Wiegmann, *Xiphosurus* of Fitzinger).

These genera are divided into five tribes, viz. *Anolians*, *Polychrians*, *Iguanians*, *Tropidolepidians*, and *Oplurians*.

The *Iguanians* comprise the genera *Corythophanes*, *Basiliscus*, *Aloponotus*, *Amblyrhynchus*, *Iguana*, *Metopoceros*, *Cyclura*, *Brachylophus*, *Enyalius*, and *Ophryoessa*.

Under the *Acrodontes*, the following genera are arranged by these Herpetologists:—*Chlamydosaurus* (Gray), *Istiurus* (Cuvier, *Lophura* of Gray, Wagler, and Wiegmann, for some species; *Physignathus* of Cuvier, Wagler, and Wiegmann, for others), *Grammatophora* (Kaup, *Agama* of Cuvier and Fitzinger, and of Merrem in part, *Amphibolurus* of Wiegmann and of Wagler), *Leiolepis* (Cuvier), *Uromastix* (Merrem, *Stellions bâtards* of Daudin in part, *Fouette-queue* of Cuvier, *Mastigura* of Fleming), *Lophyrus* (Dum., *Gonyocephalus* of Kaup, Gray, Wagler, and Wiegmann, *Agama* of Merrem in part), *Agama* (Daudin, *Agama* of Merrem, Fitzinger, and Cuvier in part, *Trapelus* of Cuvier, *Tapaya* of Fitzinger in part), *Galeotes* (Cuvier), *Draco* (Linnæus), *Stellio* (Daudin), *Sitana* (Cuvier, *Semiophorus* of Wagler and Wiegmann), *Lyriocephalus* (Merrem), *Ceratophora* (Gray), *Otocryptis* (Wiegmann), *Phrynocephalus* (Kaup).

These genera are divided into four tribes, viz. *Galeotians*, *Agamians*, *Phrynocephalians*, and *Stellionians*.

The reader will perceive that some of the most remarkable of these forms have already been noticed in this work; and as far as our limits will permit, we may perhaps call attention to others which may be specially deserving of notice. At present we shall merely observe, that MM. Duméril and Bibron make the number of the species in the family, as modified by them, 146.

Organization.

Skeleton.—The *skull* is always articulated by a single condyle situated below the great occipital foramen which opens a passage for the nervous chord. The configuration of the head presents great differences, dependent on the conformation of the bones of the cranium, the face, or jaws.

The number of cervical *vertebræ* is most frequently six, and this region is generally short, but it is strong. There

Iguana tuberculata.

are often articulated trachelian apophyses, which are in reality the rudiments of ribs. The dorsal vertebræ, meaning by that term the vertebræ which carry the ribs, vary much in number in the different genera. The first lumbar vertebræ are like the dorsal, except that they are without the articular facets which characterize the latter. Generally there are but two pelvic vertebræ, which carry the ileum or pelvis. The *ribs* are, in general, slender, weak, rounded, and of the same form, though they vary in their curvature, according as the trunk is cylindrical, depressed or compressed in the thoracic region. The first or anterior ribs are joined to the lateral parts of the sternum, or to a series of small bones which occupy the lower part of the breast; or they are united to each other on the mesial region nearly in the same manner as in the chameleons, for this disposition occurs in *Polychrus* and *Anolis*. In the *Dragons* the posterior ribs are free and prolonged in the thickness of the skin of the sides, in order to sustain the sort of parachute extended on the lateral parts of the body between the anterior and posterior limbs. All the species of the family have two pairs of limbs always apparent, and terminated by toes, the number of which varies but little. Their conformation and respective length have been used as generic characteristics principally in the case of *Anolis*, and some others which have offered some particularities, such as *Sitana*. The presence of a shoulder formed of two bones, and that of a pelvis, separates these saurians from the serpents.

The general form of the body and the disposition of the skeleton scarcely vary, except in the proportions of the different regions of the spinal column, especially in that of the tail and in the configuration of the vertebræ, the spinous and transverse processes of which correspond to the external state of compression or depression. In the greater number of species, as in those of *Lophyrus*, *Basiliscus*, *Polychrus*, and *Iguana*, the region of the back presents a well-defined projection, sustained by the series of spinous apophyses which often form that crest which has caused MM. Duméril and Bibron to name the family *Eunotes*. This disposition is most manifest in *Basiliscus* and *Agama*; whilst in *Stellio* and *Uromastix* the dorsal spines project but little. The bodies of the vertebræ which constitute the tail are much shorter in those species in which that part is not long, *Phrynocephalus* for instance, than in those which have it excessively prolonged. In these last, take *Iguana* and *Anolis* for example, there is another peculiarity, namely, that the bodies or central and cylindrical parts of the caudal vertebræ, which are large and dilated at their extremities for articulation, have, at the same time, the mesial portion more slender and fragile, so that it is in this portion that fracture often takes place, which is followed by a reproduction and consequent deformity which the tail often in that case presents. M. Rousseau (père) found in the skeletons of those saurians which had undergone mutilation of the tail a long cartilaginous cone in lieu of distinct vertebræ; and Carus has remarked, that the spinal chord is not renewed in this cartilaginous stem, which is produced in lieu of the caudal vertebræ.

Organs of Sensibility.—*Sight* and *hearing* appear to be very well developed in this family; with regard to *taste* and *smell*, the former seems to be present in a very fair degree; *touch* moderate. The *eyes* of all the Iguanians are furnished with moveable lids; the orbit in which they are placed varies in its extent and in conformity with the limits which result from the bones of the face and cranium. The greater part have a superciliary arch, which is sometimes tuberculous and very projecting, as in *Ophryoessa* and *Hypsibates*. MM. Duméril and Bibron state, that up to the time when they wrote they knew of no species in which observers had detected a linear pupil, though it is asserted that some are nocturnal. With the exception of some genera, *Otocryptis* and *Phrynocephalus* in particular, in which the *tympanum* is not apparent, all the Iguanians have an auditory canal, more or less enlarged at its external orifice on a level with the surface of the head; sometimes, as in some species of *Agama*, it is only a simple slit, the entrance of which is protected by some pointed, and, as it were, spiny scales. The sense of *smelling* does not seem to be much developed in the Saurians generally, but in the family under consideration it appears to be at a very low rate, for there is no amfractuosity in the air sinus; the external orifices of the *nostrils* have but little humidity, and are very small. They are situated generally near the extremity of the muzzle, and approach each other above; they open within the mouth by a simple slit to which the tongue may be applied, and seem principally, if not entirely, destined to aid in respiration.

The *tongue* is in general short, large, and mobile at its extremity; but it is not deeply divided at its end, which is free. The base is not retracted into a sheath, and this is a character which distinguishes it in particular from that of the *Varanians* and *Chameleons*. Wagler has employed the term *Pachyglossi* to denote this disposition. The organ is always humid, and covered with a glutinous secretion: its papillæ, which vary in form, being in some instances conical, and in others scaly, or laid like tiles (entuilées), in a direction from the front backwards, appear to be destined for the perception of sapid substances; but its principal office seems to be to direct the movement of the food submitted to the action of the teeth, and to assist in deglutition. The *os hyoides*, to which it is fastened, presents important modifications in different genera. Its horns are much prolonged in some species, and serve to support the dewlap, or longitudinal fold of the integuments under the neck and jaw, in *Sitana*, *Basiliscus*, *Draco*, &c., and especially in *Anolis*, as particularly noticed and demonstrated by Mr. T. Bell.

Organs of Digestion.—These present nothing very remarkable in this family. The stomach seems to be a continuation of the œsophagus, but the fibres and wrinkles are most often in another direction. There is no true *cardia*. The *ventriculus*, properly so called, is often conical, and the *pylorus* is not distinguishable except by a slight narrowing, which is rather elongated in *Stellio*, *Iguana*, &c. In *Polychrus*, *Galeotes*, and *Lyriocephalus*, the pylorus is but little marked, on account of its shortness and the thinness of its *parietes*. The *intestines* vary in length. In species which have the tail very long, as the Iguanas, the extent of the digestive tube is not much more than one-third of the total length of the spinal column. There is no apparent distinction, in some cases, evident between the small and large intestines, so that there is often no cœcum, as in *Cordylus*, *Agama*, and *Sitana*; whilst on the contrary in *Iguana*, *Galeotes*, and *Lyriocephalus*, there is a true cul de sac at the termination of the small intestine where it opens into the greater canal. The *pancreas* is voluminous in *Iguana*, *Istiurus*, and *Lyriocephalus*. The form and situation of the *spleen* vary. It is most frequently placed at the middle of the mesentery, under the stomach; sometimes on the right, as in *Iguana*; sometimes on the left, or at the middle of the lower portion of the stomach, as is observable in the greatest number.

The Organs of Circulation and Respiration present no remarkable difference from those of other Saurians, and the same may be said of the *Organs of Generation*.

Integuments.—These present various modifications. We have the polyedrous tubercles of *Grammatophorus*; the spines of the neck in *Agama*; those of the tail in *Doryphorus*, *Strobilurus*, *Stenocercus*, *Uromastix*, and *Trachycyclus*; the carinated scales of *Ophryoessa*, *Læmanctus*, *Tropidogaster*, and *Ecphymotes*; the cutaneous expansions of the different regions of the dorsal and caudal crests in the greater number of genera, but especially in *Iguana*, *Istiurus*, and *Basiliscus*; those of the nape on the occiput in *Corythophanes* and *Basiliscus*; of the flanks in *Draco* and *Callisaurus*; and of the neck, under the form of a dewlap, in *Sitana*, *Draco*, and *Iguana*; or in the lateral parts in front of the shoulders, as in *Chlamydosaurus*. The pores, whether of the thighs, sometimes in a simple line, sometimes in two longitudinal and parallel rows, or in front of the anus, are employed by MM. Duméril and Bibron in the classification of genera in their synoptical table. The toes are in general elongated and terminated by crooked nails. *Anolis* alone presents a peculiar dilatation under the penultimate phalanges. The shorter the toes and the nails, the less nimble the animal.

Food, Habits, &c.—MM. Duméril and Bibron state that in their anatomical researches they have found the ventriculus of many species filled with the débris of vegetables, such as flowers, leaves, and seeds, in considerable quantity, which led them to the conclusion that many are herbivorous; but they remark that this is scarcely in accordance with the form of the teeth, none of which have tubercular crowns, nor composed of apparent enamel and osseous cement. It should however be remembered that the teeth of most of the species are by no means ill-adapted for cropping vegetable substances. The family are generally nimble. The compressed and lengthened tail of many species is most useful as an instrument of progression when swimming across the inundated savannahs, and their crooked nails assist them in climbing trees and pursuing the smaller animals on which they occasionally prey.

Geographical Distribution of the Family.—The *Iguanidæ* are all inhabitants of warm climates. The *Pleurodonts*, with exception of *Brachylophus*, belong exclusively to the New World. The *Acrodonts*, on the contrary, are confined to Asia, Africa, Australasia, and, in a single instance, the south of Europe. All the *Iguanians* hitherto noticed inhabit South America, with the exception of a *Phrynosoma* and a *Tropidolepis*, which appear to be natives of North America.

Only one Iguanian belongs to Europe, the *common Stellio*, which is found also in Africa and Asia. In this last-mentioned part of the world there are 32 others, of which 28 belong to the East Indies. Among the four others may be reckoned the *Brachylophus*, which is the only one of the subfamily of *Pleurodonts* which is excluded from America; and three *Phrynocephali*, whose habitation seems to be limited to the north of Asia.

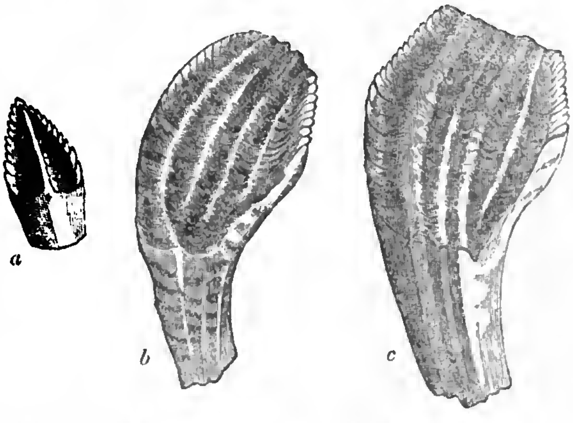
In Africa, besides the common Stellio, 12 other species of *Iguanians* occur, namely, one *Phrynocephalus*, three species of *Uromastix*, and eight *Agamæ*.

Australasia produces the four species which are referred to the genus *Grammatophorus*, an *Uromastix*, and the *Chlamydosaurus*. (Duméril and Bibron.)

Our limits do not allow of our stating in detail the views of the several authors who have treated of the genera collected by MM. Duméril and Bibron under this great family, and we must refer the reader to the works of Bell, De Blainville, Boié, Cuvier, Daudin, Fitzinger, Gray, Kaup, Latreille, Laurenti, Merrem, the Prince de Neuwied, Spix, Waglor, Wiegmann, and others; and especially to the volume of MM. Duméril and Bibron,* where the whole subject is thoroughly and luminously discussed, and whence this article is principally abridged.

IGUA'NODON, the name of an extinct gigantic reptile, whose remains were discovered by Dr. Mantell. In its characters this fossil Saurian closely approaches to the genus *Iguana*, and there can be no doubt that it was herbivorous; indeed Cuvier, at first sight, took the teeth for those of a Rhinoceros. Dr. Buckland, who dilates on the admirable structure of these teeth, considered with relation to the demands made by the habits of the animal, observes how well they are adapted for cropping tough vegetable food, such as the *Clathraria* and similar plants which are found buried with the *Iguanodon*. 'The teeth,' writes Dr. Buckland, 'exhibit two kinds of provision to maintain sharp edges along the cutting surface, from their first protrusion, until they were worn down to the very stump. The first of these is a sharp and serrated edge, extending on each side downwards, from tho point to the broadest portion of the body of the tooth. The second provision is one of compensation for the gradual destruction of this serrated edge, by substituting a plate of thin enamel, to maintain a cutting power in the anterior portion of the tooth, until its entire substance was consumed in service. Whilst the crown of the tooth was thus gradually diminishing above, a simultaneous absorption of the root went on below, caused by the pressure of a new tooth rising to replace the old one, until, by this continual consumption at both extremities, the middle portion of the older tooth was reduced to a hollow stump, which fell from the jaw to make room for a more efficient successor.' The young tooth somewhat resembled a serrated lancet. Dr. Buckland observes, that this serrature ceased at the broadest diameter of the tooth, that is, precisely at the line below which, had the serrations been continued, they would have had no effect in cutting. As these saw-like edges were gradually worn away, the cutting power was transferred to the enamel in front, which was traversed by alternate longitudinal ridges and furrows, the latter serving 'as ribs or buttresses to strengthen and prevent the enamel from scaling off, and forming, together with the furrows, an edge slightly wavy, and disposed in a series of minute gouges, or fluted chisels; hence the tooth became an instrument of greater power to cut tough vegetables under the action of the jaw, than if the enamel had been in a continuous straight line. By these contrivances also, it continued effective during every stage through which it passed, from the serrated lancet point of the new tooth to its final consumption.'

* 'Erpétologie Générale, ou Histoire Naturelle complète des Reptiles;' par A. M. C. Duméril et par G. Bibron, tom. iv., Paris, 1837.

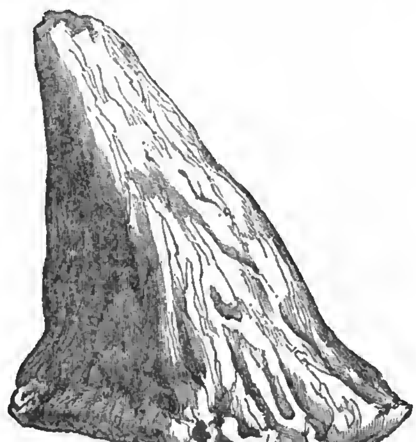


Teeth of Iguanodon; *a*, young tooth; *b*, *c*, teeth further advanced, and worn.

The size of this giant of the Weald in former ages was enormous. In Dr. Mantell's collection there is a portion of a femur twenty-two inches in girth in the smallest part. The thigh bone, then, of the *Iguanodon* exceeded in bulk that of the largest elephant, and its length is on good grounds calculated to have been from four to five feet. Dr. Mantell carefully compared the bones of the *Iguanodon* with those of the *Iguana*, and by taking an average from eight separate parts of the respective skeletons, he gives tho following as the dimensions of the former:—

	Feet.
Length from snout to the extremity of the tail .	70
Length of tail	52½
Circumference of body	14½

The thigh bone of the *Iguanodon* is considered by Dr. Mantell to be twenty times the size of that of a modern *Iguana*: but as animals do not increase in length in the same ratio as in bulk, it does not follow that the *Iguanodon* attained the length of 100 feet, although it probably approached 70 feet. (Buckland.) On the snout of this monstrous reptile was a nasal horn, and its appearance must



Nasal horn of Iguanodon, ⅔ nat. size.

have realized the wildest poetical fictions of the Dragons of old. In Dr. Mantell's museum is a large portion of the skeleton of one of these Saurians, from the quarries of Kentish-rag near Maidstone. Dr. Buckland remarks that the locality of this unique skeleton shows that the duration of this animal did not cease with the Wealden series, and he adds that the individual from which it was derived had probably been drifted to sea, as those which afforded the bones in the fresh-water deposits subjacent to this marine formation had been drifted into an æstuary.

Geological Distribution.—The Wealden fresh-water formation of the South of England, intermediate between the marine oolitic deposits of the Portland stone and those of the green-sand formation in the cretaceous series. Tilgate Forest. [HASTINGS SANDS.] Isle of Wight, and Purbeck. Rag-quarries near Maidstone.

ILCHANIC TABLES. [NASIR EDDIN.]

ILCHESTER. [SOMERSETSHIRE.]

ILDEFONSO, ST. [CASTILLA.]

ILE DE FRANCE, a province of France, forming one of the military governments into which, under the old régime, France was divided. Its greatest length was, from north-east near Laon to south-west near Dreux, 144 miles; its greatest breadth, at right-angles to the length, 130 miles, from the head of the Grand Terrein, a feeder of the Oise, to Courtenay between Montargis and Sens. It was bounded on the north by Picardie, on the west by Normandie, on the south-west by Orléanois, and on the south-east and east by Champagne. This district was watered by the Seine and its tributaries, the Yonne, the Loing, the Marne, the Oise (with its feeders the Aisne and the Terrein), and the Eure. It is now divided into the departments of Aisne, Oise, Seine, Seine et Marne, and Seine et Oise. The principal subdivisions and towns of this province are given elsewhere. [FRANCE.]

Le Parisis, or the Ile de France proper, was included in the duchy of France, which comprehended beside, the county of Orléans, Le Gâtinois, Le Chartrain, Le Blaisois, La Perche, La Touraine, L'Anjou, Le Maine, the district of Sologne, and parts of L'Amienois and Le Beauvaisis. This great fief was held in the decline of the Carlovingian dynasty by a race of powerful nobles, who acted an important part in the history of France. In the year 861 Charles le Chauve bestowed upon his kinsman Robert l'Angevin, otherwise Robert le Fort, 'the province between the Seine and the Loire,' under the title of the Duchy and Marquisate of France. His object was to make the power of this chieftain a barrier against the Bretons, who were troubling the frontier. This Robert, while he lived, bravely supported Charles le Chauve against his enemies, foreign and domestic. He died in battle against the Northmen, A.D. 866.

Eudes, son of Robert le Fort, was count of Paris, which title he bore in his father's lifetime, and duke of France. He bravely defended Paris against the Northmen, who besieged it, A.D. 885, and compelled them to raise the siege. On the death of Charles le Gros, A.D. 888, Eudes was elected king of France. He was involved in hostilities with his competitor for the crown, Charles le Simple, and died A.D. 898.

On the death of Eudes, his brother Robert, who during the reign of Eudes had received from him the county of Poitiers, became duke of France. He fought against the Northmen on behalf of Charles le Simple, against whom he subsequently formed a league with Raoul, son of Richard duke of Bourgogne, and other lords, and renounced his allegiance in a council of the nobles at Soissons. In the course of the troubles that followed, Robert, finding himself at the head of a powerful party, caused himself to be proclaimed king, and was consecrated at Reims by Wautier, archbishop of Sens, A.D. 922. Charles however, being supported by the counts of Toulouse and Auvergne, attacked Robert in the plain of Soissons. Robert fell in the battle, but his son Hugues continued the combat, and succeeded in putting Charles to flight. The battle was fought A.D. 923.

Hugues, called by the chroniclers Le Blanc, otherwise Le Grand, and, from his holding several abbeys in commendam, L'Abbé, succeeded his father in the duchy of France. He did not aspire to possess the crown, though he had it at his disposal, but bestowed it on his brother-in-law, Raoul duke of Bourgogne. He was engaged in war with the Northmen on the Loire, and with Heribert, or Herbert, count of Vermandois. Upon the death of king Raoul, A.D. 936, Hugues procured the return of Louis IV., surnamed Outremer, son of Charles le Simple, from England, where he had been conveyed by his mother. Louis was only sixteen years old; and Hugues at first virtually exercised the sovereign power, though without the title of regent. But Louis having a year after emancipated himself from tutelage, Hugues formed an alliance with Heribert of Vermandois [CHAMPAGNE], and Giselbert duke of Lorraine; and subsequently with Guillaume Longue-épée (Long-sword) duke of Normandie, against his sovereign. Hostilities, though delayed for a time by the intervention of the clergy, broke out; the rebel lords were supported by Otton, or Otho I., emperor of Germany, whose sister Hugues had married, but were after a time reconciled to Louis, A.D. 942, and peace was restored. Hugues subsequently obtained of the king the whole of the duchy of Bourgogne, of which he had previously held a part.

On the assassination of the duke of Normandie by the count of Flanders, Louis Outremer attempted to seize the duchy, to the prejudice of the young duke Richard. Hugues at first engaged to assist Richard; but the king having offered him a share of the spoil, he accepted the offer, and joined in the invasion of Normandie. The attempt was unsuccessful, and Hugues was involved in new disputes with his sovereign, whom he got into his power, and retained, until compelled to release him by Otton of Germany, who came with an army to his rescue. The war between Hugues and Louis continued till A.D. 953, when the quarrel was made up. Louis died the year after, and Hugues assisted in raising his son Lothaire to the throne. Hugues however possessed the real power of the sovereignty till his death, A.D. 956.

Hugues, surnamed Capet, son of Hugues Le Blanc, was young at his father's death, but by the protection of Richard duke of Normandie and Brunon archbishop of Cologne he succeeded in obtaining from the king the investiture of his inheritance, comprehending the duchy of France, the counties of Paris and Orléans, and the abbeys which his ancestors had possessed. He became in effect ruler of the country, and exercised his power in a way to give general satisfaction. The emperor Otton or Otho II., having invaded France, was obliged to retreat, and Hugues attacked his rear-guard, and put it to flight on the banks of the Aisne. King Lothaire died A.D. 986, recommending his son and successor, Louis V., Le Fainéant, to the guardianship of Hugues. Louis died the year after, A.D. 987, at Compiègne, and his uncle Charles, brother of Lothaire, being unpopular, Hugues assembled his friends and procured himself to be chosen king of France. Thus the Capetian dynasty replaced the Carlovingian. The royal power was at this time reduced to the lowest point. It extended only over four or five cities, of which Laon was the chief. The hereditary domains of Hugues were therefore a considerable accession to the power of the crown; but the progress made by his vassals in the counties of Paris and Orléans toward independence kept the authority of his successors low, until extended by the activity of Louis VI. and the policy of Philippe Auguste. With the accession of Hugues the separate history of the duchy of France terminates. [FRANCE.]

I'LEUM. [INTESTINES.]

I'LEUS, or ILIAC PASSION, is the name given to a severe form of intestinal disease, characterized by violent griping pain around the umbilicus, spasm and retraction of the muscles of the abdomen, obstinate costiveness, and vomiting. These symptoms are however common to several very different conditions of the bowels; they occur in severe cases of colic [COLIC] from spasm, or, as some suppose, paralysis of a portion of the intestinal canal, but more commonly they are the result of some mechanical obstruction of the canal, as by intussusception, internal hernia, unnatural adhesions between adjacent folds of intestine, &c. The treatment must therefore vary according as one or other of these conditions is presumed to exist. In the first class of cases the remedies adapted for colic, combined with active purgatives, should be employed, while in those attended with mechanical obstruction, in which there is always great tendency to inflammation of the intestines, bleeding should be had recourse to, together with purgatives combined with opium, stimulant enemata, and anodynes.

ILEX is a name given to two very different plants. As that of a species, it indicates the Evergreen Oak of the South of Europe, or *Quercus Ilex*; as that of a genus, it belongs to the common Holly, *Ilex Aquifolium*. This latter plant, which constitutes so beautiful a feature in the winter scenery of many parts of England, and whose scarlet or yellow berries render it so universal a decoration of churches (hence the name Holy-tree) and dwelling-houses at Christmas time, is in Great Britain upon the most northern limits within which it ranges in a wild state. It is however at those limits that it attains its greatest size and beauty; but it occasionally suffers from severe winters. It is common in the middle of Europe, and the southern side of the range of the Caucasus, where it is only a bush, and it probably extends far to the eastward. It is chiefly valued as a shelter in winter, and an ornamental tree, but its fine-grained, heavy, compact timber is used for a great number of useful purposes, especially by the turner and mathematical instrument maker; the black handles of metal teapots are carved out of its wood. It is also employed medicinally; the leaves and bark possess febrifugal powers of a strongly marked character: the root and the bark are said to be diuretic and expectorant, but the berries have the discredit of being poisonous, producing purgative and violent emetic effects.

Besides the common Holly and its numerous varieties, the genus Ilex comprehends a large number of species, the most remarkable of which are the *I. Balearica*, or broad-leaved species of Minorca, a very handsome kind, which is hardy in the middle and south of England; the *I. vomitoria*, or Cassena tree of the North Americans, whose leaves possess strongly marked emetic qualities; and the *I. Paraguayensis*, or Maté plant, of whose leaves a very large consumption takes place in South America under the name of Tea of Paraguay. [PARAGUAY TEA.] The leaves are dried, and afterwards used like the tea of the Chinese. See Loudon's *Arboretum Britannicum*, vol. ii., p. 505, for full information concerning this genus.

ILFRACOMB. [SOMERSETSHIRE.]

ILIAD. [HOMER.]

ILISSUS. [ATTICA.]

I'LIUM. [TROAS.]

ILLANUS, Dalman's name for a group of the great genus Asaphus, as originally constituted by Brongniart in his work on the Trilobites. The caudal plate is one large convex part, nearly corresponding to the anterior shield. From the transition strata of Christiania, Ostrogothia, &c. (*Swedish Transactions*, 1826.)

ILLE ET VILAINE, a department in the west of France, bounded on the north by the English Channel and the department of Manche, on the east by the department of Mayenne, on the south by that of Loire Inférieure, and on the west by the departments of Morbihan and Côtes du Nord. Its form approximates to a quadrangle, with the sides facing the four cardinal points: the length of the north side is about 50 miles measured in a straight line; of the east side about the same; of the south side about 40 miles, and of the west side nearly 70 miles. The area of the department is 2585 square miles, exactly the area of Devonshire. The inhabitants, by the census of 1831, were 547,052; by that of 1836, 547,249, being an increase in five years of only 197 on a population of half a million. The later census gives nearly 212 inhabitants to a square mile, a density of population far above the average of France, and considerably exceeding that of the English county with which we have compared the department. Rennes, the capital, is in 48° 7′ N. lat., and 1° 41′ W. long.; 186 miles west by south of Paris, or 215 miles by the road through Alençon, Mayenne, and Laval.

The department is crossed from west to east by the Menez mountains, which extend from the western headland of France towards the interior. This range separates the waters which flow into the Channel from those which flow into the Atlantic; it does not attain within this department to any considerable elevation. The small portion of the Channel coast which belongs to this department is of irregular outline. It is skirted towards the west by a great number of small islets or rocks, as Les Conches and Les Tintiaux, and has the headlands of Pointe du Menga or Manga and Grouin de Cancale: toward the east, where it forms the roadstead of Cancale and the Bay of St. Michel, it is skirted by broad sands and shoals.

The chief rivers are the Vilaine, which flows into the Atlantic, and the Rance, and the Couesnon, which flow into the Channel. The Vilaine rises just beyond the eastern boundary of the department (in the department of Mayenne), flows south to the village of La Chapelle, near Vitré, and then west past Vitré and Châteaubourg to Rennes, receiving the Cardache and Chèvre on the right bank. At Rennes it is joined on the right bank by the Ille from the north, and turning south flows to the boundary of the department, along which it has its course for some miles, and then quits it to flow through the department of Morbihan to the ocean. Below Rennes it receives the Meu, the Canut, and the Oust on the right bank, and the Seiche, the Samnon, and the Cher on the left. Its whole length is about 105 miles, of which three-fourths belong to this department. It is navigable from Rennes, where it is joined by the canal of the Ille and the Rance.

The course of the Meu is in the department; that of the Oust and the Cher, and of the Aff, a feeder of the Oust, for a short distance upon the border, but never within it. The Meu, Oust, and Cher are all navigable for a short distance.

The Couesnon rises just beyond the eastern boundary of the department, and at first flows westward, but gradually turns to the north and flows into the bay of St. Michel, an inlet of the English Channel; its length is about 44 miles; the lower part of its course, which is navigable, is chiefly in the department of Manche. Its principal tributary is the Ouisance. The Rance rises in the Menez mountains, and flows north-west to Dinan, in the department of Côtes du Nord. At Dinan it turns northward and re-enters the department of Ille et Vilaine just above its outfall, which forms the harbour of St. Malo. Its whole length is about 40 miles; it is navigable below Dinan, 14 or 15 miles above its mouth. The Brevon, a feeder of the Celune [MANCHE], has part of its course in this department.

The only canal, that of the Ille and the Rance, commences in the Vilaine at the junction of the Ille at Rennes, and follows the valley of the Ille to near its source; it then crosses the Menez range to the valley of the Rance, which it follows to the neighbourhood of Dinan, where it communicates with the navigation of the Rance. The summit level is where it crosses the Menez range near Hédé; on the side of Rennes are twenty locks in a slope of 21 miles long; on the side of Dinan twenty-eight locks in a slope of 18 miles. The whole length of the canal in all its windings is about 55 miles, the greater part of which is in this department.

The high road from Paris to Brest crosses this department through Vitré, Châteaubourg, and Rennes. The road to Lorient branches off from this at Rennes. The road from Paris to Dol and St. Malo, which branches off from the Brest road at Mayenne, crosses the northern part of the department through Fougères and Antrain. There are other government roads leading from Rennes in various directions. The whole length of the government roads is nearly 400 miles, but little more than half of this length is in a state of repair. The 'Routes Départementales' have an aggregate length of more than 150 miles, but little more than half of this is in repair. The bye-roads and pathways have a length of more than 2000 miles.

The whole of the department is comprehended in the western district (comprehending Bretagne and the adjacent parts of other provinces), occupied by the coal-measures and the subjacent primitive rocks [FRANCE], but there is no coal worked, or, that we know, found in the department. Iron is obtained, and there is some lead, but it has not been worked for many years. The principal rocks are granite and schists. Slate quarries are wrought in the southern part near Rédon. There are many mineral springs; that of Guichen, between Rennes and Rédon, is most resorted to.

The climate of the department is temperate; the thermometer seldom rises in summer above 77° Fahr., or falls in winter below 20°; but the south and south-west winds, which are prevalent, render the climate rainy: fogs are common, especially in spring and autumn. The agricultural produce consists of barley, oats, rye, maslin, or mixed corn, a little wheat, and a considerable quantity of buckwheat. The grain raised is barely sufficient for the consumption of the department. The cultivation of hemp and flax is considerable, and the quantity of fruit grown, apples and pears, is also great. The cider of this department will bear a sea voyage. A little tobacco is grown near St. Malo, and a small quantity of very light white wine is made. The quantity of pasture-land is considerable: the butter of this department is among the best in France. The breed of sheep has been lately improved by crossing it with the Spanish sheep. The quantity of waste land is very great, perhaps one-fourth of the whole area of the department. The quantity of woodland is small. There is abundance of game of all kinds and poultry; and there are many bees. The fresh waters abound with fish; and on the coast are caught great numbers of turbots, soles, and other fish. The oysters of Cancale are in high reputation, and the chief supply of Paris is from them. There are salt-pans along the coast.

The department is divided into six arrondissements, the situation, area, and population of which, with the number of communes, are as follows:—

Arronds.	Sit.	Sq. Miles.	Pop.	Communes.
Rennes	Central	528	130,838	78
Fougères	N.E.	382	81,688	57
Montfort	W.	367	57,554	46
St. Malo	N.W.	367	118,243	60
Vitré	E.	444	82,042	62
Rédon	S.	497	76,884	46
		2585	547,249	349

The number of cantons, or districts under a justice of peace, is 43 in the whole department.

The arrondissement of Rennes contains the city of Rennes, at the junction of the Ille and the Vilaine, which had, in 1836, a population of 35,552 [RENNES], and the towns of Hédé near the canal of the Ille and the Rance, and Château Giron between the Seiche and the Vilaine. Neither of these towns is of any importance. Hédé is in the midst of the Menez mountains.

In the arrondissement of Fougères are Fougères, near the source of the Couesnon, and on the road from Paris by Mayenne to Dol and St. Malo, with a population, in 1836, of 9384 [FOUGERES]; St. Georges de Reintembault, near the Brevon (population 3258); Louvigné du Desert (population 3349); Antrain on the Couesnon, at the junction of the Ouisance; Bazouges, near Antrain (population 4500); and St. Aubin de Cormier, on the ridge of the Menez mountains, between Fougères and Rennes. The last-mentioned place has a population of about 500 or 600 in the town, and about three times that number in the whole commune; but some historical interest is attached to it: it has an antient castle, built in the year 1222, by Pierre Mauclerc, duke of Bretagne [BRETAGNE], of which the lofty ruin of a tower in the midst of picturesque rocks yet remains. At St. Aubin de Cormier a great battle was fought in the year 1488, between the forces of Charles VIII. of France, then in his minority, and those of the duke of Bretagne, François II. The French were commanded by La Trimouille, then a mere youth; and the Bretons had the presence and aid of Louis, duke of Orléans, afterwards Louis XII., the prince of Orange, and other malcontent French nobles. The Bretons and their allies were defeated.

In the arrondissement of Montfort are Montfort-sur-Meu (population in 1836, 1772); St. Méen; Plélan, on the road from Rennes to Lorient (population 3305); Le Gué, close to Plélan; and Bréal. Montfort retains some portions of its antient walls.

In the arrondissement of St. Malo are St. Malo, at the mouth of the Rance, which had, in 1836, a population of 9744, or, including its suburb St. Servan, of nearly 20,000 [MALO, ST.]; Dol, near the sea (population 3098 town, 3939 commune); Châteauneuf, near the Rance; and Cancale (population 4880) on the sea. This last is a small seaport well known for its oysters, which not only supply Paris, but furnish also the English boats with oysters, which are laid in the beds in the æstuary of the Thames and adjacent rivers.

The arrondissement of Vitré contains Vitré (population, in 1836, 8901), and Châteaubourg on the Vilaine, and La Guerche (population 2100 town, 4219 whole commune), near the Seiche. Vitré is an antient Breton town. Some antiquaries have thought that its walls have some traces of Roman building, but this is regarded as an error. It was the place of meeting of the states of Bretagne before the Revolution. It is neither well built nor neatly kept. Savary, author of the 'Lettres sur l'Egypte,' was born here, and it was for some time the residence of Madame de Sévigné. The neighbourhood has some charming promenades and a mineral spring of considerable resort. In the neighbouring castle of Rochers several articles once belonging to Madame de Sévigné are kept as relics.

In the arrondissement of Rédon are Rédon (population, in 1836, 4506), at the confluence of the Oust and the Vilaine; Fougeray (population 5501), near the Cher; Bain (population 3490), near the Samnon; Loheac, on the road between Rennes and Rédon; and Beaulon. Rédon carries on considerable trade with Rennes and other places. Vessels of 200 tons can come thus far up the Vilaine. At Rénac, a village near this town, cheese is made, which is sold under the name of Gruyère. At Bain are several serge manufactories.

The population, when not otherwise mentioned, is that of the whole commune, according to the census of 1831.

The coarse linens and sail-cloth of this department are in high repute. Paper, starch, leather, and glass are made, and a great quantity of cordage. There are some iron-works and establishments for bleaching wax. The chief exports of the department are flax, hemp, linen thread, coarse linens for sails and wrappers, cider, leather, butter, wax, honey, and hosiery. St. Malo is the chief seaport. Several vessels belonging to the towns and places on the coast are engaged in the India trade, and in the whale and cod fisheries.

The department constitutes the diocese of Rennes, and is in the jurisdiction of the Cour Royale, and the circuit of the Académie Universitaire of that city. It is comprehended in the thirteenth military division, the head-quarters of which are at Rennes. It sends seven members to the Chamber of Deputies.

Education is in this department very backward; it is however somewhat more advanced than in the neighbouring department of Loire Inférieure, and considerably more so than in the other departments into which Bretagne has been divided. Of the young men enrolled in the military census of 1828-29, only 25 in 100 could read.

In the time of the Romans the department was inhabited by the Redones, a Celtic people, whose name has been preserved in those of the capital and the town of Rédon. It was comprehended in the district of Armorica. In the Roman division of Gaul it was in Lugdunensis Tertia. In the downfal of the empire it became part of that independent state which, from the infusion of British population, took the name of Bretagne [BRETAGNE], and shared all the revolutions of that duchy. It was the scene of contest in the Vendéan war.

ILLECEBRA'CEÆ, a small natural order of Exogenous plants, chiefly consisting of herbaceous weeds, found in the temperate parts of the world: they differ from Amarantaceæ in nothing except having stipules and a tendency to produce petals; from Alsinaceæ in little more than having stipules; and from Portulacaceæ in their sepals not being in pairs. This order is one of those which break down the limits between Polypetalous and Apetalous plants, and prove how entirely artificial are such divisions. The species are often conspicuous, especially when dried, for their silvery stipules and shining calyxes, and are sometimes beautiful microscopic objects; but they are too small to be interesting in any other way, and are of no known use. *They occur in* various parts of the world, especially in *the countries* bordering on the Mediterranean.

Illecebrum verticillatum.

1, a pair of leaves, with the intervening stipules; 2, a flower, seen from above; 3, a flower cut open.

ILLI'CIUM (from *illicio*, I allure), a genus of plants so named in consequence of their very agreeable aromatic fragrance; they belong to the Winter's bark tribe. These are now generally described as a separate family under the name of *Winteraceæ*, and are distinguished by their dotted leaves and aromatic properties from Magnoliaceæ, of which they are sometimes made a section. The genus Illicium is characterized by having from three to six petaloid sepals;

twenty-seven petals arranged in several rows below the numerous stamens and pistils. The capsules are disposed in a circular manner, and open upwards; each contains a single shining seed. The species are few in number, but widely distributed. Two are indigenous in Florida; and the others in China and the neighbouring islands. *I. floridanum* is a red-flowered species, of which the leaves are very fragrant, and the capsules smell of anise, though more faintly than the Chinese species. The bark has been proposed as a substitute for cinnamon and sassafras barks. *I. parviflorum* also, a native of North America, has similar properties, especially in its leaves.

The most important species however is *I. anisatum*, or the aniseed tree of China, of which the fruit is exported from Canton, and well known in commerce by the name of *Star anise*. In India they are called *badian khatai*, or Chinese Anise. Hence the name *badiane*, by which they are chiefly known on the continent of Europe, where they are more employed than in this country; being esteemed, as in the East, for their aromatic and carminative properties. The smell and taste of both the capsule and seed being like that of aniseed, a volatile oil is distilled from them, which may be employed for all the purposes of the oil of aniseed: it is said to give the flavour to anisette de Bordeaux and to anisette de Hollande. The Chinese use it in substance both as a condiment and a stimulant medicine, and burn it as incense in their temples. The tree flourishes in China and some of the Philippine Islands, and is found also in Japan, whence Siebold has described a new species. M. Perrotet also mentions that there is an undescribed species at Manilla, which is there called San-ki; that its leaves are mixed with their tea and coffee in the Philippines, and that a liqueur is likewise prepared from its fruit.

ILLINOIS, one of the states of the North American Union, is bounded on the south-east by the Ohio, which separates it from Kentucky for 130 miles; on the east by the Wabash for 120 miles direct distance, and by a meridian line to lake Michigan for 162 miles, by which river and line it is separated from Indiana; by the western coast of lake Michigan for 57 miles; on the north, by the parallel of 42° 30′ N. lat. to the Mississippi, 157 miles, by which it is separated from the Huron territory; on the west by the Mississippi, which separates it from the Missouri territory for 200 miles, and from the state of Missouri for 340 miles. The whole circuit of the state is 1176 miles, and its area is 57,900 square miles, or somewhat more than the area of England and Wales. It lies between 42° 30′ and 37° N. lat., and thus comprehends 5½° of latitude. The Mississippi, Ohio, and Wabash form two-thirds of the boundary of this state. The Kaskaskia rises on the east side of the state, and, flowing to the south-west for about 250 miles, falls into the Mississippi about 80 miles above the junction of the Ohio. The Illinois, the largest river in the state, rises near lake Michigan, and flows first west, and then south-south-west, into the Mississippi, which it joins 20 miles above the Missouri. About 200 miles above its mouth it expands into a lake called Peoria, 20 miles long and 2 wide. A morass at its source in wet seasons discharges a part of its waters into the river, and a part into the Chicazo, a small stream which flows into lake Michigan. This large river takes the name of Illinois only from the confluence of the Plane River from the north-east and the Kankakee from the east, both considerable streams, and navigable for boats. Thirty miles below their confluence Fox River falls into the Illinois from the north: it rises in the Huron territory, and has a course of 200 miles south-south-west, more than half of which is in this state.

The Fox River is sometimes considered the main branch of the Illinois, but whether we reckon by this or the Kankakee branch, its course through the state cannot be less than 400 miles. The other principal tributaries of the Illinois are the Vermilion river from the south-east, the Mackinaw from the north east, Spoon river from the north-west, and the Sangamon or Sanganio from the east. The last, by much the largest of these tributaries, has a very winding course to the west of more than 250 miles, of which 140 miles are navigable, and it falls into the Illinois about 130 miles above its mouth. Rock River rises in the Huron territory, and entering the state of Illinois on its north boundary, crosses it in a south-west course of about 200 miles to the Mississippi. The principal tributaries of the Wabash in this state are the Embarras river, which joins the Wabash 10 miles below Vincennes, after a south and south-east course of about 150 miles; and the Little Wabash, which falls into the Wabash about 12 miles above its mouth.

There is a range of low hills near the Ohio, and the western part of the state has an undulating surface; but with these exceptions, Illinois is one great plain, having a general slope to the south-west. It is estimated by Darby that every part of the state is included between the elevations of 400 and 1000 feet above the sea-level, the mouth of the Ohio being 320 feet above the level of the Atlantic. Its soil may be thus divided:—1. The alluvial lands on the rivers, which vary from one mile to eight in width, and are subject to occasional inundation. 2. Dry prairie lands on the borders of the alluvial soil, and elevated above it from 30 to 100 feet. These lands sometimes almost touch the river, and, though generally less fertile than the river lands, are preferred as not being subject to inundation. 3. Wet prairies covered with coarse grass. 4. Timbered land, some of which is sterile, but the greater part very fertile. It is supposed that this state contains more good arable land than any other in the Union. The American Bottom, a tract on the Mississippi extending above the mouth of the Kaskaskia for 90 miles, is noted for its fertility. Its soil, which is the richest river alluvium, continues unchanged for 25 feet below the surface, and some portions of it have produced Indian corn without intermission and without manure for near a century. The minerals are iron, copper, and lead in the north-western angle of the state. The lead-mines are worked, and are supposed to be the richest in the world. The mining district is 200 miles in extent, and passes to the north of the state. Coal is found in every part of Illinois: salt springs are common, and limestone, gypsum, and sandstones are the usual rocks. The climate is very much the same as that of Missouri, except that it is more humid, and in general less healthy. It is remarked that there is a considerable difference in the temperature between the northern and southern parts of the state. At New Harmony, which is in 38° 11′, and opposite the southern part of the state, on the east bank of the Wabash, the thermometer has been observed as low as 5° below zero of Fahrenheit. Darby doubts if the mean heat of Illinois would reach 53° Fahr.

Illinois is divided into 52 counties: its population in 1830 was 157,445, of which 747 were slaves, who were brought here while it was a territory: by the constitution no more slaves are allowed to be admitted. The increase in ten years was 185 per cent. The agricultural products of the state are maize, wheat, hemp, flour, and tobacco. Swine are reared in great numbers from the abundant mast of the forests. There are few manufactures in the state, except those of salt and lead: of lead 8,000,000 lbs. were produced in 1830. There is a single bank in the state, with a capital of 200,000 dollars.

Vandalia on the Kaskaskia, near the centre of the state, is the seat of government, but it is yet merely a village. There is no town in the state which contains 1000 inhabitants. Kaskaskia, near the mouth of the river of that name, and Cahokia on the Mississippi, are old French settlements. Belville and Galena on the Mississippi, and Shawnee town on the Ohio, are the most flourishing towns in the state, but the population of none of them exceeds 600.

Illinois college is the only public seminary. The Methodists, Baptists, and Presbyterians are the prevailing sects. The legislature consists of 26 senators and 55 representatives.

This state is within the limits of the cession which Virginia made to the United States in 1787; but the first settlements made in it were by the Canadian French before 1763. It was governed, with Indiana, as a territory of the United States from 1800 to 1809. In 1809 they were made separate territorial governments, and in 1818 Illinois was admitted into the Union, in which year its constitution was formed.

ILLUMINATING. [MANUSCRIPTS.]

ILLYRIA, THE KINGDOM OF. The name of Illyria had disappeared for many centuries from the number of European countries, when Napoleon, after the conclusion of peace at Vienna, in 1809, gave to several tracts of territory ceded by Austria, including Dalmatia, the name of the Illyrian Provinces. Those countries being recovered by Austria in 1813 and 1814, several of them were formed into the kingdom of Illyria, the extent of which was reduced in

1822 by the separation of the circle of Carlstadt and of the Hungarian Littorale, which were annexed to Hungary. The kingdom of Illyria, as now constituted, lies between 44° 43′ and 46° 25′ N. lat., and 13° 14′ and 16° E. long., and is bounded on the north by Austria and Styria, on the north-east by Styria, on the south-east by Croatia, to the south by the Adriatic, and to the west by Italy and Tyrol. The area of tho kingdom, according to the latest authorities, is 10,801 square miles. The population was stated to be, in 1834, 1,154,885, and on the 1st of January, 1837, 1,188,534 souls.

Divisions.—The kingdom of Illyria is divided into two governments, Laybach and Trieste, which are entirely independent of each other.

I. *The Government of Laybach* has an area of 6746 square miles, 743,217 inhabitants, 25 cities, 42 towns, and 5929 villages. It is subdivided into five circles, the first three of which formerly constituted the duchy of Carniola, and the two others the duchy of Carinthia. 1. *The Circle of Laybach* (otherwise Upper Carniola) has an area of 1302 square miles, and about 160,000 inhabitants. The chief town is Laybach, the capital of the circle and the government, situated in an extensive valley at the mouth of the navigable river Laybach, which divides the city into two parts, connected by five bridges. Laybach with its eight suburbs has 11,275 inhabitants. It is a bishop's see, and has a fine cathedral, twelve other churches, a lyceum, a gymnasium, and many other excellent public institutions. The castle is situated on a commanding eminence. At a short distance to the north of the town there is a stone bridge of 11 arches, 540 paces in length, over the Save. Laybach is celebrated for the congress held there in 1821. The other towns are Stein, which gives its name to the Steiner Alps, from the summits of which, 10,274 feet above the level of the sea, there is a magnificent prospect over Carniola; Krainburg, with the castle of Kieselsteen; Neumarktl, famous for tho manufacture of scythes, sickles, &c.: none of these towns have so many as 2000 inhabitants. 2. *The Circle of Neustadtl* (otherwise Lower Carniola) has an area of 1239 square miles, and about 187,500 inhabitants. The chief town is Neustadtl, the capital of the circle, beautifully situated on the river Gurk; a very pretty regularly built town, with three churches, a gymnasium, a Franciscan convent, and 1800 inhabitants. None of the other towns are of any importance. 3. *The Circle of Adelsberg* (otherwise Inner Carniola) has an area of 1138 square miles, and 87,300 inhabitants. Adelsberg, the capital, a well built town, with 1356 inhabitants, is noted for the remarkable grotto in its vicinity. The most important place in this circle is Idria, a mining town, famous for its quicksilver mines, which were accidentally discovered by a peasant in the year 1497. It is situated partly at the bottom of a narrow valley surrounded by high mountains, on the banks of the little river Idria, and partly on several low hills, of which that called Mount Calvary is distinguished by its height and picturesque form. The town consists of about 400 houses, with 4139 inhabitants, who subsist partly by lace-making and straw-platting; but the greater part are employed in the mines and works. The entrance to the mine is nearly in the middle of the town, by a large iron gate, which opens to a horizontal passage hewn in the solid rock leading to a flight of 757 steps cut in the limestone rock, which are kept in perfect order, and provided with a handrail. At the foot of this staircase there is a small aisle serving as a chapel, where the miners perform their devotions before they proceed into the mine, and where a couple of tapers burning on the altar alone cheer the eternal gloom that reigns in these subterranean caverns. The visitor proceeding from this chapel soon reaches various adits running in all directions, and would soon be bewildered in this labyrinth without a guide. This mine is one of the greatest curiosities in the Austrian empire, and unequalled for the order, beauty, and safety which are remarked in every part. The noxious exhalations of the quicksilver, which sensibly affect respiration, and the suffocating heat, frequently 90° in September, soon make the visitor anxious to return to the light of day, to which he ascends by a perpendicular shaft in a kind of box or case, which lands him on the surface of the earth at a great distance from the spot at which he entered. The greatest depth of the mine is 750 feet. The produce of these mines has very materially diminished; it is stated to have formerly amounted to 18,000 cwt. of quicksilver annually; in 1822 it was said to be 5000 cwt.; and Cannabich, a highly esteemed author, in his 'Geography,' published in 1836, says it is now only 1500 cwt. Besides the quicksilver works, there is a manufactory of cinnabar, which produces 1800 cwt. annually. In the vicinity there are marble, jasper, and freestone. All the establishments for smelting, refining, &c. are admirably arranged, and there are various benevolent institutions for the poor miners, whose health is most dreadfully impaired by the deleterious atmosphere in which they are compelled to 'ply their sickly trade.' 4. *The Circle of Clagenfurt* (otherwise Lower Carinthia) has an area of 1441 square miles, 128,795 inhabitants, 23 towns, and 1685 villages. The chief town is Clagenfurt, formerly the capital of Carinthia, now of the circle, containing with the four suburbs 9200 inh. [CLAGENFURT.] There are no other large towns in this circle, and none in fact that have so many as 2000 inh. The village of Ferlach on the Drave, which with some neighbouring hamlets has 2840 inh., is famous for its manufactures of firearms. 5. *The Circle of Villach* (otherwise Upper Carinthia) has an area of 1626 square miles, 13 towns, and 1147 villages. The chief town, Villach, is situated on the banks of the Drave, which is here navigable, in a deep valley, and in a beautiful country, which has been called the Inner Austrian Switzerland. The town, which was formerly much larger than it now is (perhaps the Julium Carnicum, Colonia Julia, or Forum Vibii of the Romans), has 2400 inh. Villach was formerly a staple place for the commerce between Italy and Germany, and the traffic is still considerable.

II. *The Government of Trieste*, comprehending the city and territory of Trieste and two circles, has an area of 4055 square miles, and 426,539 inh., of whom 350,650 are Slavonians, 52,000 Italians, 19,000 Germans, 2500 Jews, 2300 Greeks, and 40 Armenians. 1. *The Territory of Trieste* has an area of 40 square miles, and, including the city of Trieste (the most important seaport and commercial town in the Austrian dominions), 55,000 inh. [TRIESTE.] 2. *The Circle of Istria* has an area of 2178 square miles, and 192,564 inh. The chief town of the circle, Mitterburg or Pisino, has only 1600 inh. The other most remarkable towns are Capo d'Istria, a seaport on an island in the Adriatic, connected with the continent by a bridge, 5000 inh.; Rovigno, 9500 inh.; Pola, celebrated for its fine Roman antiquities; Pirano, 6500 inh.; Dignano, 3600 inh. To this circle belong the following islands in the Gulf of Quarnero, viz., 1, Cherso and Osero, united by a bridge, having an area of 78 square miles, and 14,000 inh.; chief towns, Cherso, 3000 inh.; Lussin piccolo, 3500 inh., the largest harbour in the Adriatic; Lussin grande, 2218 inh. 2, Veglia has an area of 98 square miles, 15,000 inh.; chief towns, Veglia, a bishop's see, 1200 inh., and Visca (including Viscavecchia), 3000 inh. 3. *The Circle of Görz* has an area of 1837 square miles, and 175,000 inh. [GÖRTZ]; chief towns, Görz or Gorizia, 9700 inh. [GORTZ or GORIZIA]; Aquileja, 1400 inh.; Grado, 2200 inh.; and Monfalcone, 1200 inh., where a new harbour called Porto Rosega was opened in 1825.

Face of the Country, Soil, Climate.—Illyria is on the whole a mountainous country, but the coasts are partly low and sandy, and partly marshy, especially towards the west. On the west the bay of Trieste, and on the east that of Quarnero, run deep into the land, and form the great peninsula of Istria, the extreme point of which is Capo Promontore. In the circles of Villach and Clagenfurt the soil is good, and the valleys are in general fertile: these two circles would produce sufficient corn for the consumption of the inhabitants, if immense masses of rocks did not cover so much of the surface, and the elevation above the sea did not produce a temperature unfavourable to vegetation. The circles of Neustadtl, Adelsberg, and Laybach consist of rock, marshes, and sandy flats, and are unfruitful. The coast has a dry limestone soil, and in many parts suffers from a scarcity of water, but the vegetation is very luxuriant. Three great chains of mountains traverse the kingdom from west to east:—1. The Noric Alps occupy the circles of Villach and Clagenfurt, at the point where they first enter Illyria, which is on the frontier between Carinthia, Tyrol, and Austria: above the Ens stands the Grossglockner, 11,782 Vienna feet above the level of the sea. 2. The Carnic Alps. 3. The Julian Alps. All the mountains belonging to the chain of the Julian Alps are composed of primitive limestone, and are remarkable for their caves, of which there are above a thousand from the river Isonzo to the frontiers of Bosnia. The most remarkable and most frequently visited of these caverns are the Adelsberg grotto and the Magdalen cavern, both near Adelsberg. The first is distinguished by its extent and the extraordinary number and beauty of its stalactites. The Magdalen cavern is remarkable on account of a small lake in it, in which the *Proteus anguinus* is found. Illyria has only two principal rivers: the Drave flows for 120 miles through the circle of Villach and Clagenfurt; and the Save becomes navigable at Laybach. On the coast are the Isonzo and the Quieto; there are besides, in the government of Laybach, many smaller rivers, some of which disappear under ground, and rise again; others become dry during the summer. There are no canals for navigation; the only canal, that of Wörth, in the circle of Clagenfurt, serves only to float timber. Of the numerous lakes, the largest are the lake of Clagenfurt, 11 or 12 miles long, but narrow; the Ossiach lake, 7 miles long; and the Mühlställer lake, 8½ miles long and from 2 to 3½ miles wide; this is the deepest and most beautiful lake in Carinthia, and the surrounding scenery is highly picturesque.

The most remarkable lake in Carniola is that of Zirknitz, in the circle of Adelsberg, about three miles long, and from one and a half to two and a half wide, of which many wonderful stories are told, all originating in the fact that it is sometimes quite full to the brim, and at others dried up, and this without any regularity or regard to the season of the year; sometimes it does not dry up for years together. Carinthia is much more abundant in mineral waters than Carniola, but there are none that enjoy any remarkable celebrity. The climate of course varies in different parts. The lofty mountains covered with snow, which either never melts or only in the height of summer, cause the air to be rather sharp and raw in the circles of Villach and Clagenfurt: the vine does not thrive here. Though there are some persons afflicted with goître, the climate is on the whole healthy. It is much milder in the circles of Laybach, Adelsberg, and Neustadtl, where the vine, chestnut, and maize flourish. The government of Trieste has a hot climate; the vegetation is luxuriant, and the choicest fruit would succeed if the soil were good; for in the circle of Görz the mulberry-trees bear the winter very well, as do the olive and the orange in the territory of Trieste: it is to be regretted that there is a deficiency of water. In the western parts on the coast the air is rendered extremely unhealthy by the exhalations from the lagoons.

With respect to its natural productions, Illyria is inferior to many other parts of the empire. It however abounds in mineral wealth. Besides quicksilver, it has copper of the finest quality; excellent iron, lead, silver (but in small quantities), cinnabar, alum, coals, and, besides a great variety of marbles, rock-crystal, porphyry, jasper, garnets, &c., &c.

The vegetable products contain many rare Alpine plants, medicinal herbs, and roots; also wheat, rye, barley, oats, maize, buck-wheat, potatoes, pulse, some flax, hemp, and hops, garden vegetables, and fruit. The forests have been much thinned for the use of the iron-works, but there is still an abundance of pine, oak, and other timber. In the animal kingdom there is nothing remarkable. The horned cattle and the horses are in general small, but the breed has been much improved of late years. The largest flocks of sheep are in the islands, especially Veglia, which has likewise many horses. Swine and poultry abound everywhere. Of wild animals there are stags, fallow deer, wild boars (in Carniola only), the chamois on the Noric Alps, foxes, &c. Bears and wolves are rare. The game consists of pheasants, bustards, partridges, snipes, and waterfowl. Singing-birds and birds of prey are numerous. The lakes abound in fish. The fisheries on the Adriatic are very important, especially the tunny, mackerel, and anchovy fisheries.

Manufactures and Trade.—Though Illyria is not a manufacturing country, it has some branches of linen and woollen manufacture, which are pretty equally dispersed over the whole kingdom. The most important manufactures are those of various articles in iron and steel. There are considerable manufactures in Trieste, but they have little influence on the rest of the kingdom. Fine roads traverse the kingdom in all directions for the convenience of commerce, which chiefly consists in the transit trade between Vienna and Trieste.

History.—Antient Illyria comprehended all the provinces on the east coast of the Adriatic, with the adjacent islands as far as Epirus, and was inhabited by a people called by the general name of the Illyric nations. Illyria also extended into the interior as far as the Ister (Danube) and the Alps which lie between Italy and Germany. The Macedonic nations formed the eastern boundary. Within these vague but extensive limits, which comprehend a considerable portion of the Austrian and part of the Turkish dominions, there were other nations, and particularly Gauls, mingled with the Illyrians. (Strabo, 312, &c.) The numerous excellent ports along this coast gave the natives great advantages for prosecuting a piratical warfare. The Illyrians defeated Amyntas II. of Macedonia, B.C. 383, and his eldest son, Alexander II., was obliged to purchase peace of them and give his brother Philip as a hostage. When Philip came to the throne he defeated the Illyrians, B.C. 359, and for a time broke their power. That the Illyrians were formidable neighbours to the Macedonians appears from the fact of their long-continued wars and the several great defeats which the Macedonians sustained from them. Piracy was the chief pursuit of the maritime Illyrians, which brought them into collision with the Romans, by whom they were subdued. On the division of the empire Illyria remained to the Western empire; but on its decline (476) fell to the Eastern empire. In the sixth century colonies of Slavonians from Russia and Poland settled in the country, and soon made themselves independent of the Byzantine government: thus arose the little kingdoms of Croatia and Dalmatia. The Venetians and Hungarians took some small portions (1090): in 1170 the kingdom of Rascia was created, out of which, 200 years later, Bosnia was formed. Dalmatia submitted to Venice, but was conquered in 1270 by the Hungarians; but both they and the Venetians soon lost almost the whole country to the Turks, the Venetians retaining only a small part of Dalmatia, and the Hungarians Slavonia and Croatia. Thus the name of Illyria disappeared from the map of Europe till it was revived by Napoleon in 1810, and continued by Austria after the recovery of the province in 1813 and 1814. It was in 1822, as we have had occasion to observe, that the Emperor Francis, in order to give his faithful Hungarian subjects a new proof of his favour, and to afford them an opportunity of enjoying the advantages of foreign commerce, resolved to annex to Hungary the Littoralo with the seaport of Fiume.

IMAGINARY. [NEGATIVE AND IMPOSSIBLE QUANTITIES.]

IMAGINATION denotes in its widest sense that faculty of the mind by which it produces at will thoughts or ideas as materials for every other mode of the mental activity. It is often employed in a narrow acceptation as synonymous with fancy, which properly is only a particular species of imagination combined with judgment. Still narrower is the domain of this faculty according to the definition of Dr. Reid, who confines it to a lively conception of the objects of sight, and makes the imagination to differ from conception only as a part from the whole. And similarly Mr. Addison teaches that 'the pleasures of imagination are such as arise from visible objects, since it is the sense of sight that furnishes the imagination with its ideas.' In its widest signification however imagination is coextensive with invention, furnishing the writer with whatever is most happy and appropriate in language, or vivid and forcible in thought. In the same manner it is the imagination that suggests to the scientific inquirer those bold conjectures of analogy or difference which lay open the secrets of nature and multiply its usefulness to man. Indeed, to adopt the language of Mr. Dugald Stewart, 'All the objects of human knowledge supply materials for her forming hand; diversifying infinitely the works she produces, while the mode of her operation remains essentially uniform.'

It is in this illimitable activity that imagination differs from conception, which also is a reproductive faculty, but apparently a mere passive potentiality to bring forth certain given and particular ideas; while the former, when once awakened by the presentation of a single thought, produces out of its storehouse of ideas all the manifold variations of similar and dissimilar. In this procedure, while it is bound indeed by the general laws of association, it is yet free to choose the principle of its combinations. Accordingly every age and every sex, every form of government and of religion, is said to have its special succession; and what is called a knowledge of men consists in nothing else than a knowledge of the train in which their ideas respectively succeed to each other.

A disordered imagination exhibits itself chiefly under three forms or characters: the fantastical, the fanatic, and the enthusiast; and similarly the due succession of its representations may be triply distinguished into the natural, the logical, and the poetical.

On the particular character of the imagination depends the happiness or misery of the individual. Acting upon human hopes and fears, it assumes the name of sensibility, and by the bright or sombre images with which it fills the distant prospect of life it affords a double relish to every enjoyment or gives a keener edge to sorrow and misfortune.

I'MAUS. [HIMALAYA MOUNTAINS.]

IMBECILITY. [INSANITY.]

IMBROS, an island of the Ægean Sea near the southwest coast of the Chersonesus of Thrace, 18 miles southeast of the island of Samothrace, and about 22 miles northeast of Lemnos. It is now called Imbro, and also Lembro. It is of an oval form, and its circumference has been reckoned at about 30 Italian miles of 60 to a degree of latitude. (Dapper, *Déscription des Isles de l'Archipel.*) Its surface is hilly and well wooded, and it abounds in game. The valleys produce abundantly corn, wine, oil, and cotton. The island is watered by a stream called Ilissus, besides many springs. The population consists of about 4000 Greeks, who inhabit four villages, the principal of which has a castle, and is called Imbro. This island was in remote times the seat of the worship of the Cabiri, like the neighbouring islands of Samothrace and Thasos. (Cousinery, *Voyages en Macédoine.*) It was taken by the Persians about 508 B.C., under Otanes, general of Darius Hystaspes. It was afterwards possessed in succession by the Macedonians, by Attalus, king of Pergamos, and lastly, by the Romans.

Coin of Imbros.
British Museum. Actual Size. Copper. Weight, 86 grains.

IMIRE'TIA. [GEORGIA.]

IMITATION, in Music. [FUGUE.]

IMMATERIALISM. [BERKELEY; MATERIALISM.]

IMMORTALITY. [MATERIALISM.]

I'MOLA, a town and bishop's see of the Papal State, in the delegazione or province of Ravenna, is built in a fine plain on the banks of the river Santerno, over which there is a handsome bridge of recent construction. Imola is upon or near the site of the antient Roman colony of Forum Cornelii, but the present town was built by the Longobards. The town with its suburbs contains 10,500 inhabitants (Calindri, *Statistica*). It has a fine cathedral and several other churches, a theatre, a handsome hospital, a college with a library of 4000 volumes, and a considerable manufactory of cream of tartar. The country around produces good wine. Imola is on the high road from Bologna to Rimini, at the point where another road branches off to Ravenna. Barnaba Chiaramonti was bishop of Imola before his exaltation to the papal chair under the name of Pius VII.

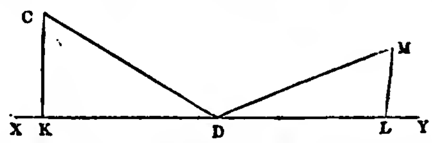
IMPACT (*in* and *pango*), the shock of two bodies, one or both of which are in motion: impact and collision are the technical terms used in mechanics for the meeting of bodies which are in motion.

It is usual to treat the first principles of this subject by supposing the bodies in question to be spherical; and for the following reason. When a body receives a blow, if it be free to turn as well as to move forward, a rotatory motion is, generally speaking, produced, as well as a motion of translation. But if the direction of the blow be in a line which passes through the centre of gravity, no rotatory motion is produced. Now if two equal spheres move upon a plane, it is obvious that when either strikes the other the direction of the blow passes through the centre of gravity. Making use then of equal spherical balls, of the same or different weights, moving upon a level plane, let it be remembered that all conclusions apply equally to bodies of any form, having no rotatory motion, and striking each other in such a way that the line joining their centres of gravity passes through the point of contact at the moment when they strike.

The simple mathematical theory of impact proceeds, like other mechanical theories, upon suppositions which can only be approximately obtained in practice. For instance, if in the preceding supposition the level plane and the balls exercise any friction on each other, the consequence will be that the balls will begin to roll on the table, even though the blows which set them in motion pass through their centres. To the existence of this friction are due many phenomena which a game at billiards will present, and which will not result from the common theory. Let the table, then, be supposed to exert no friction on the balls, so that one of the latter, struck by a blow the direction of which passes through the centre, will move along the table without rolling.

Let us now suppose the ball A to be impelled directly towards an immoveable obstacle, such as an upright ledge at the end of the table. On striking this ledge, the ball will, generally speaking, recoil more or less. Some substances will hardly give any recoil, while others will send the ball back with nearly the same velocity as that of its approach. This spring or elasticity is more easily measured than explained; it arises in the following manner. At the moment of impact, the ball compresses the part of the obstacle against which it strikes, which pressure continues until the reaction of the obstacle has destroyed all the velocity of the ball. At the same time the parts of the ball close to the point of impact have been compressed in a similar manner. If then there were no effort in the parts of the obstacle nor in those of the ball to recover their former position, the ball would remain at rest, close to the obstacle. If the recoil were complete, that is, if the parts of both bodies endeavoured to recover their position with a force equal to that which disturbed them, the recoil would rapidly but gradually [IMPULSE] create in the ball a velocity equal to that with which it approached. These two cases are the theoretical extremes which it is most probable no material bodies attain: in the first case they are said to be wholly inelastic, and in the second the elasticity is said to be perfect. But if only a fraction e of the velocity of approach be restored, then e is said to be the measure of the elasticity of the bodies.

Now suppose the ball A (which is so small that *its size* may be neglected) to approach obliquely towards *the obstacle* XY, say in the direction CD. Let CD *be the velocity*, or length moved over in one second. Then [COMPOSITION; VELOCITY] the velocity CD is equivalent to the two velo-



cities CK and KD. The first is destroyed, and then partially restored by the impact; the second remains unaltered, except by the friction at the moment of impact, which we do not consider. If then we take DL equal to KD, and draw LM perpendicular to XY, and in length such a fraction of KC as e is of 1, the ball will move after impact with the velocities DL and LM, that is, with the velocity DM in the direction DM. If the system were perfectly inelastic, the ball would proceed along DL; if perfectly elastic, ML would be equal to CK, and DM and CD equally inclined to XY. If the size of the ball be taken into account, XY must be supposed to be a line parallel to the obstacle, and distant from it by the radius of the ball.

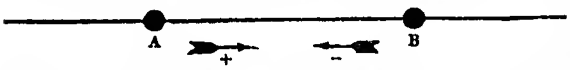
The principles upon which are determined the velocities after impact of different balls which strike one another are as follows:—

1. If two perfectly inelastic balls move towards each other in opposite directions, and with velocities inversely proportional to their weights or masses, they will destroy each other's velocities and remain at rest. Thus if A were twice as heavy as B, but if B moved twice as fast as A, there would be no motion after impact [MOMENTUM; MOTION, LAWS OF]. Let a be the velocity of A, and b of B; then A and B being expressed in the same units of weight, and a and b in the same units of length and time, the preceding condition is fulfilled when $Aa = Bb$.

2. If the same velocities be added to or taken from both balls, so that their rate of approach is not altered, the forces

exerted in the shock will not be altered, and the rate of recess after the shock will not be altered. Thus a cannon ball rebounding from a wall, both having the motion of the earth, strikes with the same force and rebounds in the same manner as it would do if the motion of the earth were taken from both, or if the earth were at rest.

Now let two balls, A and B, move in the *same* direction with the velocities a and b, A being the hindmost, and a the greater velocity. Give to both the velocity x in the contrary direction, x being greater than b, but less than a, so that the actual velocities become $a-x$ and $x-b$ in *contrary* directions. Let x be so taken that $A(a-x) = B(x-b)$, so that after the impact there would be no motion if A and B were quite inelastic. Hence x is $Aa + Bb$ divided by $A + B$. Let e be the measure of the elasticity, so that, instead of resting, the balls rebound with the velocities $e(a-x)$ and $e(x-b)$. Let the first-mentioned direction be called positive, and its contrary negative. Then



$e(a-x)$ is in the negative direction, and $e(x-b)$ in the positive direction. Restore to both the velocity x in the positive direction, which was taken from both, and which did not affect the impact, and the velocities after impact are:—

Velocity of A after impact: $x - e(a-x)$ in the positive direction, or $e(a-x) - x$ in the negative direction, according x is greater or less than $e(a-x)$. That is, the velocity of A after impact is $x - e(a-x)$, which is in the positive or negative direction, according as $x - e(a-x)$ is positive or negative.

Velocity of B after impact: $x + e(x-b)$ in the positive direction.

Substitute for x the value already found, or $(Aa + Bb) \div (A + B)$, and we have, after the impact,

$$\text{Velocity of A} = \frac{Aa + Bb - eB(a-b)}{A+B} = u.$$

$$\text{Velocity of B} = \frac{Aa + Bb + eA(a-b)}{A+B} = v.$$

$$\text{Velocity lost by A} = (1+e)(a-b)\frac{B}{A+B} = \alpha.$$

$$\text{Velocity gained by B} = (1+e)(a-b)\frac{A}{A+B} = \beta.$$

$$\left.\begin{matrix}\text{Momentum lost by A}\\ \text{and gained by B}\end{matrix}\right\} = (1+e)(a-b)\frac{AB}{A+B}$$

$$v - u = e(a-b)$$

$$Au^2 + Bv^2 = Aa^2 + Bb^2 - (1-e^2)(a-b)^2\frac{AB}{A+B}$$

$$= Aa^2 + Bb^2 - \frac{1-e}{1+e}\{A\alpha^2 + B\beta^2\} \quad \text{[Vis viva.]}$$

The preceding formulæ will remain true when the bodies are moving in contrary directions, if, the direction of A's motion being called positive, the velocity of B, or b, be made negative. The signs of the formulæ will show in which direction the motion after impact takes place. The following conclusions will now be readily deduced by any one who understands the preceding results.

1. If two inelastic balls move in the same direction, they do not separate after the impact, but either move on with a common velocity, or are reduced to rest. If both move in the same direction, the velocity after impact is $(Aa + Bb) \div (A + B)$; but if they move in different directions, the motion after impact is in the direction of that ball of which the momentum (Aa or Bb) is the greatest, and the velocity is $(Aa - Bb) \div (A + B)$ or $(Bb - Aa) \div (A + B)$. When the momenta are equal, there is no motion after the impact. If $b = 0$, or if one of the balls be at rest before impact, the velocity after impact is $Aa \div (A + B)$. To deduce these results, make $e = 0$ in the formulæ, and give the velocities their proper signs.

2. If two perfectly elastic balls move in the same direction they separate after the impact, the velocity of the foremost being augmented from b to $b + 2(a-b)A \div (A+B)$. But the velocity of the hindmost is either retarded, altogether destroyed, or made to change its direction, the algebraical formula for the velocity after impact being $a - 2(a-b)B \div (A + B)$. This is nothing when B exceeds A, and when b is to a as $B - A$ is to $2B$. And according as b is to a in a less or greater ratio than the preceding ratio, A's velocity is or is not altered in direction.

3. If two perfectly elastic balls move in opposite directions, that of A being called positive, the velocities of A and B after impact are determined in magnitude and direction by the formulæ

$$a-(a+b)\frac{2B}{A+B} \text{ and } -b+(a+b)\frac{2A}{A+B}.$$

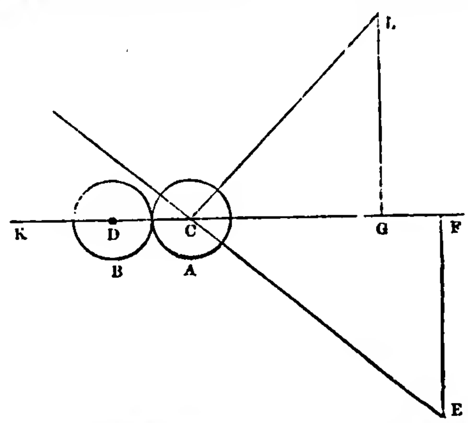
4. If two perfectly elastic balls be equal in magnitude, the velocity of each after the impact is that which the other had before the impact, both in magnitude and direction.

5. In all cases perfectly elastic balls recede from each other after impact with the same velocity with which they approached before impact; since if $e=1$, $v-u=a-b$. But in every other case the rate of recess after impact is the same proportion of the rate of approach before impact which e is of 1.

6. The *vis viva* of a couple of perfectly elastic balls is the same before and after impact; in every other case it is less after impact than before.

Now suppose two balls A and B to move in directions oblique to one another, and to strike each other. Decompose the velocity of each ball into two, one in the line joining the centres at the moment of impact, and the other perpendicular to it. The pair of velocities perpendicular to the central line will not be altered by the impact; and as far as the remaining velocities are concerned, the case is precisely the one already solved. Find the velocities in the central line as altered by the impact, compound them with the perpendicular velocities which remain unaltered, and the resulting velocities and directions will be those with which the balls will proceed after the impact.

To take the most simple case, suppose the ball A, moving in the direction EC, and with the velocity EC, to strike the ball B, which is at rest. Join D and C, the centres of the balls, and decompose EC into FC in the line joining the centres, and EF perpendicular to it. Then A will only



strike the ball B with the velocity FC. Suppose that by the preceding rules it is found that A, striking B at rest with the velocity FC, will be thrown back with the velocity CG, while B is struck forward with the velocity DK. Then B will receive this velocity, and this one only: as to A, it has after the impact acquired the velocity CG, which it combines with the velocity GL, equal and parallel to EF; so that CL represents the velocity and the direction of the motion of A after the impact.

In every case of impact, when the balls approach one another with uniform velocities, the centre of gravity of the balls moves uniformly, and in a straight line. After the impact, though the directions and velocities of the balls may have changed, yet their centre of gravity still continues to describe the same line, and with the same velocity as before. This proposition is proved in all works on elementary mechanics.

IMPATIENS, a genus of plants so called from the sudden and elastic force with which they burst their capsules; hence 'Noli me tangere' is the name of one of the species. Another is well known as a highly ornamental annual by the name of Balsam, whence the natural family to which it belongs has been called Balsamineæ. The genus is especially an East Indian one, though single species extend into Europe, Siberia, and North America. Linnæus was only acquainted with seven or eight species, but Dr. Wight, in the 'Madras Journal,' vol. ii., states that not less than one hundred species are now known, and almost entirely from the mountains of the peninsula of India, and the Himalayas; in those from Silhet as far north as the Sutlej, and in 30° of N. latitude, at as great elevations as 7000 feet. They are absent from the plains of India; some are found on the Malabar coast, little elevated above the sea, but only during the monsoon. Dr. Royle has stated that they are only found in the Himalayas during the rains, and hence inferred that the moisture and moderate temperature, as well as the equability of both during the rainy season, is as favourable to their growth as the heat and moisture of the peninsula; but Dr. Wight has since ascertained that the species are chiefly found at elevations of 4000 and 4500 feet, in a season where there is moisture combined with a moderate but equal temperature. These facts are important as showing the influence of climate on vegetation; and useful as affording hints and principles for the cultivation of these plants at a lower temperature than is necessary for the plants of the plains from the same latitudes; though great success has been attained in the cultivation of balsams in this country.

IMPENETRABILITY, a name given to the property of matter, the existence of which is suggested when we see that any attempt to place one solid body in the part of space occupied by another is either resisted by the latter, or its success preceded by the removal of the latter. It is then but another name for the cause of that resistance, which we know by the sense of touch, and which is necessary to every idea which we form of matter.

The impenetrability of matter can only be taken in conjunction with the hypothesis of its porosity. Otherwise, it might be successfully disputed. Salt may be dissolved in water without increasing the bulk of the fluid; the (impenetrable?) matter is then penetrated; or else the matter of the fluid has interstices. But if any attempt be made to press the fluid into a smaller space, the impenetrability of the water will appear by its resistance to the pressing substance.

Are we not then making a purely gratuitous introduction of words to supply explanations of phenomena? When matter resists, we have recourse to impenetrability, which is merely saying, so soon as we find resistance, that matter has a power of resisting. But when we ascertain that different portions of matter can be made to fill the same space, whether by solution, pressure, or otherwise, we then appeal to a porosity which we cannot make visible, and presume that matter has empty spaces in which other matter may be placed. This is very much like nature's horror of a vacuum, and other explanations of the same kind.

The answer to this difficulty, and others of a similar kind which occur in attempting to define simple mechanical terms, is that the beginner must not receive them as explanations or as doctrines, but simply as statements of observed phenomena, or at best as terms which imply that explanation is wanted, and serve, till further explanation, to enable us to recal the phenomena themselves and the universality of their existence. Subsequent study and experiment must ascertain the character of this impenetrability, that is to say, the laws of the resistance from which it derives its name. The term is useful to remind us that there is a something which shows itself in all matter; but neither its etymology nor any common notions attached to it must be allowed to dictate any conclusion as to the nature, mode of action, or consequences of that something.

A closer inquiry into the action of matter upon matter shows us that the fundamental notion upon which the above-mentioned something received the name of impenetrability is incorrect. That notion evidently was, that when, for instance, one ball is rolled towards another, the rolling ball absolutely touches the stationary one before it causes motion. There are many circumstances from which it can be inferred, with the highest degree of probability, that such contact is only apparent, and not real. It must be concluded that when the two balls come within a certain small distance of one another, repulsive forces, of the cause and mode of action of which we know nothing, begin to be excited between those particles of the balls which are nearly in contact. It is not our intention in this article to go further into the preceding subject than the mere mention of what are called *molecular* attractions and repulsions, and this merely to point out that the action of matter upon matter must be admitted to commence before the instant at which their surfaces come into contact. [INERTIA.]

IMPERA'TOR. [EMPEROR.]

IMPERIAL CHAMBER, KAMMERGERICHTE, the highest judicial court of the German empire, was established in 1495 by Maximilian I., in consequence of the earnest representations of the Diet, for the purpose of deciding upon all feuds and contentions between the nobles and other members of the empire, administering impartial justice, and thus restoring internal tranquillity to Germany. The chamber consisted of a judge or president appointed by the emperor, and sixteen assessors, half of whom were nobles, and the other half doctors or licentiates of law, all chosen by the emperor out of the lists of candidates presented by the States. They were all irremovable and for life, which was a novel feature of this court. They decided by majority of voices, the president having a casting vote. The Imperial Chamber held its sittings at Frankfort-on-the-Main, but it was afterwards removed successively to Worms, Nürnberg, Augsburg, Ratisbon, and lastly to Wetzlär, where it continued till the dissolution of the empire in 1806. The authority of this court was at first very limited, in consequence of the indefinite exercise of the Imperial prerogative, and the establishment of the Aulic council, which being originally a court of appeal for the Austrian territories, had its jurisdiction extended by Maximilian to take cognizance of suits concerning the empire. [AULIC COUNCIL.] When however the Aulic Council assumed the right of citing the elector of Cologne before it, the States resisted this stretch of authority as an infringement of the rights of the Imperial Chamber. (Coxe's *House of Austria.*) Charles V. remodelled the Imperial Chamber, and framed new regulations for its proceedings, which have been greatly praised by competent judges. (Pütter, *Historical Development of the Germanic Constitution.*) He also established an annual visitation for the purpose of inspecting the proceedings of the chamber, making a report thereupon, and granting in particular cases a new trial on the demand of the parties concerned. The visiting commission consisted of one commissary appointed by the emperor, and other commissaries or delegates appointed by several of the electors, ecclesiastical as well as secular, and by one of the Imperial cities. By the religious peace of 1555 it was agreed that the judge and assessors might be taken indiscriminately from among members of the old religion and of the confession of Augsburg, but it was not until the peace of Westphalia that the proportion of each was definitively settled. The number of assessors was then extended to fifty, of whom the Protestant states presented twenty-four, and the Catholic states a like number, but the two remaining presentations being left to the emperor, the persons appointed were of course Catholics also, making the number of Catholics twenty-six in all. For the quicker despatch of business the chamber was divided into sections called senates, consisting of five or seven members, each senate having for president a count or baron of the empire, who was styled presiding assessor. These presiding assessors were afterwards styled presidents of the Imperial Chamber, but were distinct however from the chamber judge, or first president of the whole court. By the same peace of Westphalia the Aulic Council also was remodelled, and, being opened to Protestants as well as Catholics, became a court of the whole empire, with exclusive jurisdiction in causes which concerned whole principalities, and from that time the business of the Imperial chamber was engrossed mainly by private lawsuits rather than with affairs concerning the States.

(Pütter; Coxe; Dunham, *History of the Germanic Empire;* Harpprecht, *Kammergerichte Archiv.;* Müller, *Kammergerichtsordnung.*)

IMPETI'GO is a term which has been employed by writers in many independent significations, and for various diseases, but is now confined to a disease of the skin, which Dr. Willan has defined to be 'an eruption of yellow itching pustules, appearing in clusters and terminating in a yellow, thin, scaly crust.' It is commonly known in this country as the humid or running tetter, and occurs on all parts of the body, though most frequently on the extremities.

A variety of it is not unfrequently met with in grocers and those much engaged in handling sugar, and to this the term grocer's itch has been applied; but it differs from the itch, properly so called, in its non-contagiousness.

I'MPETUS. [MOMENTUM.]

IMPORTS and EXPORTS are terms used to denote that part of the commerce of a country which is carried on with foreigners and with its external possessions and dependencies. The foreign trade of England is coeval with its earliest history. It must not however be supposed that the commercial dealings of those early days bore much resemblance to those of more modern times. The visits of foreigners to our shores (for England was an exporting country before its inhabitants were become ship-owners or navigators) were then confined to procuring tin from Cornwall. We may be certain that those by whom this earliest British trade was conducted did not obtain the metal without leaving in exchange that which was considered more valuable by the miners. Of what those importations consisted we are not precisely informed. 'Salt, earthenwares, implements made of copper, of ivory, and of amber,' are said to have formed the principal merchandise at that time imported into Britain. In those notices of early times which relate to our commerce no mention is made of wool, which afterwards, and at a comparatively remote period of our annals, became a principal article of export from this country. We learn from Madox's 'History of the Exchequer' that in the reign of Richard I. Gervase de Aldermanbury accounted, as chamberlain of London, for money received as fines from merchants for leave to export wool. In 1275, according to Rymer (tom ii., p. 50), wool was allowed to be exported upon payment to the king of 10 shillings per sack. Within the next twenty years the custom of wool was raised to 20 shillings the sack, and in 1296 was further raised at the will of the king to 40 shillings the sack. It has been attempted to justify this export-duty on the ground of its being a tax upon the foreign manufacturers or consumers, to whom English wool was an article of necessity; but the duty acted as a burthen upon the grower, not only in respect of his surplus quantity which was necessarily exported, but also because the price of the remainder was as necessarily governed by the net value that could be obtained for that surplus. Accordingly we find that this imposition of customs upon the export of wool was a frequent cause of ill feeling between the commons and the crown.

In a statement of the trade of England, said to have been found upon record in the Exchequer, and quoted in a tract called the 'Circle of Commerce,' published in 1623 by Edward Misselden, the list of our exports comprised only wool, coarse woollen cloths, and a small quantity of leather, amounting in value to 294,184*l.*, including the export-duty; while the imports included fine woollen cloths, wax, wine, linen cloth, mercery, and grocery wares, to the amount of 38,970*l.* The shilling at that time contained 213 grains of silver. Taking into account the different value of money then and at present, these values are equivalent to 728,606*l.* and 96,518*l.* of the present coin respectively. This statement of imports and exports does not appear entitled in all respects to be considered accurate. The great disproportion exhibited between the value of the exports and the imports is such as could not have existed in the commerce of an independent nation; but it is remarkable that this circumstance was only brought forward and commented upon as the proof of 'an extraordinary balance of trade in favour of the nation,' a strange conclusion from such premises, but founded upon a view which we can hardly say is wholly exploded at the present day. It is however now pretty generally acknowledged that the commerce of a country to be successful must include in the value of its imports the whole value of its exports, together with the gain which forms the sole inducement of the merchants by whom it is prosecuted.

Until a time comparatively recent our official trade accounts were not kept in such a manner as to allow of any certain deduction being made from them. The annual value of our imports and exports, drawn from statements deserving of full confidence, and extending back to the beginning of the present century, has already been given. [GREAT BRITAIN.] The following analysis of the most important part of the tables whence that statement was drawn, namely, the export of British produce and manufactures, will show the course of our foreign and colonial trade during the period embraced by it, and may lead to reflections by no means favourable to the restrictive system adopted by our legislature.

A statement of the real or declared value of British and Irish produce and manufactures exported from the United Kingdom to different foreign countries and colonial possessions, in each of the years 1805 to 1811, and 1814 to 1836.

Years.	Northern Europe.	Southern Europe.	Africa.	Asia.	Un. States of America.	Brit. N. Am. Colonies, & W. Indies.	Foreign West Indies.	Central and Sn. America (incl. Brazil).	America, excl. of the Unit. States.	Total.
	£.		£.	£.	£.	£.	£.	£.	£.	£.
1805	13,625,676		756,060	2,904,584	11,011,409	...	...	...	7,771,418	36,069,147
1806	11,363,635		1,163,744	2,937,895	12,389,488	...	...	...	10,877,968	38,732,730
1807	9,002,237		765,468	3,359,225	11,846,513	...	...	...	10,439,423	35,412,867
1808	9,016,033		633,125	3,524,823	5,241,739	...	...	...	16,591,871	35,007,591
1809	15,849,449		804,452	2,867,832	7,258,500	...	...	...	18,014,219	44,794,452
1810	15,627,806		595,031	2,977,366	10,920,752	...	...	...	15,640,166	45,761,121
1811	12,834,680		336,742	2,941,194	1,841,253	...	...	...	11,939,680	29,893,549
1814	14,113,775	12,755,816	372,212	2,340,417	8,129	11,429,452	1,791,167	2,683,151	...	45,494,119
1815	11,971,692	8,764,552	333,842	2,931,935	13,255,374	10,687,551	1,156,875	2,531,150	...	51,632,971
1816	11,369,086	7,231,469	351,674	3,071,197	9,556,577	7,016,410	860,948	2,147,497	...	41,657,858
1817	11,408,083	7,685,491	406,359	3,725,386	6,930,359	7,405,516	1,279,781	2,651,337	...	41,492,312
1818	11,809,243	7,630,139	390,586	3,876,677	9,451,009	7,789,780	1,169,609	3,905,757	...	46,112,800
1819	9,895,397	6,895,255	316,294	2,715,018	4,929,815	6,861,314	892,306	2,376,328	...	34,881,727
1820	11,289,891	7,139,612	393,298	3,810,290	3,875,286	5,756,864	939,781	2,921,300	...	36,126,322
1821	9,044,155	6,859,287	482,117	4,277,790	6,214,875	5,461,863	1,050,778	2,942,237	...	36,333,102
1822	8,327,576	8,273,985	384,944	3,984,796	6,865,262	4,778,721	868,040	3,166,714	...	36,659,039
1823	8,055,638	6,801,490	507,328	3,941,448	5,464,874	5,311,757	1,073,914	4,218,893	...	36,375,342
1824	7,691,357	8,007,583	417,741	3,692,404	6,090,394	5,779,033	1,171,221	5,572,579	...	38,422,312
1825	8,547,781	6,098,577	401,589	3,622,981	7,018,934	5,847,287	907,988	6,425,715	...	38,870,851
1826	7,822,776	6,070,494	295,768	4,322,240	4,659,018	4,601,072	570,409	3,194,947	...	31,536,724
1827	8,533,263	5,945,701	671,488	4,799,451	7,018,272	4,980,572	907,309	4,004,319	...	36,860,376
1828	8,243,082	5,532,788	716,926	4,892,408	5,810,315	4,980,748	818,056	5,489,005	...	36,483,328
1829	8,346,118	6,199,356	828,729	4,231,350	4,823,415	5,193,808	969,885	4,929,966	...	35,522,627
1830	8,376,751	7,233,887	905,220	4,455,392	6,132,346	4,695,581	939,822	5,188,562	...	37,927,561
1831	7,317,870	6,232,570	803,392	4,105,444	9,053,583	4,671,276	1,039,634	3,615,969	...	36,839,738
1832	9,897,057	5,686,949	880,753	4,235,483	5,468,272	4,515,533	1,176,804	4,272,247	...	36,133,098
1833	9,313,589	6,298,200	937,015	4,711,619	7,579,699	4,690,139	958,736	4,842,396	...	39,331,413
1834	9,505,892	6,501,141	993,120	4,644,318	6,844,989	4,351,093	1,279,302	5,177,671	...	41,288,526
1835	10,303,316	8,161,117	1,146,047	4,456,116	10,568,455	5,345,698	1,152,841	4,887,068	...	47,020,658
1836	9,999,861	9,011,205	1,468,062	6,750,842	12,425,605	6,518,744	1,238,781	5,955,468	...	53,368,572

It will be seen that although the aggregate value of our exports has considerably increased during the last four years of the series, it is now but little greater than during the early years following the peace of 1814; and if we carry the examination into the geographical divisions of the table, it will be apparent that the portion of our trade which is carried on with the rich and neighbouring countries of Europe has actually and materially declined during that interval.

The spirit of jealousy and retaliation which, by our long-continued system of restrictions for the supposed advantage of a few producers, we have raised up in other countries, is continually showing itself in a more and more formidable shape, causing the exclusion of British manufactures from one market after another, to an extent which would long ago have either compelled the reform of our commercial code, or have produced the ruin of our merchants, but for the extension of previously-existing markets, and the opening of new ones in Asia and America.

The list of our imports from foreign countries and from British colonies and dependencies comprises almost every article of use and of luxury which cannot be profitably produced within the kingdom, including in this description most of those raw materials of manufacture which give employment to a large proportion of our population, and thereafter make up a great part of our exports. The actual value of the cotton, flax, silk, and wool imported in 1836, and a great part of which was afterwards exported in a manufactured state, amounted to at least 21,000,000*l*. It is mainly owing to the mechanical inventions which have given such extension to those branches of manufacture that England has hitherto maintained her commercial superiority, and has been enabled to provide for the sustenance of her continually increasing population.

IMPOSSIBLE. [NEGATIVE AND IMPOSSIBLE QUANTITIES.]

IMPOST (*Imposta*, Italian), the horizontal mouldings serving as a sort of cap or cornice to the piers of arches, and on which the archivolts, or curved mouldings and faciæ surrounding the arches themselves, rest. Like these latter the impost is made plainer or richer according to the order employed, or to the general character of the design. And when the archivolts of the arches are omitted, either the impost is omitted likewise, or a plain hand is substituted for it. This is generally done in basements beneath an order, they being usually rusticated, and the joints of the rustics sufficing for decoration, and giving the requisite architectural expression. Imposts are contrary to the genius of the Pointed style, but, except in the case above alluded to, essential in Roman and Greco-Roman architecture. We have however a few recent instances in which imposts have been omitted, and the archivolt of the arch continued vertically down the edges of the piers. This was a favourite practice with Soane, both in his designs and many of his executed buildings; and it has also been adopted by Burton in the arches of the Ionic screen and opposite gateway, Hyde Park Corner, Piccadilly; but the effect is by no means happy, especially in external architecture, though it may be tolerated in buildings on a small scale, or which make no pretensions to correctness of style.

IMPREGNATION (in Vegetable Physiology). Plants, like animals, are in their more perfect species furnished with organs, by the mutual action of which they are multiplied; the matter contained in the one fertilizing that which belongs to the other, and the result being a young plant or embryo, or vegetable fœtus. In what way this circumstance occurs was till of late years little known, except in the most superficial manner: modern observation has however thrown great light upon the subject, although the inquiry is still in want of much ulterior investigation.

In a perfect plant the anther, or male organ, contains a matter called pollen. The pollen is a congeries of excessively small hollow cases, having to the eye the appearance of fine dust. Each case contains a mucilaginous matter, in which there float granules often not exceeding the 25,000th part of an inch in diameter. The female organ, or pistil, is a hollow case, of considerable size compared with the pollen grains; it bears ovules, eggs, or young seeds in its interior, and is furnished at its apex with a lax, naked, secreting tissue, called the stigma.

At the proper time the anther discharges its pollen, which, by contrivances of various kinds, is made to fall upon the viscid stigma, to which it sticks. In that situation each grain of pollen emits one or more fine transparent tubes, which plunge into the lax stigmatic tissue and descend to the vicinity of the ovules, with which they eventually establish a communication through the foramen of those organs. Into the pollen-tube thus emitted the molecular and mucilaginous matter originally contained in the pollen is discharged, and passing along it eventually arrives in contact with the ovule. What there takes place cannot at present be said to be well made out. By some it is supposed that a portion of the molecular matter is introduced into the sac of the amnios, and there develops into an embryo. But it is by no means certain that this is the fact, although it is no doubt probable that some kind of action of the molecular matter upon the sac of the amnios and its contents produces the embryo. The whole subject is the more in need of careful investigation now that Mr. Griffith has shown that in Loranthus and Viscum at least the ovulum is a formation subsequent to impregnation. (*Linn. Trans.*, vol. xviii., p. 77.)

IMPRESSMENT OF SEAMEN. [SEAMEN.]

IMPROPRIATIONS. [BENEFICE, p. 219; TITHES.]

IMPROVVISATORI are extempore versifiers who can, without preparation, pronounce a certain quantity of verses upon any given subject. This practice is of frequent occurrence in Italy, and the facilities which the structure of the Italian language affords to versification and rhyme are of great assistance towards it. The improvvisatore delivers his verse, generally accompanied by a guitar, and with a sort of chaunting cadence; and he spins out hundreds, nay at times thousands of lines, with apparent ease: whole dramas have been thus delivered. It must not be imagined however that this kind of extempore poetry is of the best kind; in reality very few of those compositions can stand the test of publication. Still they have the merit of the flow of language and the quick adaptation of accessory ideas and images to the main subject, which rivet the attention and excite the surprise of the listener.

Some improvvisatori have been men of real information and poetical genius, and their compositions are consequently superior. An Austin friar of the name of Brother Philip, blind and living in the time of Sixtus V., is mentioned as having done wonders in this way. In our own time Gianni, of Genoa, a man of considerable poetical talent, was made improvvisatore to Napoleon's court, with a handsome salary, and Sgricci of Florence has become known throughout Europe by giving specimens of his art in the various capitals. Several ladies have distinguished themselves in the same art; they are styled improvvisatrici.

IMPULSE. When a body rolls down a gently-inclined plane we can see the gradual alterations of its velocity, and can readily admit that between the instants at which the body has two different velocities it takes in succession all intermediate velocities, or that the change of velocity is perfectly gradual. But when a body is violently struck, as in the case of a bat and a ball, we can see no gradations of velocity, but the ball appears to be at once altered from a state of rest into one of rapid motion, without having passed through any of the intermediate states. In this case it is said to have received an impulse, which word must be interpreted to mean, any cause by virtue of which velocity is communicated suddenly and without gradations.

Though the term impulse may be of convenient application to cases of motion in which velocities are changed very rapidly, it must be remembered that the idea of *absolutely* instantaneous change of velocity is in no degree *less absurd* than that of a point which is in two different positions at the same instant of time. Impulse then must be considered as pressure which, beginning from nothing, increases so rapidly with the time as to produce large effects in a small fraction of a second. Some account of the manner in which impulses act is given in the article PRESSURE.

It is to be remembered that there is nothing absurd in the idea of any change in the state of a body, provided that a time, no matter how small, be allowed for it to take place in. A cannon ball now at rest may, in the millionth part of a second, be imagined to have acquired a velocity such as it has when it issues from the mouth of the gun, provided only that a pressure be imagined sufficient to produce the effect. It is only the production of velocity in no time at all which must not be admitted; though it must be owned that the excessive smallness of the times in which some pressures produce a great effect makes us familiar with the notion of impulse, which further inquiry shows us to be a mechanical impossibility as long as the present laws of nature last.

INA, called also INAS, and IN, king of the West Saxons, and one of the most distinguished kings of the heptarchy, was the son of Cenred, whose descent is carried up through Ceolwald, Cutha, and Cuthwin, to Ceawlin, the third king of Wessex, the son of Cenric, and the grandson of Cerdic, the founder of the monarchy. There are some difficulties however about this account of the genealogy of Ina, on which see a note in Sir F. Palgrave's 'Rise and Progress of the English Commonwealth,' part i., p. 408. He succeeded Ceadwalla, but how is not known, in 689, in the lifetime of his father Cenred; for a collection of laws which he published in the fifth year of his reign are stated in the introductory paragraph to have been enacted with the advice of Cenred and other counsellors. These laws of Ina, which are probably in great part ratifications of older laws, are seventy-nine in number; by them, to quote the summary of Dr. Lingard, 'he regulated the administration of justice, fixed the legal compensation for crimes, checked the prevalence of hereditary feuds, placed the conquered Britons under the protection of the state, and exposed and punished the frauds which might be committed in the transfer of merchandise and the cultivation of land.' The first of the great military successes of Ina was achieved against the people of Kent, who, some years before his accession, had slain Mollo, the brother of Ceadwalla, but who, with their king Wihtred, were, in 692, forced to submit to Ina, and to pay him the full *were*, or legal compensation, for the murder of Mollo, which the Saxon Chronicle states at 30,000 pounds of silver, and Malmsbury, certainly by a great exaggeration, at 30,000 marks of gold. In 710 we find Ina engaged in war with the Britons of Cornwall, under their king Gerent or Geraint (in Latin, Gerontius or Geruntius), whom he finally subdued, and even, it is said, compelled to resign his dominions. A subsequent contest with Ceolred, king of Mercia, was terminated, in 715, by the battle of Wodnesbeorhe, where however it is doubtful which side obtained the victory. The last years of Ina's reign were disturbed by the attempts of several pretenders to the throne—one of whom, called the Atheling Cynewulf or Cenulf, was slain in 721; and another of whom, called Eadbyrht, after being driven from the castle of Taunton, in which he had in the first instance fortified himself, was placed at their head by the people of Sussex, and was not finally put down till 725, after a war of more than two years' duration. In 728 Ina, on the persuasion, it is said, of his wife Ethelburga, who was a daughter of King Escwin, the predecessor of Ceadwalla, resigned his crown in the Witenagemot, and retired to Rome, where he appears to have lived for a few months in obscurity, and to have died before the expiration of the year, his own death being soon followed by that of his wife. There seems to be no truth in the story told in the History ascribed to Matthew of Westminster, that he founded an English school or college at Rome, and established for its support the tax called first Romescot, and afterwards Peter's Pence. He was however a great benefactor of the church; and the abbey of Glastonbury in particular was indebted to him for ample augmentations both of its revenues and its privileges. He is of course a great favourite of the monkish historians; but in this instance their panegyrics seem to have been deserved by the real merits of Ina, both as a warrior and a legislator.

I'NACHUS, a genus of brachyurous crustaceans, placed by M. Milne Edwards under his tribe *Macropodians*. [MACROPODIANS.]

INARCHING. [GRAFTING.]

INCA. [PERU.]

INCANDESCENCE. [HEAT.]

INCIDENCE, ANGLE OF, the angle made by a straight line which passes through any point of a line or surface with the perpendicular to the tangent or tangent plane of that line or surface, drawn through the point in question. The term is little used except in optics.

INCISORS. [DENTITION.]

INCLINATION (commonly called the dip) of the magnetic needle is the angle which such needle, when supported on its centre of gravity, makes with the plane of the horizon.

The instrument by which this inclination is exhibited is a slender cylindrical or prismatic bar of steel, from six to ten inches long, having, perpendicularly to its length, a short axis of bell-metal usually passing through its centre of gravity, which is the middle point of the bar. The latter, previously to being magnetised, would of course, if supported on or suspended by its centre of gravity, remain at rest in any position with respect to the horizon; but on receiving that quality by any of the ordinary processes it becomes subject to the magnetic forces in the earth, and its position is then determined by the direction of their resultant. In general the horizontal axis is made to rest on the edges of two plates of agate, and a graduated circle of brass, having its centre coincident with the centre of gravity of the needle, serves to show the amount of the inclination. The plane of the circle is in a vertical position, and when the inclination is to be observed it must be made to coincide with the vertical plane which passes through the line of direction of the said resultant. The angle made with the geographical meridian of the place by this vertical plane, which is that of the needle's motion, is called the declination of the needle, or commonly the *variation*. [DECLINATION; VARIATION.] It is probably however incorrect to say that the plane in which the needle moves by the action of the magnetic power in the earth is exactly perpendicular to the horizon, though its deviation from such plane is so small as to be insensible in the most delicate observation.

The discovery of the inclination or dip is ascribed to Robert Norman, who observed that in London it amounted to nearly 72 degrees. This ingenious person, in order to ascertain whether or not the inclination was the same in other parts of the world, furnished needles properly mounted to several commanders of ships who were engaged in making voyages to the Indian Ocean, and from them he learned that about the equator the needles remained nearly parallel to the horizon; that on sailing northwards from thence their north ends became depressed, and on sailing southwards their south ends tended below the horizon. In consequence of this information Norman, in 1576 or 1581, published his work entitled 'New Attractive,' in which he announces the discovery; and without expressly saying that he considered the needle to be attracted to the earth, he mentions its tendency to some point within it. Erroneously supposing the inclination to be subject to an invariable law, he states that at the poles of the earth the needle will be perpendicular to the horizon; and he held out a prospect that the latitude of a ship at sea might, by means of this instrument, be easily found.

Dr. Gilbert, who in 1600 published his work 'De Magnete,' was the first to assert that the earth possessed a magnetic property; he supposed however that this property existed only in the terrestrial particles. Dr. Halley, in order to account for the changes observed in the direction of the needle, imagined that the earth is hollow, and that it encloses a magnetic nucleus which revolves on an axis distinct from that of earth's diurnal revolution. He also endeavoured to explain those changes by assuming the existence of four magnetic poles, two in the arctic and two in the antarctic regions; the latter not diametrically opposite to the former. But it will readily be imagined that hypotheses, formed at a time when comparatively few observations had been made, could lead to no useful results; and on account of the diffused polarity in the magnetism of the earth, it must be admitted that the prospect of being enabled to assign correctly the law of its phenomena is still very remote.

From the observations of La Caille, La Peyrouse, and Humboldt, it seemed that the series of places on the surface of the earth where the magnetic needle rested in a position parallel to the horizon were situated on a great circle of the sphere inclined to the geographical equator in an angle of about 12 degrees; it was supposed to cross the latter in two points diametrically opposite to each other, and one of these was placed in 113° 14′ W. long. This was therefore denominated the magnetic equator. The points where the axis of this equator would meet the surface of the earth were, of course, considered as the magnetic poles; and it was concluded that there the magnetised needle would rest in a vertical position. Afterwards, comparing with each other the numerous experiments of Humboldt in Europe and South America, and assuming the magnetic equator to be a great circle of the sphere, M. Kraft of St. Petersburg determined that the tangent of the needle's inclination was equal to twice the tangent of the magnetic latitude of the place of observation.

The experiments of M. Humboldt, which were published in 1805, first made known the fact that the intensity of the magnetic attraction in the earth is least at places where the dipping-needle is horizontal; they also showed that, with considerable irregularities, the intensity increases with the increase of the inclination. From comparisons of the observed intensities with the inclinations and the positions of the places of observation on the earth, M. Biot investigated the seat of magnetic attraction in the latter; and his conclusion is, that this seat is indefinitely near the centre of the earth. He also obtained from his formulæ the same law respecting the inclination as had been immediately before announced by Kraft. And Dr. Young, in 1820, from a consideration of the experiments of Humboldt, was led to suppose that the intensity of the magnetic force would vary as $\sqrt{4-3\sin.^2 d}$ (d representing the inclination, or dip, of the needle).

Unfortunately the observed irregularities of the inclination in different places are so great that no reliance can be placed on either of the above formulæ. On the spot assigned by Biot for the magnetic pole, Captain Sabine, in 1823, found the inclination to be little more than 80 degrees; and this officer observes that no position can be proposed for the magnetic poles with which (if the magnetic equator and parallels are supposed to be circles of the sphere) stations whose magnetic latitudes are the same will not have differences of dip amounting to 10 or 15 degrees; and he considers that, on such an hypothesis, the inclination cannot be taken as an indication of magnetic latitude. In fact, it is now ascertained that the magnetio equator is a curve of double curvature, and crosses the geographical equator in three or four places.

The two voyages made by Captain Sabine, in 1822 and 1823, one towards the equator, and the other towards the north pole, have furnished the latest information we possess concerning the effects of terrestrial magnetism. At the island of St. Thomas, near the equator, the inclination of the needle was 0° 4′ towards the south; tho inclination was towards the north as the ship returned to Europe; at London it was found to be 70° 3′ north; and at Spitzbergen, the most northern station, it was 81° 11′ north. The intensities were determined at all the stations by observing the times in which ten vibrations of the dipping-needle were made; and, being reduced to the value of the intensity when the inclination is nothing, the results were found to differ so much from those indicated by the above formula, as to be decisive against the supposition that any relation subsists between the inclination of the needle and the intensity of terrestrial magnetism. It may be stated here that the result of Captain Sabine's experiments relating to the intensity is, that the latter increases in going from the magnetic equator towards the pole, according to the formula $\sqrt{1 + 3 \cos.^2 i}$ (i being the distance, in degrees, of the given place from the magnetic pole); whence the intensity at the pole appears to be twice as great as that at the equator. Captain Sabine places the pole in lat. 60° N., long. 80° W. from Greenwich (Sabine's *Pendulum, &c., Experiments*, p. 495): but from the observations of Sir Frederic Parry it would appear to be situated in about lat. 70° N., long. 100° W.

When it is intended to observe the amount of the inclination by means of the dipping-needle, the latter having been constructed with a horizontal axis passing through its centre of gravity, it will be necessary first to bring the vertical circle into the plane of the magnetic meridian by means of a horizontal needle, which, having been placed for the purpose on a pivot provided for it, is immediately afterwards to bo removed; the axis of the dipping-needle must thon be placed on the agate plates, which by means of a screw are to be adjusted so that the axis may pass through the centre of the circle. The needle being at rest in the position which it assumes, that is, nearly in the direction of the magnetic attraction, it must be caused to vibrate on its axis, like a pendulum on its point of suspension, by bringing a small magnet near either of its extremities: after a few oscillations it will again rest nearly in the same place as before, and the value of the inclination may then be read on the graduated circle. This must be repeated several times. The face of the circle should then be roversed by turning the latter half round on the vertical axis, and the needle should be made to perform as many vibrations as before; after which a mean of all the inclinations thus observed must be taken. The poles of the needle are then to be reversed by the usual process, and a mean of the inclinations again found, after a repetition, with the reversed poles, of all the former operations. The true inclination will thus be very nearly obtained.

Together with the method just described, it will be sometimes convenient for determining the inclination, to use an element which can be more readily estimated than the precise point at which the needle rests on the circle; and this is the time in which the needle makes any given number of vibrations. On such time the amount of the inclination may, in the following manner, be shown to depend.

Let NCS (*fig.* 1) be the direction of the needle in the plane of the magnetic meridian; take NC to represent the intensity of the magnetic force in that line, and resolve this force into the forces represented by Cn and nN, in a horizontal and vertical direction respectively. Then, representing the force in CN by M, and the angle HCN of inclination by d; if the needle be made to traverse horizonally by a weight applied to some part of the arm CS, the intensity Cn may be expressed by M cos. d. Again, if the needle be placod in a vertical plane perpendicular to the magnetic meridian, the horizontal intensities on the two arms being

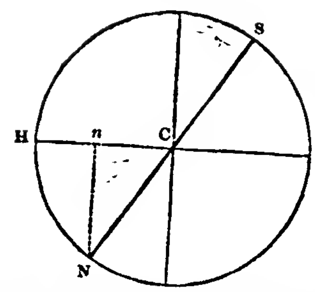


Fig. 1.

counteracted at C, the point of support, it follows that the needle will assume a vertical position, and that nN, or M sin. d, will represent tho intensity in that direction. Now, like the force of gravity in producing the vibrations of pendulums, the intensity of the magnetic force is proportional to the square of the number of vibrations made by the needle in a given time; or, the time of making one, or any given number of oscillations, is inversely proportional to the square root of the force of attraction. Therefore, if we count the time (T) in which a given number of oscillations are performed by a dipping-needle moving freely in the plane of the magnetic meridian, and the time (t) in which that number of oscillations are performed by the needle in a plane perpendicular to the meridian, we shall have

$$t^2 : T^2 :: M : M \sin. d; \text{ or } t^2 : T^2 :: 1 : \sin. d.$$

Likewise, if we count the time (T) in which a given number of oscillations are made in the plane of the magnetic meridian, as before, and the time (t') in which that number are made by a needle when traversing horizontally, we shall have

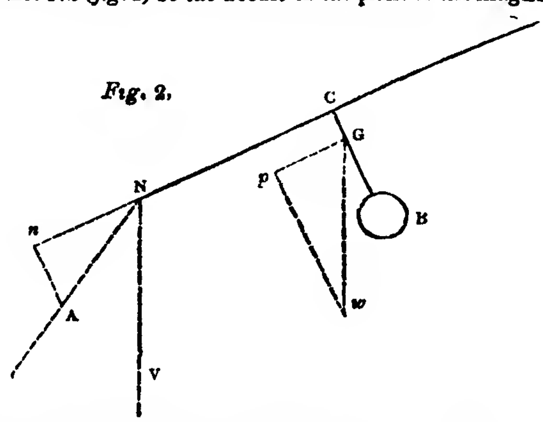
$$t'^2 : T^2 :: M : M \cos. d; \text{ or } t'^2 : T^2 :: 1 : \cos. d.$$

And by either of these methods the amount of the inclination d may be obtained.

It is seldom that the horizontal axis will be found to pass precisely through the centre of gravity of the needle; and when this is not the case, the magnetic attraction in the earth becomes combined with that of gravity, so that the inclination due to the former is either increased or diminished by that which depends on the latter; and the observed inclination requires a correction in order to reduce it to what it would be if the centres of gravity and motion were coincident. For the purpose of obtaining the amount of this correction with precision, by rendering the effect of gravity very perceptible, Professor Mayer caused a wire with a brass ball at one end to be screwed into a needle, perpendicularly to the length of the latter, and immediately above or below the horizontal axis. Previously to being magnetised, the needle was made to balance itself accurately in a horizontal position when the wire and ball were below the point of support; and the place of the centre of gravity was, consequently, somewhere in the axis of the wire. Then, by observing the inclination both when the ball is above and when it is below the axis of the needle, the intensity of magnetism and the action of gravity may be eliminated; and a formula expressing the truth, in terms of the observed inclinations, may be obtained.

Let NS (*fig.* 2) be the needle in the plane of the magnetic

Fig. 2.



meridian, and C be the place of the horizontal axis. Let NA be the direction in which the magnetic attraction (M) acts on the needle, and let the same line represent that force; also, let NV be a vertical line: then $\angle$ANV ($=d$) will be equal to the complement of the needle's true inclination; and, SN being produced, $\angle n$NV ($=b$) is the complement of the observed dip or inclination. Resolve NA into Nn and nA by drawing the latter perpendicularly to SN produced; then An will express the effective force of the magnetic attraction in that direction. But An = AN sin. nNA = M sin. $(b - d)$; or (by trigonometry) = M (sin. b cos. d − sin. d cos. b); and this being multiplied by NC ($=l$) gives the energy of the magnetic power to turn the needle about C.

Let B be the brass ball at the end of the wire CB, and let G be the centre of gravity of the needle and ball. Then, taking Gw to represent the weight (W) of these, resolve it into Gp and pw; the former parallel and the latter perpendicular to NS: the last produces no effect to turn the needle about C; and the former is equal to W sin. Gwp, or to W cos. b. Then, if CG be represented by g, we have Wg cos. b for the effect of the weight of the needle to turn the latter about C. This force, in the above position of the ball, acting in an opposite direction with respect to the magnetic power at N, must be subtracted from the latter, in order to give the combined effect of both gravity and magnetism on the needle; and, in the case of equilibrium, we have

$$Ml\,(\text{sin. } b \text{ cos. } d - \text{sin. } d \text{ cos. } b) - Wg \text{ cos. } b = 0;$$

or, dividing by M l cos. b, and putting C for $\frac{Wg}{Ml}$, we get

$$\text{tan. } b \text{ cos. } d - \text{sin. } d - C = 0; \text{ whence tan. } b = \frac{\text{sin. } d + C}{\text{cos. } d}.$$

By reversing the needle on its fulcrum C, so that G may stand above C, we should have, in like manner,

$\text{tan. } b' = \frac{\text{sin. } d - C}{\text{cos. } d}$; and combining together these two equations we obtain, finally,

$$\text{tan. } d = \tfrac{1}{2}\,(\text{tan. } b + b'):$$

where b and b' are the complements of the two observed dips or depressions of the needle, and d is the complement of the required inclination.

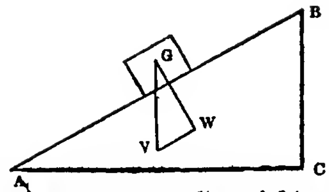
One of the needles used by Captain Sabine in the voyages of 1822 and 1823 was of the kind last mentioned. [MAGNETISM; VARIATION.]

INCLINATION. The inclination of two lines is a phrase commonly used for the angle which they make with one another. Thus two lines which make a very small angle are said to be at a very small inclination to each other. Looking at the etymology of the word, and its use in common language, it would seem proper to say that one line is without inclination to another when the two are perpendicular; and that the smaller the angle the greater the inclination. But custom has settled otherwise, and has, in fact, made the word inclination synonymous with angle; while the term angle of incidence holds the place which, according to etymology, belongs to angle of inclination.

INCLINED PLANE. Among the mechanical powers, as they are termed, meaning the contrivances by which pressure is advantageously applied, the inclined plane has held a place in practice in every country in which the arts have made any progress. But the introduction of this contrivance into the theory of mechanics dates from the time of STEVINUS, to whose life we refer for an account of the very remarkable addition which he made to the first principles of statics by means of the inclined plane.

If a weight be placed upon a horizontal plane on which there is no friction, it is obvious that the weight will be entirely supported, and that any horizontal pressure, however small, will cause motion. If the same plane be made vertical instead of horizontal, the weight cannot be placed *upon* it, for if the heavy body were made to touch the plane and then left to itself, it would fall down the plane exactly in the same manner as it would fall if there were no plane; that is, supposing there to be no friction.

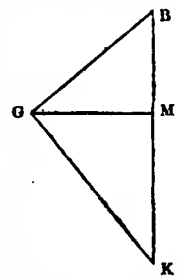
If the plane be made to assume an oblique or inclined position, the effect produced will be intermediate between those of the preceding cases. The weight will not rest, nor will it acquire velocity as rapidly as when it falls freely. The reaction of the plane will counterbalance a portion of the weight, as follows:—Let AB represent a section of the plane, and G a section of the weight. Let GV represent



the magnitude and direction of the weight, and draw GW and WV perpendicular and parallel to AB. Then [COMPOSITION] the pressure GV is equivalent to the two pressures GW and WV, of which the former is destroyed by the resistance of the plane, and the latter only acts to propel the heavy body down the plane. Now VW is to VG as BC is to AB; that is, a weight placed upon an inclined plane is propelled down the plane by such a fraction of the whole pressure of the weight as the height of any section of the plane is of its length.

If then it were required to draw the heavy body G up the plane, any pressure exceeding VW would be sufficient for the purpose; and a pressure equal to VW, applied in the direction AB, would keep the weight at rest.

If a body which is placed at B on an inclined plane be allowed to fall to G, the velocity which it will then have, and the time of describing BG, are determined as follows:—Let BK be vertical, GM horizontal, and GK perpendicular to BG. Then the velocity at G is that which would be acquired by a body falling freely from B to M; and the time of describing BG would be that in which a body falls freely from B to K. From hence follows immediately the remarkable proposition that if any number of chords be drawn from the highest point of a vertical circle, and if these chords be the sections of as many inclined planes, the times of falling down any two of these chords are the same.



The preceding results are obtained by applying the method explained in the article FALL OF BODIES. Using the notation in that article, and supposing θ to be the angle by which the plane is inclined to the horizon, the accelerating force which urges the weight downwards is $g \sin\theta$. Consequently we have the following equations:—

$$v = g\sin\theta.\,t. \quad s = \tfrac{1}{2}\,g\sin\theta.\,t^2. \quad v^2 = 2\,g\sin\theta.\,s.$$

Here s is the length BG: and $s \sin\theta$ is BM.

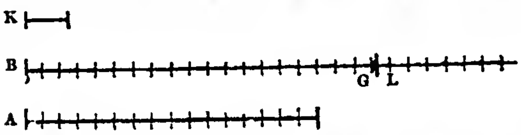
The preceding results suppose friction not to exist: now let there be a friction, the proportion of which to the pressure is the fraction k. Then W representing the weight, the propelling pressure VW is W $\sin\theta$. But the pressure on the plane, or GW, is W $\cos\theta$; consequently k W $\cos\theta$ is the amount of pressure down the plane which friction will resist. If then k W $\cos\theta$ be greater than W $\sin\theta$, that is, if k be greater than $\tan\theta$, the weight will not move; if k be equal to $\tan\theta$, the weight will be just poised, and any pressure, however small, will cause motion; if k be less than $\tan\theta$, the weight will move downwards with an accelerating force $g\,(\sin\theta - k\cos\theta)$.

There are many remarkable properties connected with the motion or equilibrium of bodies on inclined planes; but the preceding are those which are most fundamental and most frequently required.

INCOMMENSURABLE, INCOMMENSURABLES, THEORY OF. The application of arithmetic to any science of concrete magnitude supposes a certain magnitude to be taken as unity, and all other magnitudes to be expressed by the number of times or parts of times which they contain this unit. Such an application therefore requires the assumption of this proposition, that all magnitudes are either fractions or multiples, or compounded of fractions and multiples, of any magnitude that may be named. This proposition is not true; for instance, we shall presently prove that if the side of a square be called 1, no number or fraction whatsoever will exactly represent the diagonal. But we shall also prove that it may be made as nearly true as we please: for instance, that we may find a line as nearly equal to the diagonal as we please, which shall be a definite arithmetical fraction of the side. Quantities which are so related that when one is capable of being represented in terms of a certain unit the other is not, are called *incommensurables*. The reason is as follows:—any two whole numbers or fractions of the same unit must have a common measure: thus all whole numbers have the common measure 1; and any two fractions, $\frac{a}{b}$ and $\frac{p}{q}$ (a, b, p, and q being whole numbers), have the common measure $\frac{1}{bq}$, which is contained exactly aq times in the first, and bp times in the second. Conversely, any two magnitudes which have a common measure can be arithmetically represented by the same unit: for if A and B have the common measure M, and if this measure be contained 7 times in A and 10 times in B, then it is evident that by taking M as the unit, A is represented by 7, and B by 10. If then there be two magnitudes which cannot be represented by means of the same unit, they cannot have any common measure, and are therefore *incommensurable*. It also follows from the preceding that any two commensurable magnitudes must be to one another in the proportion of some one whole number to some other whole number.

To prove that there are such things as incommensurable magnitudes, we shall take the 117th (and last) proposition of the tenth book of Euclid, which demonstrates that the diagonal and the side of a square are incommensurable. Let D be the diagonal and S the side, and if they be not incommensurable let a and x be the whole numbers to which they are proportional, that is, let M be a common measure, and let D and S severally contain M, a and x times. Then the square on D will contain the square on M aa times; and the square on S will contain the square on M xx times. But the square on D is double of the square on S; therefore aa is twice xx. Now let a and x have no whole common measure except unity, which may be supposed, for if they have a common measure divide both by it, which will give two whole numbers in the same proportion; and so on until no common measure is left. Then because a times a is double of x times x, a times a is an even number; whence a is an even number, for if a were odd, a times a would be odd. Therefore x is not an even number, for if it were, a and x would have the common measure 2: whence x is an odd number. Let k be the half of a, which is a whole number, since a is even; whence $a = 2k$, and $aa = 4kk$, which is also $2xx$, and thence it follows that $xx = 2kk$. Therefore xx is an even number, and x also, for if x were odd xx would be odd: whence x is even. But it was just now proved to be odd; so that the same number is both odd and even, which is absurd. This contradiction follows whenever we suppose S and D to be in the proportion of any two whole numbers; consequently S and D are not in the proportion of any two whole numbers, and therefore are incommensurable; for if they were commensurable they would be in the proportion of some two whole numbers.

We have next to prove that any two magnitudes whatsoever, being incommensurable, may be made commensurable by as small an alteration as we please in either. Let A and B be two incommensurable magnitudes, and let K be a third magnitude of the same kind, which may be as



small as you please, provided only that it be given and known. [INDEFINITE.] Now, some aliquot part of A must be less than K; if not the hundredth, try the thousandth; if not the thousandth, try the millionth, and so on. Whatever K may be, it is possible to divide A into equal parts, each of which shall be less than K. Let M be such an aliquot part of A, and having divided A into its parts, set off parts equal to M along B. Then A and B being incommensurable, B will not contain M, the measure of A, an exact number of times, but will lie between two multiples of M, say BG and BL. From this it is obvious that B does not differ from either BG or BL by so much as GL, and therefore not by so much as K. But BG and BL are both commensurable with A, since all three are multiples of M. Here there are BG and BL, the first a little less than B, and the second a little greater, neither differing from B by so much as K, but both commensurable with A. Thus it is also evident that two whole numbers may be found which shall be as nearly as we please in the same ratio as two given incommensurable quantities.

The difficulty thus inherent in the application of arithmetic to concrete magnitude is not met with in practice, because no case can arise in which it is necessary to retain a magnitude so closely that no alteration, however small, can be permitted. But in exact reasoning, where any error, however small, is to be avoided, it is obvious that the arithmetic of commensurable magnitudes, and the arithmetic (if there be such a thing) of incommensurable magnitudes, must not be confounded. The difficulty was overcome by Euclid, in the manner pointed out in the article PROPORTION, so completely and effectually that nothing has been added to his solution of it except unsuccessful attempts to evade it. Those who avoid the fifth book of Euclid generally substitute either the tacit assumption that all magnitudes are commensurable, which is not true, or some metaphysical play upon words, which a person who feels the rigor of Euclid places on the same shelf with nature's horror of a vacuum, and other explanations of the same kind. We could even point out a celebrated work on geometry which expressly rests on being able to make its errors too small to be perceived by the senses, and asks for no other reception of propositions which involve incommensurables.

The doctrine of incommensurable quantities was carried by Euclid to an extent which would excite as much admiration as any portion of his writings, if the tenth book were generally known and read as the production of a person unassisted by algebra. [IRRATIONAL QUANTITIES.]

INCOMPATIBLES (in Chemistry). Such salts or other compounds as suffer mutual decomposition when made to act upon each other are said to be incompatible. It is upon the changes which bodies undergo in consequence of their incompatibility that numerous important processes depend; thus the salts of barytes and those which contain sulphuric acid always decompose each other; and the sulphate of barytes, which is insoluble and precipitated, being washed, dried, and weighed, indicates the quantity of sulphuric acid, and consequently that of the salt containing it, which was decomposed by the barytic salt.

INCONCINNOUS INTERVALS, in music, are sounds which agree with no scale, therefore are disagreeable to the ear, and never used in any kind of composition.

INCREMENT and DECREMENT. When two quantities are considered together, one of which is greater or less than the second, the latter is said to be the former with an increment or decrement. In the older English writings the calculus of differences is called the method of increments. This phraseology refers to the supposition of magnitudes being generated by continued increase or decrease as in the method of fluxions, so that two different magnitudes are spoken of as the same thing in different states, and of course at different times. Some difficulty to the beginner may be occasionally avoided by his stopping to interpret 'let x become $x+h$' as follows:—'let us, having considered the value of a function of x, proceed to consider the alteration which will arise if $x+h$ be written instead of x.'

INCUS. [EAR.]

INDEFINITE means 'not given or defined in magnitude. Thus a definite straight line is that of which the extremities are known; an indefinite straight line is one of which the direction is given, and which may be supposed to have any length, or which can be lengthened if necessary, without contravening any of the conditions of the problem. Thus Euclid, in the first book, constructs an equilateral triangle upon a definite straight line; and shows how to draw two lines making with one another the same angle as that made by two given indefinite straight lines.

There is however a reprehensible use of the word indefinite which is found in many mathematical works; namely, the employment of it to avoid the odium which attaches to the word infinite. Thus we hear of making a magnitude indefinitely great, of an indefinitely small arc being equal to its chord, of the circle being a polygon of an indefinitely great number of sides. In all these cases it would be better, with a proper definition, to use the word infinite at once.

A want of proper distinction between definite and indefinite sometimes leads to confusion. For instance, it is said that if a straight line be halved, if its half be then halved, and if fresh portions be continually taken, each of which is tne half of the preceding, the result will at last become less than 'any line which can be named.' This is not true if the line which is to be named be indefinite; that is, if we may at any part of the process make it as small as we please: for it is obvious that whatever a line may be, a smaller line can be named. But it is true of a definite line, made definite, or given in length, at the beginning of the process: name any line, however small, but such as you name it let it remain; then by continually halving any other line, however great, you must at last arrive at a line which is less than the length you named. The phraseology of a line 'less than any line which can be named' has often caused a difficulty by not specifying the time at which it is to be named. The language used by Euclid himself is as follows (book x., prop. 1), and is free from the ambiguity in question: 'Two unequal magnitudes being given, if from the greater be taken away its half, and from what is left its half, and if this be done continually, a magnitude will at last be found which is less than the lesser of the two given magnitudes.'

INDENTURE. [Deed.]

INDEPENDENTS, the name of a sect, class, or denomination of English Protestant Dissenters, one of the three who united form the Three Denominations, the other two being the Presbyterians and the Baptists.

When the principle of resistance to the power which maintained at least an outward and specious uniformity of Christian practice and opinion had received encouragement and was successful, it was not to be expected that nations who recognised the principle would agree among themselves respecting what should be done in their new condition of religious freedom. In England the politicians of the time soon succeeded in establishing a national church with pastors and bishops, and the church has been maintained in that form and order from the time of the Reformation, with the slight exception of the period of the Commonwealth. But there were many people in England who objected to several things which made a part of the constitution of that church; and as their objections consisted very much in the desire of what they considered a greater degree of purity in its forms, they were called in derision Puritans and Precisians, in which allusion was also included to the greater strictness with which they observed their religious duties, and their supposed peculiar preciseness in respect at once to an exactness of conformity to Scripture precedent and to the obligations of a severe morality.

These persons were not all of one mind within themselves. Many united with these distinguishing characteristics the principle that, there being no scriptural authority for the Episcopal order, the government of the church or the superintendence of its ministers ought to be vested not in an individual, but in synods and presbyteries; these formed the Presbyterians. There were others who would have no union or government of the church, who regarded each congregation of faithful men as being in itself a church, and when properly constituted with deacons and a pastor forming a body which was independent of every other, and competent to its own direction and government without any interference from presbyteries, bishops, or from the state itself; this is the pure principle of English Independency.

Robert Brown, a clergyman of tho reign of Elizabeth, is generally reputed to be the first person in England who publicly avowed this opinion, and acted upon it by the establishment of various such separate churches, which however had no enduring existence. There is some question whether ho retained his opinions to the last: but it is certain that after he had given no small trouble to the authorities in the church, he was presented to the living of Achurch in Northamptonshire. Whoever wishes to peruse a full account of of this person may refer to the *Biographia Britannica*. He closed a long and very troubled life in the gaol at Northampton, or very soon after he had left it, in 1630.

Other persons, and some of them of celebrity in the history of the Puritans, adopted the opinion, but were restrained from acting upon it by the laws then in force for maintaining the Church of England as then established. But when Episcopacy was abolished and Monarchy had been overcome, there was a large party of these Independents which suddenly presented itself, who had a great share in the struggle which was then made, and who were the means of preventing the establishment of a Presbyterian church in England, which it was the object of by far the larger portion of the Puritan body taking part in the contest to form. Cromwell belonged to the Independents. Dr. John Owen, dean of Christ Church, who was also for a time vice-chancellor of the University of Oxford, is considered as the chief ornament of this denomination at the time (the Commonwealth) when it first became considerable.

What the issue might have been of the struggle between the principle of Independency and the principle of Presbyterianism cannot now be told, the king being soon restored, and with him the Episcopal church. In 1662 the Act of Uniformity was passed, the object of which was to exclude from the ministerial office in the Church of England divines of either of those opinions. The act required a direct acknowledgment of the principle of Episcopacy. The effect of it was, that about 1900 ministers retired from the places they held in the church. Some make them 2000. These are the ministers whom Dissenters mean when they speak of 'the illustrious two thousand,' 'the ejected ministers,' or 'the Bartholomew worthies.' During the reign of Charles II. every effort was made to prevent these persons continuing to exercise their ministry. But it was all in vain. They, or at least the greater part of them, persisted in preaching, notwithstanding the certain penalties of imprisonment and fine. However, the Revolution of 1688 freed them from these penalties; one of the first acts of the new government being to grant toleration to them, that is, to allow them to open meeting-houses, or chapels, and to conduct the services under the protection of law.

The Independents were inconsiderable at that time as compared with the Presbyterians. Both however (and the Baptists also) built chapels for themselves and formed themselves into congregations, called the Presbyterian congregations and the Independent congregations; and each denomination had its own board or fund.

The 'Act of Toleration' was passed in 1689, and for the seventy years succeeding that date the Independent denomination (as indeed was the case with the whole body of Dissenters) dwindled, and it would probably by this time have become extinct but for the state of things which we have now to describe.

About the middle of the eighteenth century there was an extraordinary revival of religious zeal under the influence created especially by the Wesleys and Whitefield. The Dissenters, like the Church, had adopted the principle pretty generally, that to inculcate the moral duties, to present the paternal government of God as a source of consolation and of hope, to hold out the prospect of future accountableness and of eternal life, to show the evidence on which we receive Jesus Christ as the minister and messenger of his heavenly Father, were the principal subjects on which it was the duty of Christian ministers to insist. This it was easy to represent as an abandonment of the distinctive truths, as they are sometimes regarded, of Christianity; and many persons, under the preaching above alluded to, were disposed so to regard it, and to seek a ministry by whom these distinctive truths would be made more prominent. Most of these persons joined themselves to one of the three Methodist bodies; the Wesleyan Methodists, the Whitefieldian Methodists, or the Countess of Huntingdon's Connection; but there were many who declined to unite themselves with any of these bodies, and formed themselves into separate churches upon the Independent principle. This new body of persons incorporating with themselves the small remains of the old Independents of England, who, in some instances had, throughout the period by some called the period of Religious Indifference, adhered to the original opinions of the Puritan body at large, which were Calvinism, and had continued to make those opinions prominent in the public services, or joining themselves to such decayed and decaying churches, now form that vast body of Dissenters called Independents. By this accession the Independent denomination now greatly outnumbers the Presbyterian denomination, and for the last few years has determined the proceedings of the body of Dissenters when acting in concert.

Of late however this concert has been disturbed. The body of Presbyterian Dissenters have withdrawn from the union of the three denominations, and act by themselves.

The Independents have numerous chapels in London and in various parts of the country, with many very acceptable and popular ministers. They have also several institutions for the education of their ministers. They still maintain the principle of Independency; are in general strongly opposed to a national establishment, whether

Episcopal or Presbyterian; and in doctrine vary, from the high Calvinism of the Savoy Confession, which exhibits the doctrines held by the Independents of the time of the Commonwealth, to the most moderate form of orthodoxy.

The number of Independent ministers is about the same as the number of chapels. The following is a list of the colleges and academies which are exclusively confined to the education of ministers for the Independent denomination. Some of them have wealthy endowments; others depend upon annual subscriptions for their support. Very few Independent ministers are able to pay the expenses of their own education.

Homerton college, Middlesex, founded in 1730. The uumber of students is 20; the term of study is 6 years.

Rotherham college, Masborough, Yorkshire, founded in 1756.

Coward college, University college, London, was, previous to the removal of the institution to London, at Wymondley, Herts. Dr. Doddridge wes the first tutor of this college. Number of students, about 18; term of study, 5 years. This college is more richly endowed than any other dissenting college.

Highbury college, Middlesex, founded in 1778. Number of students, 40; term of study, 4 years.

Western academy, Exeter, founded about 1750.

Blackburn, Lancashire, founded in 1816.

Airedaile college, Undercliffe, near Bradford, Yorkshire.

Newport Pagnell academy, founded in 1783.

Hackney academy, Middlesex, founded in 1802. Term of study, 2 years.

A new college has been recently founded at Birmingham.

The following list of the number of Independent chapels in the different counties of England is taken from the Supplement to the 'Congregational Magazine' for the year 1829, since which time many new Independent chapels have been built:—

Bedfordshire, 8; Berkshire, 14; Buckinghamshire, 21; Cambridgeshire, 23; Cheshire, 27; Cornwall, 31; Cumberland, 16; Derbyshire, 36; Devonshire, 65; Dorsetshire, 22; Durham, 13; Essex, 64; Gloucestershire, 38; Hampshire, 49; Herefordshire, 11; Hertfordshire, 28; Huntingdonshire, 9; Kent, 44; Lancashire, 88; Leicestershire, 17; Lincolnshire, 18; London and Middlesex, 91; Monmouthshire, 24; Norfolk, 21; Northamptonshire, 35; Northumberland, 8; Nottinghamshire, 12; Oxfordshire, 14; Rutland, 3; Shropshire, 25; Somersetshire, 47; Staffordshire, 32; Suffolk, 33; Surrey, 27; Sussex, 31; Warwickshire, 30; Westmoreland, 12; Wiltshire, 38; Worcestershire, 10; Yorkshire, 154; North Wales, 172; South Wales, 202.—Total, 1683.

INDETERMINATE, a word which is mostly applied in methematics, not to the character of a megnitude, but of a problem. A question is said to be indeterminate when it admits of an infinite number of solutions: if the number of solutions, few or many, be finite, the problem is sometimes, but we believe not most frequently, called indeterminate. The word indeterminate is also applied to the co-efficients of an assumed form of expansion, and the investigation by which they are then found is called the 'method of indeterminate co-efficients.' But when thus used, the word means nothing more than unknown, and the co-efficients are unknown or undetermined quantities. In the French mathematical writings, the word *indeterminé* should sometimes be translated by indeterminate, sometimes by arbitrary, and sometimes by undetermined, or unknown.

INDEX. [EXPONENT.]

INDIA. [HINDUSTAN.] There are at present three presidencies of India:—

Presidency.	Capital.	Governor.
Bengal	Calcutta	Lord Auckland
Fort St. George (or Madras)	Madras	Lord Elphinstone
Bombay	Bombay	Sir Robert Grant

Lord Auckland is also Governor-General of India. The Bengal Presidency was in Nov. 1834 (under powers given by 3 & 4 Wm. IV., c. 85, s. 38) divided into two, namely, the Presidency of Bengal, and that of Agra; but at the end of 1835 the Agra Presidency merged again into that of Bengal. The Compeny still retain, by the above act, the power of dividing this Presidency.

Some years ago there was another presidency, called the Presidency of Prince of Wales Island, Singapore, and Malacca; but it now forms part of the Bengal Presidency, though the chief civil officer there is still called governor, on account of certain legal technicalities.

During part of the duration of the Agra Presidency, the seat of government was at Allahabad, a circumstance which has given rise to some confusion. The reader should bear in mind these facts in his perusal of the article HINDUSTAN.

INDIA COMPANY. [EAST INDIA COMPANY.]

INDIAN CORN. [MAIZE.]

INDIAN INK. [INK.]

INDIAN RUBBER. [CAOUTCHOUC.]

INDIA'NA, one of the states of the North American Union, is bounded on the south-east by the Ohio, which separates it from Kentucky for 280 miles, or 450 miles reckoned along the windings of the river; on the east by a meridian line, which separates it from the state of Ohio for 177 miles, and from the Michigan territory for 10 miles; on the north by the parallel of 41° 47′ N. lat. to Lake Michigan for 110 miles, and by the southern extremity of that lake for 40 miles; on the west by a meridian line to the Wabash for 162 miles, and by that river to its mouth for 120 miles direct distance, which line and river separate it from the state of Illinois. It lies between 37° 48′ and 41° 47′ N. lat.; its circuit is about 900 miles, and its area is 36,500 square miles, or about 14,000 square miles less than the area of England. The Ohio and the Wabash are the most important rivers. The Wabash rises in Ohio and flows thence into this state, having a course first to the north and then to the south-west; it then makes a great bend to the south, and flowing in that direction about 90 miles it becomes the boundary of the state. Its whole course through this state, and along its western boundary, is between 500 and 600 miles, for the whole of which distance it is navigable except at its falls or rapids. All the other principal rivers of the state are tributaries of the Wabash: the White River enters the Wabash about 120 miles above its mouth, and is formed of two main branches, of which the northern has a south-west course of about 300 miles, and the East Fork has also a general south-west course of 200 miles. Both of them receive several large tributaries. Above the great bend the Wabash receives the Tippecanoe and Eel rivers from the north-east, then the Missisinewa from the south-east, and Little River from the north-east. White-water rises in Ohio, and entering this state on its eastern boundary after a course of 80 miles, returns to Ohio and falls into the Miami. Many streams fall into the Ohio, but none of much magnitude. The same remark applies to those which flow into Lake Michigan. The two branches of the Maumee which flow into Lake Erie, the St. Joseph's and St. Mary's, both enter this state from Ohio before their confluence, and, what is most remarkable, in a course almost directly opposite to that which the united stream takes after the junction. Both the Kankakee and its main branch the Pickimink rise in this state, and the former has the greater part of its course likewise in it.

This state, like Illinois, has a general slope to the south-west. Like that state also it is, with few exceptions, one great plain. There is indeed a tract of hilly country north of the great bend of the Wabash, and the state is skirted on the south by those eminences called 'Ohio hills,' which sometimes touch the Ohio and sometimes retire from it for two or three miles; they occasionally rise 300 feet above the river. The timbered and prairie lands are more intermixed in this state than is usual; and the alluvial river bottoms are all wide. The soil is admirably suited for grass and grain. The climate is somewhat more equable than that of Illinois, and milder than that of western Pennsylvania. It is everywhere healthy except in the neighbourhood of the wet prairies and swamps. Iron, copper, coal, and salt have been found, but no mines are yet worked. Among its numerous caves is one of great extent near the Ohio, in which Epsom salts are found in lumps from one to two pounds weight. A bushel of its earth yields from four to twenty-five pounds of the salt. Nitre and gypsum are found in the same cave.

Indiana is divided into sixty-four counties. Its population by the last census was 343,081; its increase in ten years was 133 per cent. The agricultural products of the state are wheat, maize, tobacco, and a little cotton; swine and cattle are also reared. The most successful vineyards in the United States are at Vevay on the Ohio. They are managed hy the Swiss settlers at that place, and consist of native species of the vine, the foreign being found too succulent in that soil and climate.

A canal designed to connect the Wabash from the mouth of the Tippecanoe with Lake Erie through the Maumee River is in progress, and when completed it will probably be the channel by which Indiana and a part of Illinois will receive their foreign merchandise from New York. Its whole length will be 211 miles, of which about 40 miles is in Ohio. In June, 1834, there was but one bank in the state, with a capital of 150,000 dollars. Another has been chartered.

Indianopolis, on the east bank of White River, in 39° 47′ N. lat., is the capital of Indiana. It is near the centre of the state, and is accessible to steamboats. Its population in 1830 was only 1200, but, like other towns in the state, it is rapidly increasing. Vincennes, on the Wabash, 150 miles above its mouth, was settled by the French about 1690: the population is about 1800. New Albany, on the Ohio, a little below Louisville in Kentucky, is the largest town in the state, containing a population of 2500. Jeffersonville, opposite to Louisville, is a small but handsome town with 1000 inhabitants. Madison, midway between Louisville and Cincinnati, has a great export trade, particularly in barrelled pork: its population is 2000. Vevay, on the same river, 45 miles below Cincinnati, contains about 1500 inhabitants, chiefly Swiss. New Harmony, on the Wabash, was founded in 1814 by a society of Germans, under George Rapp, who some years afterwards sold the establishment to Robert Owen, and removed with his followers to Pennsylvania. There is a college at Bloomington, and another at South Hanover, which are yet only humble establishments. The Baptists are the most numerous sect, and next to them the Presbyterians and Methodists. The general assembly consists of a senate of 30 members, and a house of representatives of 75. The annual expenses of the state do not generally exceed 40,000 dollars. Indiana was included in the cession of Virginia to the United States in 1787. It was placed under a territorial government with Illinois in 1800, and under a separate one in 1809. In 1816 it became a state and formed its present constitution.

About 5000 Indians still remain in the northern part of the state: they are principally Pottawattamies and Miamis.

INDIANITE. This mineral occurs in granular masses. Hardness 5·0 to 5·5: scratches glass. Colour white or greyish; lustre shining; translucent; specific gravity 2·74; infusible by the blowpipe; gelatinizes in acids. It occurs associated with garnet, felspar, fibrolite, and hornblende.

INDIANS. [North American Indians.]

INDICATORI'NÆ, Mr. Swainson's name for the *Honey Guides*, a subfamily of cuckoos (*Cuculidæ*).

There appears to be but one genus, *Indicator* (Le Vaillant), which is thus characterised. Bill straight, finch-like; the base triangular; the sides compressed. Culmen and gonys equally inclined towards the tip; gonys angulated. Wings lengthened, pointed. Tail moderate, rounded. Feet short. Middle toe much longer than the tarsus.

Mr. Swainson is of opinion that the nearest approach to the creepers yet known is made by the African Honey-guides, whose bill is not unlike *Orthonyx*; and he adds that these birds are said to climb in a more perpendicular manner than any others of this family: the same zoologist has pointed out the affinity of *Indicator* to *Buphaga*.

The species are not numerous. The stories told of these birds indicating the nests of bees and guiding men to them by their motions and cries, from the time of Sparrman downwards, appear to be perfectly authentic, though some great travellers affected to disbelieve them, Mr. Swainson censures Bruce and Le Vaillant for their scepticism on this subject, and quotes Mr. Barrow to prove the universality of agreement on this point in the country itself. He farther says, 'If more evidence was wanting than this and other similar confirmations of Dr. Sparrman's statement, it will be found in the following note by M. Wiedmann, attached by a label to the specimen from which the subsequent description was taken:—"So soon as this bird sees a man in the woods, where a bee's nest is in the neighbourhood, he flies before the man, and cries shirt! shirt! shirt!"' Mr. Swainson then proceeds to describe his *Indicator leucotis*, (*Ind. albirostris*, Temm.). (*Birds of Western Africa; Naturalist's Library; Ornithology*, vol. viii., 1837.)

Mr. Steedman, in his *Wanderings and Adventures in South Africa* (1835), says, 'The little honey-sucker, or *Indicator*, kept fluttering before us with its cry of *cherr, cherr*, as if inviting us to follow. It is frequently known to conduct travellers to a nest of honey deposited in the hollow of a tree. I have however heard many instances mentioned of its stopping short of the hive, and hovering over a spot where a lion or tiger has been reposing, justly establishing its character as an indicator. Mr. Van der Nes informed me that he was once induced to follow it in expectation of discovering honey; and on pushing through the thick brushwood that enveloped the trunk of a tree over which the indicator was hovering, he suddenly came upon a leopard: at the same instant the animal made a spring in a contrary direction, and, much to his gratification, disappeared, without attempting to do him any injury, being evidently as much alarmed at the intrusion as the Veld cornet had been at so unexpected an encounter.'

Geographical Distribution of the Indicatorinæ.—Africa.

The other subfamilies belonging to the *Cuculidæ* are, according to Mr. Swainson, *Coccyzinæ*, *Crotophaginæ*, and *Leptostominæ*.

The *Coccyzinæ*, or *Hook-billed Cuckows*, are characterized as having the *wings* short and rounded, the *nostrils* linear, the *bill* curved, the margins of the upper mandible dilated, the *tarsus* naked and lengthened, and the *tail* very long and concealed.

The genera comprised by Mr. Swainson under this subfamily are:—

Serisomus, which has the bill short and strong, the gonys thick, ascending, and angulated; the culmen thickened and arched; the tarsus and middle toe equal, the lateral toes unequal, and the claws short. Example, *Serisomus cristatus* (Sw.). *Locality*, Africa. (Sw.)

Zanclostomus. Bill much compressed throughout, gonys curved downwards, culmen and upper mandible greatly curved, and the basal margin considerably dilated; wings, tail, and feet as in the last genus, but the lateral fore-toes nearly equal. *Locality*, Tropics of the Old World (Sw.). Example, *Zanclostomus Javanicus*, *Phænicophæus Javanicus* (Horsf.), Java.

Coccyzus (Vieillot). Bill moderate, thickened at the base, compressed; gonys straight; basal margin of the upper mandible not curved outwards, and scarcely dilated; tarsus and middle toe of equal length; lateral toes unequal. *Locality*, America only. Example, *Coccyzus Cayanensis*. This genus haunts the branches of lofty trees, from which it collects the insects which form its food.

Mr. Swainson places the *Coucals* of India and Africa under the new subgenus *Leptourus*.

Ptiloleptus. Wings very long; bill intermediate in form between *Coccyzus* and *Centropus*; nostrils long and linear; feathers of the head and neck slender and rigid; tarsus and middle toe equal, lateral toes unequal, all the claws curved and of equal size; tail-feathers eight. Habits terrestrial. *Locality*, South America. Example, *Ptiloleptus cristatus*. (Sw.)

Centropus (Illiger). Bill strong; tarsus and middle toe equal; anterior claws slender, slightly curved; hinder claw very long and nearly straight. *Locality*, Africa. Example, *Centropus Senegalensis*. Mr. Salt, in his 'Travels,' notices this bird as common in the mountainous districts (Abyssinia), generally sitting in the thick caper and thorny bushes, whence it is difficult to drive it.

Geographical Distribution of the Coccyzinæ.—Asia, Africa, America.

The *Crotophaginæ*, or *Horn-bill Cuckows*, consist of the following genera:—

Crotophaga. [Crotophaga, vol. viii.]

Dasylophus. Bill rather large and compressed throughout; gonys angulated; culmen convex, gradually arched; frontal feathers incumbent and concealing the nostrils; feathers before the eye erect, forming a double crest. (Sw.) Example, *Dasylophus superciliosus*. (Sw.)

Phænicophæus (Vieillot). Bill large, very thick, smooth, resembling that of a toucan in miniature, face naked; nostrils basal, oval, close to the gape, placed in a groove of the bill, and defended by stiff, erect bristles. (Sw.)—Example, *Phænicophæus viridis*.

Geographical Distribution of the Crotophaginæ, Africa, America.

The *Leptostominæ*, or *Long-billed Cuckows*, consist of the following genera:—

Saurothera (Vieillot). Bill lengthened, longer than the head, and straight, except towards the tip; the culmen convex, the gonys straight, the upper mandible with its margins finely crenated; orbits naked; wings moderate, second and third quills longest; feet short —Example, *Saurothera velata*.

Anadænus. General structure of *Saurothera;* but the upper mandible is only notched at the tip, the margins are entire; wings much rounded, the four first quills graduated. (Sw.) *Locality*, India. Example, *Anadænus rufescens.*

Leptostoma. Bill very long and entire; wings very short and rounded; tail long and cuneated; tarsus much longer than the toes. Example, *Leptostoma longicauda.*

Mr. Swainson considers *Leptostoma* to be the grallatorial type of the *Cuculidæ*. *Centropus* he also considers to be a grallatorial type.

Geographical Distribution of the Leptostominæ, India, America, ——? [CUCULIDÆ; CUCULINÆ.]

INDICTION; CYCLE of INDICTION. [PERIOD OF REVOLUTION.]

INDICTMENT is a written accusation of one or more persons of a crime or misdemeanor preferred to and presented by a grand jury. The sheriff is bound to return to every session of the peace and every commission of oyer and terminer and of general gaol delivery twenty-four freeholders of the county, who are usually chosen from the class of gentlemen of fortune. Twelve at least of this panel, and not more than twenty-three, are sworn upon the grand jury. They are previously instructed in the articles of their inquiry by a charge from the presiding judge, and then withdraw to sit and receive bills of accusation, which are presented to them in the name of the crown, but at the suit of any private person. The decision of the grand jury is not in the nature of a verdict upon the guilt of the accused, but merely the expression of their opinion that from the case made by the prosecutor the matter is fit to be presented to the common jury, and therefore in conducting the inquiry the evidence in support of the accusation only is heard. If the grand jury think the accusation groundless, they indorse upon the bill 'not a true bill,' or 'not found;' if the contrary, 'a true bill;' and in finding a true bill twelve at least of the grand jury must concur. Anciently tho words 'ignoramus' and 'billa vera' were used for the like purposes. When a bill is found to be a true bill, the trial of the accused takes place in the usual form; and when the bill is found not to be true, or, as it is frequently called, 'ignored,' the accused is discharged, but a new bill may be preferred against him before the same or another grand jury. Sometimes, when the bill is ignored on account of some slip or error, the judge will direct the accused to be kept in custody, in order to prevent him from escaping from justice. (4 Bl. *Com.*)

INDIES, EAST. [EAST INDIES.]

INDIGESTION. [DYSPEPSIA.]

INDIGO, a well known and beautiful blue vegetable colour, which is extensively employed in dyeing and calico printing.

Botany.—[INDIGOFERA.]

Chemistry.—Indigo is found in the leaves of several plants, in which it occurs in a peculiar and very different state from that in which it constitutes blue indigo. When the plant is in full flower it contains most colouring matter, and it is then cut, and put, either recent or previously dried, into vats, and covered with water; fermentation takes place accompanied with the evolution of carbonic acid and probably other gaseous products, and the yellow liquor is covered with a froth which in a little time becomes of a violet colour, and a substance is dissolved which is rendered blue by absorbing the oxygen of the air, and being then rendered insoluble it is precipitated; and this, when collected and dried, is indigo.

The usual appearance of indigo as it occurs in commerce is that of nearly cubical cakes of an intense blue colour and earthy fracture; that is most esteemed which when rubbed by a hard body assumes a fine copper-red polish. Indigo seldom contains more than about half its weight of pure colouring matter, and frequently much less.

According to Berzelius the indigo of commerce, besides some earthy matter, consists of indigo-blue, indigo-red, indigo-brown, and a glutinous matter. When common indigo has been treated with dilute acids, alkalis, and alcohol, the remainder is indigo-blue, or indigotin, or indigo nearly in a state of purity. The chemical propertios of this are, that it is insoluble in water or alcohol; neither dilute acids nor alkaline solutions act upon it; when heated to between 500° and 600° it rises in a purple vapour, and condenses in minute prismatic crystals. It is soluble in strong sulphuric acid, and what is remarkable and unusual is, that, unlike most vegetablo matter, it neither decomposes nor is decomposed by the acid; the solution has an intense blue colour, and is employed occasionally in dyeing, under the name of Saxon or liquid blue.

Chemists are not agreed as to the nature of this solution of indigotin; it has been called *sulphate of indigo*. According to Berzelius, it contains indigo-purple, sulphate of indigo, and hyposulphate of indigo: the two last compounds have also been called sulphoindigotic acid and hyposulphoindigotic acid. They combine with oxides to form salts of a fine blue colour.

Of all the properties of indigotin the most remarkable is its deoxidizement by bodies which have a powerful affinity for oxygen, such as the protoxide of iron, the solution of sulphuret of arsenic in potash, and the hydrosulphates, &c. It is by the employment of these means, and especially of the protoxide of iron [BLUE], that indigo is rendered soluble in lime-water and alkaline solutions, and thus applied to the fixing of indigotin upon cloth. According to Dumas indigotin is composed of

Hydrogen	3·97	or eqs.	15
Carbon	72·34	„	45
Oxygen	12·60	„	4
Azote	11·13	„	3
	100·04		

Indigotic Acid is prepared by treating indigotin with twice its weight of hot nitric acid of sp. gr. 1·280. When pure it has the form of colourless needles, which are but slightly soluble in cold water, but readily soluble in hot water and alcohol. According to Dumas it is indigotin combined with five times more oxygen; this it acquires by decomposing the nitric acid. It is a feeble acid, and acts faintly upon litmus, but it decomposes carbonates. When heated in a tube, it sublimes without change; when heated in open vessels it takes fire and burns with much smoke.

Carbazotic Acid is obtained as already described by the action of a large quantity of nitric acid upon indigo. The substances which have been mentioned under the name of indigo-brown, indigo-red, and gluten, are quite unimportant substances, except that they render common indigo impure by their presence.

Manufacture and Trade.—On the discovery of Mexico the use of Indigo was found to be common among the Aztecs, who employed it to impart a blue colour to their cotton fabrics. After the conquest of Spain the plant was extensively cultivated in Central America and in the Antilles, and its produce in those parts was for a long time greatly superior to that made in India. Since the beginning of this century however the cultivation and preparation of indigo in India have been so much improvod that the importations from Bengal have again been considered the finest in quality, and have commanded the highest prices in the markets of Europe the cultivation in our West India colonies has long ago ceased.

In the indigo factories of Bengal it is the custom for the European factors to provide the seed and to advance the money necessary for the cultivation to the ryots, or native farmers, who are bound to deliver to the factor, by whom they are thus supplied, the whole number of plants produced, at a price agreed upon between them. The terms of these contracts have usually been such, that any failure in the crop from bad seasons or other accidental circumstances has given to the factor a command over the cultivator to whom advances have been made; the farmer by this means becomes dependent upon his creditor, so that he is compelled to deal year after year exclusively with the same party. These factories aro frequently conducted upon a very large scale, and a considerable amount of capital is engaged in them.

The seed is sown in straight furrows about a foot apart, and usually in the spring season. Great care is required to keep the young plantation free from weeds, particularly in the early stages of vegetation. When the plants begin to blossom, which usually occurs about two months from the sowing of the seed, they aro cut down about one or two inches above the ground, collected into bundles, and delivered at the factory. A subsequent growth from the same root is again ready for the sickle in six or eight weeks, and four crops are sometimes thus obtained from one sowing; but the produce diminishes rapidly after the second cutting, and it is seldom found profitable in India to obtain more than four harvests from the samo roots. Among the Arab cultivators in Egypt the seed is sown only once in seven years, and two crops are obtained each year.

Two distinct methods are pursued for extracting the colouring matter from the plants. In most cases it is extracted by fermentation, but in some instances by scalding. In both cases the whole plant, stalks and leaves, is subjected to the process, as colouring matter is yielded by every part. Where fermentation is the process used, three wooden vats are provided, and so placed at different levels that the contents of the first or highest can be readily transferred to the second, and again from this to the third or lowest vat. The upper vessel, which is also the largest, is called the steeping vat; in this the plants are loosely laid in sufficient quantity to cover the bottom, and water is poured over them until they are all covered to the depth of three inches: heavy wooden frames are then laid upon the plants to prevent their rising during the fermentative process. In about 18 hours this process usually begins, the plants swell and give off large quantities of gas, which tinge the water with a lively green colour. This fermentation is allowed to go on until all the colouring matter, or grain, as it is technically called, is extracted, after which the turbid liquor is drawn off into the second vat. If this is done too soon there will be a loss of colouring product, and if it is deferred too long, so that the putrefactive fermentation commences, the quality of the dye will be injured. Immediately upon the drawing off of the liquor from the steeping vat, this is cleared from the refuse plants and washed, and a supply of fresh plants is subjected to the process. The turbid liquor, upon being received into the second vat, is violently agitated and beaten, in order to separate the pulp or grain from the water. A great quantity of air bubbles are driven off by this beating, and the colour of the contents of the vat changes from green to deep blue. Some lime-water is added at this time, which assists in the separation of the grain. This beating process must be continued so long as to separate all the grain, but if carried beyond this point a second fermentation would begin, which would materially injure the quality of the indigo.

When the grain has subsided to the bottom of the vat the supernatant liquor is drawn off, and the grain is discharged into the third vat, where a further subsidence and drawing off of liquor ensue, and the grain is next transferred to sacks, which are hung up to drain; it is then placed in small wooden boxes, which are exposed to the air and sun until all moisture is evaporated, when the process is completed, and the indigo is packed in chests for shipment.

The method here described is that which is commonly pursued in America and in some parts of India; but in the great indigo factories of Bengal some part of the drying is effected by the agency of fire. When the beating process has been performed, the contents of the second vat are transferred to a boiler, the bottom of which is of iron, and the sides are of masonry. In this the evaporation is carried on until the grain is of sufficient consistency to be transferred to large cloths, in which it is gradually dried by exposure to the air and sun. The great advantage of this mode of proceeding is, that it effectually prevents any fermentation after the first separation of the grain, which evil is very likely to be experienced, notwithstanding the utmost care is used to prevent it.

The method of extracting the dyeing matter from the plants by scalding is not much employed. Indigo thus made is said to have less colouring matter, and the dye is accounted to be less permanent than that extracted by fermentation. The scalding or boiling is performed in vessels of about eighteen inches diameter, to which fire is applied until all the colouring matter is extracted. The liquor is then strained into other vessels and beaten, as already described for the separation of the grain. The matter is then left for subsidence, when the supernatant liquor is drawn off, and the grain is put into bags to drain. The remaining drying processes are performed as already described.

The trade in indigo is of considerable importance to the merchants engaged in commerce between Bengal and this country, as it forms a very convenient means of remittance in return for the outward shipments of British manufactures. A great part of what is thus brought to England is re-exported to the north of Europe and to Italy. The quantities imported, re-exported, and taken for use in the United Kingdom, during each of the ten years from 1827 to 183", were as follows:—

	Imported. lbs.	Re-exported. lbs.	Taken for use. lbs.
1828	9,913,010	4,588,658	3,064,915
1829	6,748,281	4,286,605	2,113,830
1830	8,216,440	4,686,748	2,676,945
1831	7,299,605	4,374,241	2,490,134
1832	6,353,065	5,346,725	2,395,653
1833	6,635,436	3,664,814	2,323,300
1834	4,155,296	3,928,226	2,447,827
1835	4,168,395	4,074,598	2,590,606
1836	7,710,544	3,691,951	2,840,398
1837	6,545,873	3,587,561	2,226,194

Of the above importations 94 per cent. was supplied by India.

The following statement of the annual produce of indigo in the territories possessed by the East India Company, during each of the twenty years from 1812 to 1831, was laid before the Committee of the House of Commons on the Affairs of India previous to the last renewal of the Company's charter. It shows how greatly this branch of cultivation has been extended, especially of late.

	Chests.		Chests.
1812	23,500	1822	25,700
1813	22,800	1823	29,800
1814	28,500	1824	24,100
1815	30,500	1825	43,500
1816	25,000	1827	28,000
1817	20,500	1828	45,300
1818	19,100	1829	30,000
1819	20,700	1829	43,200
1820	27,200	1830	32,100
1821	21,100	1831	30,000
	238,900		331,700
Annual average	23,890	Annual average	33,170

Not being an article of substantive or independent consumption, but depending in this respect upon the condition and progress of other manufactures, upon the cost of which the price of dyeing-stuffs has only an inconsiderable effect, the market value of indigo is subject to violent fluctuations, according to the productiveness of the crop. It is only when the price has been driven down to a ruinous rate by the glutted state of the principal markets that speculators step in to check and palliate the evil. The following statement, taken from the accounts of the East India Company, will show how hazardous the trade has been from fluctuations in consecutive years:—

Season.	Average Sale Price per lb. s.	d.	Average Amount of Cost per Chest. £	s.	d.	Average proceeds per Chest. £
1822-23	10	2¾	94	15	6	90
1823-24	9	4	94	3	2	110
1824-25	11	5¾	80	11	5	140
1225-26	9	1½	89	2	1	100
1826-27	8	9	93	2	0	110
1827-28	7	5	87	2	8	80
1828-29	5	3¼	93	4	2	70
1829-30	4	3¾	72	6	2	55

History.—Its common name in India is *neel*, or *leel*, and its Sanscrit *neelee*. From these no doubt the Persian *neeleh* and the Arabic *neeluj* were derived. In the Arabic it is also called *ossareh-neel*, juice or extract of the neel-plant. It is noticed by Avicenna under the name of *neel*, but has been erroneously considered in the Latin translation to be the analogous dyeing substance called *woad*, produced by *Isatis tinctoria*, a plant not found in India. It was undoubtedly known to the Greeks and Romans, as Beckman has shown in the 4th volume of his 'History of Inventions.'

The accounts given by Dioscorides of 'Indicon' (ἰνδικόν), lib. v. c. 107, and by Pliny of 'Indicum,' lib. xxxv. c. 27, are substantially the same. The name does not give us any assistance, for, like Persica, Armeniaca, and others, the name was given from the country whence the substance was procured, and Pliny says, 'ex India venit.' Two kinds are described; one is unknown, but described as 'found swimming upon the coppers or vats in purple dyers' work-houses,' according to the translation of Holland. In some editions of Dioscorides the chapter is entitled 'On the stone Indicum' (περὶ ἰνδικοῦ λίθου), and it has hence been supposed that the substance described was of a mineral nature, but in the same way catechu was and still is frequently called *Terra Japonica*. That the true indigo was known is clear from the direction given by Pliny for detecting sophistications: 'The proof thereof is by fire, for cast the right indico upon live coles it yieldeth a flame of most excellent purple.' Indigo is moreover mentioned in the 'Periplus' of Arrian as exported from Barbarike on the Indus to Egypt. That it was known at still earlier periods is probable, as Mr. Thomson, from the effects of chemical tests on the blue stripes with which the selvage of Egyptian cloths is bordered, concludes that they were dyed with indigo. (*Eg. Antiq.*, ii., p. 190.) The earliest notice of this substance in modern Europe is in a Latin treaty between Bologna and Ferrara, in A.D. 1193, where 'indigum' is mentioned as a customable article. Marco Polo, in the thirteenth century, describes the process of making 'endicum' in the kingdom of Coulan, or Coilum. In the seventeenth century so great was the consumption of indigo in Europe that the sale of woad became seriously injured, and the use of indigo was probibited, which, in an Imperial edict published in 1654, was denominated the *devil's dye*, as hops were in England prohibited as 'the wicked weed.' The Nuremburghers moreover compelled the dyers annually to swear that they would never use indigo. (*Phil. of Perm. Colours*, i., p. 166.)

Dr. Bancroft has remarked that many plants employed to dye blue contain more or less of the basis of indigo, combined with only a small portion of oxygen, and therefore capable of being extracted and held in solution by water, long enough at least for its application as a dye. He therefore considers it not surprising that the inhabitants of all countries, excepting India, should have thought it sufficient to pound or grind the plants naturally containing this basis, and leaving it to the dyer to adopt such processes as would enable the basis to absorb such further portion of oxygen as, when assisted by the dyeing process, would fix it permanently in the cloth and fully manifest its blue colour. He further observes—'By what circumstance or event the people of Hindustan alone were led several thousand years ago to discover and adopt means by which the blue colourable matter of the indigo plant might be extracted, oxygenated, and precipitated free from almost all the other matters naturally combined with it, and afterwards brought into the dry solid form in which we now find it, no one can, I believe, conjecture.' (i., p. 168.) This early adoption of a complicated process is a proof, among many others, of the early attention paid by the Hindus to arts unknown to their contemporaries.

(Beckman, *History of Inventions*, vol. iv.; Bancroft, *On Permanent Colours*, i., p. 165; Roxburgh, *Trans. of Soc. of Arts*, vol. xxviii.; *Tropical Agriculturist*, p. 334.)

INDIGO'FERA, a genus of plants of the natural family of Leguminosæ, indigenous in the equinoctial parts of Asia, Africa, and America, and celebrated for some of the species yielding indigo. The species are about 150 in number; all are small herbaceous or shrubby plants; the leaves are usually pinnate; the flowers small and papilionaceous, in axillary clusters of a purple, blue, or white colour. The calyx is 5-cleft; segments acute; vexillum roundish, emarginate; keel furnished with a subulate spur on both sides. Stamens diadelphous (9 and 1). Legume continuous, one or more seeded. Seeds usually truncated, separated by cellular spurious partitions. There is some difficulty in ascertaining all the cultivated species, as the subject is usually neglected both by naturalists and cultivators.

I. tinctoria is the species generally cultivated in India, whence it has been introduced both into Africa and America. It is suffricticose, erect branched; leaves pinnate; leaflets 5 or 6 pairs, long-obovate, scarcely pubescent; racemes of flowers axillary, shorter than the leaves. Legumes approximated towards the base of the rachis, nearly cylindrical, slightly toruloze, deflexed, and more or less curved upwards; sutures thickened; seeds about 10, cylindrical, truncated at both ends. This species is sometimes called Indigo Franc and French indigo in the West Indies. It is said to be found wild along the sands of Senegal. (*Flore de Senegambie*, vol. i., p. 178.)

I. Anil. From the name it might be inferred that this was an Asiatic plant; but it is said by De Candolle to grow wild in America, and to be cultivated in both Indies, as also along the Gambia in Africa. The name *anil*, which has passed into the Spanish, has evidently the same origin as the Arabic *neel* or *nīl*. The Spaniards and Portuguese, who had found the way to India by two opposite courses, must there have become acquainted with indigo, and adopted its Indian name: they were the first to manufacture it in America, the Portuguese in Brazil, and the Spaniards in Mexico. This species is characterized by an erect suffricticose stem; leaves pinnate in 3 to 8 pairs; leaflets oval-oblong, scarcely pubescent on the under surface; racemes axillary, shorter than the leaves; legumes compressed, not toruloze, deflexed, curved, with both sutures thickened and prominent, 10 to 12-seeded. Messrs. Wight and Arnott state, 'We have not sufficient materials to enable us to determine if *I. Anil* be a distinct species: we know of no distinguishing character, unless it is to be found in the fruit, and the descriptions given of that part in the two species differ in different authors.' But the authors of the 'Flore de Senegambie' consider them distinct, as do most botanists.

I. cærulea, Roxb. This is a new species described by Dr. Roxburgh, and called *karneeli* in Telinga by the natives of the peninsula of India. Dr. R. states that from the leaves of this plant he had often extracted a most beautiful light indigo, more so than he ever could from the common indigo plant, or even from *Nerium tinctorum*, and in a large proportion. He says it is an erect shrubby species, growing in dry, barren, uncultivated ground, to the height of three feet, and higher in good garden soil. It flowers during the wet and cold seasons. The leaves are pinnate; leaflets four-paired, obovate, emarginate; racemes rather shorter than the leaves; legumes reflexed, curved, contracted between the seeds, hairy; from 3 to 4-seeded. De Candolle inquires whether this be sufficiently distinct from *I. tinctoria*. Dr. R. states that it comes near to *I. argentea*, Linn. The process he adopted for extracting indigo from this plant was similar to that practised with the leaves of *Nerium tinctorum*, or the scalding process.

I. argentea is a species usually stated to be a native of India, and the authority of Roxburgh might be cited for the fact; but Messrs. Wight and Arnott state that *I. argentea* of Linnæus is not found in India. It is the species cultivated in Egypt and Barbary for the sake of its indigo, and, according to Humboldt, also in America. The Indian species which has been confounded with it is *I. paucifolia* of Delile, which has alternate leaflets, and linear, slightly compressed, toruloze legumes. *I. argentea* is shrubby, with round branches, which appear of a silky whiteness from appressed pubescence; leaves pinnate, one to two-paired; leaflets opposite, obovate, silky-pubescent; racemes shorter than the leaf; legumes pendulous, much compressed, toruloze, canescent; 2 to 4-seeded.

I. disperma. This, according to Humboldt, is also one of the species cultivated in America, and seen among the most antient hieroglyphical paintings of the Mexicans. Dr. Bancroft considers it as the species called Guatemala indigo, which yields fine pulp, but is less productive than other species. The stem is herbaceous, weak; the branches round; leaves pinnate, 4 to 6-paired; leaflets elliptico-oblong, smooth; racemes slender, larger than the leaf; legumes round, subtoruloze, mucronate; 2-seeded.

Plants of other genera are also employed for obtaining indigo; as Wrightia (Nerium, Roxb.) tinctoria, Marsdenia tinctoria, Galega tinctoria, but especially the two first. Dr. Bancroft (vol. i., p. 190) also adduces Spilanthes tinctoria, Scabiosa succisa, Cheiranthus fenestralis; also a species of Bignonia and a Tabernæmontana, on the African coast, with Amorpha fruticosa and Sophora tinctoria, as all yielding a blue dye, or coarse sorts of indigo.

INDIVISIBLES. [CAVALIERI.]

INDORE, a city in the province of Malwa, and the capital of the dominions of Holkar, which at present consist of about 11,500 square miles on both sides of the river Nerbudda. Indore, which stands in 22° 42′ N. lat. and 75° 50′ E. long., is a modern city, the old city on the same site having been wholly destroyed by fire by Sindia, in 1801, during the war between that chief and Holkar. The extension of the city since 1818 has been extremely rapid, and its population has increased in the last twenty years from 10,000 to 60,000 souls. The streets are spacious and well paved; a great proportion of the houses are of two stories, and built of masonry; but there is no uniformity of plan, and, as is common in India, there are many dwellings interspersed of the meanest description. The raja's palace, which was begun in 1819, is a large quadrangular granite building. The English residency is without the city, about a mile to the south. Indore is 371 miles from Nagpore, 456 miles from Bombay, and 1030 miles from Calcutta, all travelling distances.

INDRE, a river in France belonging to the system of the Loire. It rises in the hilly region of central France of which the mountains of Auvergne form the nucleus. The source of the Indre is not however in the Auvergnat mountains, but near Boussac, just within the department of Creuse, amid the subordinate elevations which extend from Auvergne towards the north. From its source it flows north-west past St. Sévère and La Châtre, both in the department of Indre, to Châteauroux, capital of that department, receiving on its right bank the Tessonnes and the Igneray, and on the left the Vouvre or Vanvre, which receives the Magny. Close above Châteauroux it is joined on the right bank by the Angotin. From Châteaurox it pursues its course to the north-west by Buzançais, Châtillon sur Indre, in the department of Indre, and Loches and Cormery, both in the department of Indre and Loire. From Cormery it gradually turns westward, and flows past Montbazon and Azay le Rideau into the Loire. Its whole length is about 115 miles, for about 36 of which, namely from Loches, it is navigable. Between Loches and Cormery it receives the Indroye. Near its junction with the Loire this river is divided into several arms, one of which joins the Cher.

INDRE, a department of central France, bounded on the north by that of Loir et Cher, on the east by that of Cher, on the south by those of Creuse and Haute Vienne, on the south-west by that of Vienne, and on the north-west by that of Indre et Loire. Its form is compact. The greatest length is from the bank of the Cher, on the north, to near Aiguerande, on the south, 60 miles. The greatest breadth, at right angles to the length, is from the neighbourhood of St. Chartier in the east to the bank of the Gartempe in the west, about the same distance. Its area is estimated at 2669 square miles, which is rather more than that of Lincolnshire. The population, by the census of 1831, was 245,289; by that of 1836 it was 257,350, showing an increase of 12,061 in five years; and giving about 96 or 97 inhabitants to a square mile, considerably below the population of Lincolnshire, and less than two-thirds of the average relative population of France. Châteauroux, the capital, is on the left bank of the Indre, in 46° 49′ N. lat., and 1° 41′ E. long., 143 miles in a direct line south-by-west of the barriers of Paris, or 157 miles by the road through Orléans and Vierzon.

The surface of the department is generally level, but there are some hills of small elevation on the western side. The Indre enters the department at the south-east corner a very short distance from its source, and crossing it in a north-west direction divides it into two nearly equal parts. No part of its navigation is in this department. All its tributaries mentioned in the preceding article belong to this department, except the Indroye, and even that has its source just within the boundary. The eastern side of the department is watered by the tributaries of the Cher, which itself touches the boundary on the north side. Of these tributaries the principal are the Arnon, which just touches the eastern boundary, with its feeder the Theols; the Feuzon, with its feeder the Nahon, which receives the Moulins; and the Modon. The western side of the department is watered by the Creuse, a tributary of the Vienne, which crosses this part in a north-west direction, and receives the Bouzane, into which flows the Gourdon. The Gartempe, a feeder of the Creuse, just touches the western border; its tributary the Anglin, or Langlin, receives the Benaise, and the united stream of the Abloux and the Sosne. The Claise, also a feeder of the Creuse, waters a portion of the western side. That portion of the department which lies between the Creuse and its feeder the Claise is covered by an immense number of étangs, or pools, some of them of considerable extent, but of little depth. These large sheets of water produce, in the heats of summer, pestilential exhalations very injurious to animal life. Beside the pools there are also many marshes. The drainage of this district, which is called 'Brenac,' would bring many thousand acres into cultivation, besides removing a perpetual source of disease.

The department is entirely destitute of inland navigation. The road from Paris by Orléans to Limoges passes through it, entering it on the north-east side, and passing through Vatan, Châteauroux, and Argenton. There are roads from Châteauroux to Guéret (Creuse), Tours (Indre et Loire), Blois (Loir et Cher), and Bourges (Cher). The aggregate length of the government roads is about 250 miles, of which about three-fourths are in good repair; the remainder is out of repair or unfinished. The aggregate length of the Routes Départmentales is about 125 miles, of which nearly one-half is out of repair or unfinished. The bye-roads and paths have a total length of nearly 3300 miles.

A line drawn from north-east to south-west through Châteauroux determines the geological character of the department. North-west of that line is found the chalk which surrounds the Paris basin [FRANCE, *Geological Character*, vol. x., p. 408]; south-east of it the formations between the chalk and the new red sandstone, or red marl. Along the southern border of the department the primitive rocks are found. Iron is abundant; many mines are wrought; and there are excellent quarries of marble, millstones, sandstone, and limestone. Stones for lithography, gun-flints, and potters' clay are also procured.

The air is generally tolerably mild; but there is a sensible difference of temperature in different parts of the department. In the marshy districts the climate is constantly moist and unwholesome. The prevailing winds are the north-east, south, west, and north-west, especially the last, which is frequently injurious to the crops. The more common diseases are intermittent, malignant, and inflammatory fevers, inflammation of the lungs, and rheumatism. In the marshy districts sudden blindness is not unfrequent, but it admits of cure.

The soil varies much; but, excepting in the sandy tracts, which form tolerably wide heaths, it is considered fertile. Agriculture is in a backward state, but the produce is beyond the consumption of the department. The species of grain chiefly cultivated are wheat, rye, barley, oats, and buck wheat. The vine is cultivated in all parts of the department, though not to any great extent; the wine produced is of very middling quality: half of it is exported. The cultivation of hemp is general. Very little fruit is grown, except of apples and pears for cider, and of these not many. The quantity of woodland is considerable: the oak is the most common timber tree, and there are the hornbeam, the beech, the birch, and the alder. The ash, the willow, the poplar, and the elm are found in the valleys. The pasture lands are extensive; a great number of horned cattle are reared; also of horses, the breed of which is receiving continual improvement, and sheep. The breed of sheep has been much attended to; the wool has long been considered very good, and constitutes a considerable portion of the wealth of the department. Swine and goats are numerous, and poultry is abundant, especially geese and turkeys. Bees are neither numerous nor well attended to, and there is but little game. The rivers and pools abound in fish, but the practice of dragging the pools every two years prevents their growing to a sufficient size.

The department is divided into four arrondissements, as follows:—

Arrondissement.	Situation.	Area in sq. miles.	Population.	Communes.
Châteauroux,	Central & N. W.,	956	96,903	85
Le Blanc,	S.W.,	726	57,789	56
Issoudun,	N.E.,	459	47,572	49
La Châtre,	S.E.,	528	55,086	59
		2669	257,350	249

There are 23 cantons, or districts under the jurisdiction of a justice of the peace.

The arrondissement of Châteauroux contains Châteauroux on the Indre (population, in 1836, 13,847) and Bourg Dieu, or Bourg Deols (pop. 1792 town, 2113 commune), which is in fact a suburb of Châteauroux [CHATEAUROUX; BOURG]; Argenton (pop. 3459 town, 3964 commune), on the Creuse; St. Marcel, close to Argenton; Levroux (pop. 2343 town, 3058 commune), on the Moulins; Valançay (pop. 3095), on the Nahon; Buzançais (pop. 2729 town, 4416 commune), Palluau, and Châtillon (pop. 2269 town, 3339 commune), all on the Indre; and Argy, near that river.

Argenton was a place of note in the time of the Romans. It was called Argentomagus, and was on the frontier of the Bituriges and the Pictones or Pictavi. Many medals and other antiquities have been found here. An antient fortress was demolished by Louis XIV.: some ruins yet remain.

Levroux is also of great antiquity. The Romans erected here a fortress, of which a tower is still standing, and the remains of an amphitheatre and of other antiquities may still be traced. It is supposed that its Roman name was Gabatum. The town is surrounded with walls, which are flanked with towers, and strengthened by a ditch. There is an antient castle of the middle ages. Valançay has a handsome château, which was the residence of the late king of Spain, Ferdinand VII., during his captivity in France. Some woollen cloth is made in the town. Buzançais is the seat of a considerable trade in wool.

In the arrondissement of Le Blanc are Le Blanc (population, in 1836, 5095), on the Creuse [BLANC, LE]; Belabre, on the Anglin; St. Gaultier, on the Creuse; St. Benoist 'sur-le-Sault', between the Anglin and the Abloux; Mézières and Martizay, on the Claise; and Azay le Féron, near the same river. St. Benoist is in the midst of the most picturesque scenery of the department. The rocks and cascade of Montgerno, in the neighbourhood of it, are of great beauty.

In the arrondissement of Issoudun are Issoudun (pop. in 1836, 11,654) on the Théols [ISSOUDUN], and Vatan (pop. 1889 town, 2764 commune) on the road from Paris to Châteauroux. In the neighbourhood of Vatan is a Druidical monument, a 'dolmen,' in perfect preservation.

In the arrondissement of La Châtre are La Châtre (pop. in 1836, 4471) on the Indre [CHATRE, LA]; St. Sévère on the same river; St. Chartier, on the Igneray; and Aiguerande, Cluis-Dessus, and Neuvy St. Sepulchre, all on the Bouzane. At Aiguerande is an antient monument, of octagonal form, of the purpose of which no tradition has been preserved; it has been supposed to have been designed for the purpose of sacrifice.

The population given above, where not otherwise noticed, is from the returns of 1831, and is that of the whole commune.

The iron-works of the department are numerous and important: they send out cast-iron, bar-iron, pig-iron, and sheet-iron, besides ploughshares and coulters and the like. Red and black earthenware are manufactured; also woollen cloths of various qualities, common hats, cotton hosiery, and a small quantity of linens. There are also some tanyards, paper-mills, and dye-houses; and one manufactory of saltpetre. The exports of the department consist of grain, cattle, wool, woollen cloths, and iron.

The department of Indre constitutes with that of Cher the archiepiscopal diocese of Bourges. It is comprehended within the jurisdiction of the Cour Royale and the circuit of the Académie Universitaire of that city. It is included in the fifteenth military division, the head-quarters of which are at Bourges. It sends four members to the Chamber of Deputies.

Education is very little diffused in this part of France; it is the lowest in this respect of all the departments except seven. Of every 100 young men enrolled in the military census of 1828-29 only 17 could read.

This department originally formed part of the territory of the Bituriges Cubi, a Celtic nation; and in the later Roman division of Gaul was included in the province of Aquitania Prima. It afterwards passed under the dominion of the Visigoths, from whom it was wrested by the Franks under Clovis. In the middle ages it constituted part of the province of Berri, or Berry. [BERRI.]

INDRE ET LOIRE, a department of central France, bounded on the north by that of Sarthe; on the north-east, by that of Loir et Cher; on the south-east and south, by that of Indre; on the south-west, by that of Vienne; and on the north-west, by that of Maine et Loire. Its form is irregular: the greatest length is from north to south, 68 miles; its greatest breadth at right angles to the length is nearly 60 miles. Its area is estimated at 2371 square miles, very nearly that of the English counties of Dorsetshire and Wiltshire: the population by the census of 1831 was 297,016; by that of 1836 it was 304,271, showing an increase of 7255 in five years, and giving on the average more than 128 inhabitants to a square mile. This is however considerably below that of the average relative population of France, and still more below that of the English counties above mentioned. Tours, the capital, is on the south bank of the Loire, in 47° 24′ N. lat. and 0° 41′ E. long.; 123 or 124 miles in a straight line south-west of the barriers of Paris; 142 miles by the road through Orléans and Blois, or 140 miles through Chartres.

The surface of the department is generally flat, and the hills which do occur are of small elevation. The Loire traverses the department from east to west, dividing it into two parts, of which the southern is considerably the larger. It passes the towns of Amboise, Tours, Luynes or Luines, St. Mars, Langeais, and Candes: the first two towns and the last are on the south, the other three on the north. The Loire is navigable throughout, and receives all the drainage of the department. The banks of the Loire are famed for their richness and beauty, being adorned with vine-covered hills, orchards, villages, and chateaux. The Cher enters the department on the east side below Montrichard, and flows west by Bleré, approaching the Loire so nearly as to pass within a mile or two of Tours, and holding its course parallel to that river for many miles before their junction. Two arms pass from this river into the Loire, at a distance of several miles from each other, and long before the junction of the main stream; crossing the narrow tongue of land between the two rivers, and forming two portions of it into oblong islands. One of these channels enters the Loire just below Tours, the other opposite the little town of St. Mars. The Cher is navigable throughout the whole of its course in this department. The Indre enters the department on the south-east and passes to the north-west between Loches and Beaulieu, where it divides into two arms, which reuniting enclose a small island; from thence it proceeds, by Cormery, where it bends gradually towards the west, Montbazon, and Azay-le-Rideau, to the Loire, into which it falls just at the junction of the Cher. The navigation of the Indre begins at Loches. The Indroye, a small feeder of the Indre, has the greater part of its course in the department, but rises in the adjacent one of Indre it passes Montresor, and joins the Indre on the right bank. The Vienne first skirts and soon after enters the department on the south-west side, and passes first to the north, and then to the north-west past L'Ile Bouchard and Chinon into the Loire, which it joins at Candes, just on the western border of the department. It is navigable throughout. It receives on its right bank, at the spot where it enters the department, the Creuse, which has a part of its course in the department or on the border. The Claise, the Evre, and the Gartempe, which join the Creuse, the last on the left bank, the others on the right, and the Egronne and the Brignon, feeders of the Claise, belong more or less to this department. Two small streams join the Vienne below the junction of the Creuse, the Manse on the right bank, and the Vende (with its feeder the Mable) on the left. None of these tributaries of the Vienne are navigable, except the Creuse for a short distance.

The above-mentioned rivers all belong to that portion of the department which is south of the Loire. The northern part is entirely destitute of navigable streams. The Branle, or Brenne, joins the Loire above Tours, and there are some other tributaries. The Long and the Fare flow into the Loir, a tributary of the Loire, which lies altogether without the department; and the Doit and the Latan belong to the system of the Aution, which joins the Loire near Angers.

There are some marshes and étangs, or pools, in the department. The largest are those of Rillé and Les Hommes, in the north-west.

The official returns of the inland navigation of the department are incomplete: they omit all notice of the Indre and the Cher. They give the length of the navigation of the Loire at 83,937 mètres, or about 52 miles; that of the Vienne at 54,555 mètres, or 34 miles; and that of the Creuse at 8400 mètres, or 5 miles. The navigation of the Indre and the Cher may be estimated at about 40 miles each. About 40,000 mètres, or 25 miles, of the Canal du Berry, designed to shorten the navigation of the Loire by avoiding the circuit which it makes by Orléans, will, when finished, be in this department.

The high road from Paris, by Versailles, Chartres, and Vendôme, to Bordeaux and other places in the south of France, runs through this department. It enters it on the north-east side, and passes south-west by Château Renault to Tours, where it crosses the Loire: from Tours it runs south by Montbazon and Sainte Maure, crossing the Cher, the Indre, and the Creuse, at which last it quits the department. Another road from Paris to Tours, by Orléans and Blois, enters the department on the east side, and passes along the north bank of the Loire. From Tours there are government roads to St. Aignan on the Cher (Loir et Cher), to Châteauroux (Indre), and to Le Mans (Sarthe), with a branch from this last road to Laval (Mayenne). The aggregate length of the government roads is about 192 miles, of which all except seven miles of unfinished road is in good repair. The Routes Départementales have an aggregate length of 283 miles, four-fifths of which are in good repair, the rest out of repair or unfinished. The bye roads and paths have an aggregate length of nearly 8700 miles. Few departments of France are so well furnished with the means of communication, whether by land or water.

The department is almost entirely occupied by the chalk-belt which surrounds the Paris basin. In the valley of the Loire the chalk is covered with very deep alluvial beds, and the fertilizing mud left by the inundations of the river has rendered this district so fertile as to obtain for it the designation of the garden of France. Almost every kind of culture is pursued with success. In the higher lands remote from the Loire the chalk is covered with other formations, probably alluvial, which are in some places suited to the cultivation of the vine and the growth of wood, and in others form tolerably extensive tracts of waste land, which however an improved system of agriculture is gradually bringing into cultivation. Freestone, millstones, and stones for lithography are quarried; and there are pipeclay and potters' clay.

The quantity of corn produced is now more than sufficient for the consumption of the department: all kinds are cultivated. Kidney beans and other pulse, vegetables, melons, liquorice; aromatic herbs, as angelica, fennel, aniseed, and coriander; and a great quantity of flax and hemp are also grown. The quantity of fruit is great: the plums, when preserved, are in high repute, and are exported to various parts. The cultivation of the vine is one of the most important branches of the agriculture of the department: the vineyards occupy about a sixteenth part of the soil. The mulberry is cultivated in sheltered situations for the silkworms, which are bred in considerable number. The walnut is very generally grown, and furnishes a considerable quantity of oil. The meadows are tolerably numerous, but not many head of cattle are bred. Swine and poultry are abundant; game, including the wild boar, the stag, and the roebuck, is not very plentiful. The rivers and pools furnish some fish.

The department is divided into three arrondissements, comprehending in all 24 cantons, or districts, under a justice of peace, and 285 communes:—

Arrondissements.	Situation.	Area. Sq. Miles.	Pop. 1836.	Communes.
Tours,	N., N.E., and Central,	1033	151,119	127
Chinon,	W.	642	90,511	89
Loches,	S. and S.E.	696	62,641	69
		2371	304,271	285

In the arrondissement of Tours are Tours, the capital of the department, on the south bank of the Loire, with a population in 1836 of 26,669; Amboise (pop. 4613), also on the south bank of the Loire; Château Renault, or Renaud (pop. 2289 town, 2468 commune), on the Branle; Luynes, on the north bank of the Loire; Reugny, near the Branle; Neuvy, near the Long; St. Christophe, between the Long and the Fare; Bleré, on the Cher; and Cormery and Montbazon, on the Indre. [AMBOISE; TOURS.] Château Renault is divided by the Brenne into the Upper and Lower towns. Luynes has a handsome hospital or almshouse, and several manufactories of laces and trimmings: it gave title to Charles d'Albert, constable of France, and favorite of Louis XIII. In the neighbourhood of this town many of the inhabitants occupy dwellings excavated in the side of the chalk cliffs. In the neighbourhood of Bleré is the castle of Chenonceaux, which was once the residence of Diane de Poitiers, and received great embellishment from her and from Catherine de' Medici.

In the arrondissement of Chinon are Chinon (population in 1836, 6911) and L'Ile-Bouchard, on the Vienne; Richelieu (pop. 2685 town, 2782 commune) on the Mable; Faye, near the same river; Candes, at the junction of the Vienne and the Loire; Azay le Rideau, on the Indre; St. Espain and Ste. Maure (pop. 1589 town, 2259 whole commune), on the Manse; Bourgueil (pop. 1650 town, 3556 commune), on the Doit; Langeais and St. Mars, on the north bank of the Loire; Savigné, near the Etang de Rillé; and Château La Vallière, on the Fare. Chinon is surrounded with walls, the remains of its antient fortifications, and has preserved the ruins of a castle, in which Henry II. of England died, and where Jeanne d'Arc presented herself first to Charles VII. of France. The townsmen carry on a considerable trade in wine and in preserved plums. Langeais has the ruins of a castle, built in the tenth century, in an apartment of which was negotiated the marriage of Charles VIII. of France with Anne of Bretagne, a marriage which eventually united that duchy to the crown of France. Some linens are manufactured here; and also tiles. The melons of the neighbourhood are considered excellent.

In the arrondissement of Loches are Loches (pop. in 1836, 4753), on the Indre; Beaulieu (pop. 1800 town, 2222 commune), which is little more than a suburb of Loches, being separated from it only by a small island of the Indre and the two arms of the river which enclose it; Montresor, on the Indroye; Preuilly and Le Grand Pressigny, on the Claise; La Guerche and La Haye, on the Creuse; Ligueil, on the Evre; and Le Louroux and Mantelan, north-west of Loches. Loches is on a slope rising from the river Indre, and is commanded by an antient castle which overlooks a beautiful prospect, and is rendered interesting by many historical recollections. Here Agnes Sorel sought to rouse the energies of her lover Charles VII.; here Bishop Balue endured a confinement of eleven years in an iron cage, to expiate his offences against his master Louis XI. The tomb of Agnes Sorel, originally erected in the choir of the church at Loches, is now in the office of the sub-prefect. La Haye was the birthplace of Descartes, whose house, with its simple furniture, is still carefully preserved.

The population as given above is, where not otherwise distinguished, that of the whole commune, and from the returns of 1831.

The manufactures of the department are of considerable importance. The manufacture of silks for upholstery and for dress, which had long since obtained considerable celebrity, is now but little carried on. Woollen yarn, woollen cloths, carpets, and flannel; paper, leather, files (at Amboise, where is the most important manufactory of the kind in France), earthenware, and pottery. The best wines are sent to Nantes to be shipped for the Netherlands; other wines are exported to Paris and into Normandie; hemp is sent to be made into rope and sail-cloth at Angers, or exported to Lorraine. Preserved fruits are sent into all parts of France, and even exported to foreign lands.

This department constitutes the archiepiscopal diocese of Tours, and is included in the jurisdiction of the Cour Royale and the circuit of the Académie Universitaire of Orléans. It is comprehended in the fourth military division, the head-quarters of which are at Tours. It sends four members to the Chamber of Deputies.

In respect of education, the department is in a very backward state. Of the young men enrolled in the military census of 1828-29, only 27 in every 100 could read and write.

This department was antiently the seat of the Turones, one of the nations of the Celtic stock, whose name has been preserved in that of the capital of the department, Tours, antiently Cæsarodunum. Amboise was known to the Romans by the name Ambacia. Under the later division of the Roman empire, the country of the Turones was comprehended in the province of Lugdunensis Tertia. From the Romans it passed into the hands of the Franks, who held the part north of the Loire, and of the Visigoths, who occupied all the country south of the Loire; but the conquests of Clovis brought the whole into the power of the Franks. In the middle ages it constituted the province of Touraine. It was the earliest seat of the silk manufacture in France, which occupied in the sixteenth century forty thousand persons: there were seven hundred silk-mills and eight thousand manufactories or shops. The revocation of the edict of Nantes nearly annihilated this important branch of the industry of Touraine.

INDUCTION (Mathematics). The method of induction, in the sense in which the word is used in natural philosophy, is not known in pure mathematics. There certainly are instances in which a general proposition is proved by a collection of the demonstrations of different cases, which may remind the investigator of the inductive process, or the collection of the general from the particular. Such instances however must not be taken as permanent, for it usually happens that a general demonstration is discovered as soon as attention is turned to the subject.

There is however one particular method of proceeding which is extremely common in mathematical reasoning, and to which we propose to give the name of *successive induction.* It has the main character of induction in physics, because it is really the collection of a general truth from a demonstration which implies the examination of every particular case; but it differs from the process of physics inasmuch as each case depends upon one which precedes. Substituting however demonstration for observation, the mathematical process bears an analogy to the experimental one, which, in our opinion, is a sufficient justification of the term 'successive induction.' A couple of instances of the method will enable the mathematical reader to recognise a mode of investigation with which he is already familiar.

Example 1.—The sum of any number of successive odd numbers, beginning from unity, is a square number, namely, the square of half the even number which follows the last odd number. Let this proposition be true in any one single instance; that is, n being some whole number, let 1, 3, 5, ... up to $2n + 1$ put together give $(n + 1)^2$. Then the next odd number being $2n + 3$, the sum of all the odd numbers up to $2n + 3$ will be $(n + 1)^2 + 2n + 3$, or $n^2 + 4n + 4$, or $(n + 2)^2$. But $n + 2$ is the half of the even number next following $2n + 3$: consequently, if the proposition be true of any one set of odd numbers, it is true of one more. But it is true of the first odd number 1, for this is the square of half the even number next following. Consequently, being true of 1, it is true of $1 + 3$; being true of $1 + 3$, it is true of $1 + 3 + 5$; being true of $1 + 3 + 5$, it is true of $1 + 3 + 5 + 7$, and so on, *ad infinitum.*

Example 2.—The formula $x^n - a_n$, n being a whole number, is always algebraically divisible by $x - a$.

$$\begin{aligned} x^n - a^n &= x^n - a^{n-1}x + a^{n-1}x - a^n \\ &= x(x^{n-1} - a^{n-1}) + a^{n-1}(x - a). \end{aligned}$$

In this last expression the second term $a^{n-1}(x - a)$ is obviously divisible by $x - a$: if then $x^{n-1} - a^{n-1}$ be divisible by $x - a$, the whole of the second side of the last equation will be divisible by $x - a$, and therefore $x^n - a^n$ will be divisible by $x - a$. If then any one of the succession

$$x - a, \ x^2 - a^2, \ x^3 - a^3, \ x^4 - a^4, \&c.$$

be divisible by $x - a$, so is the next. But this is obviously true of the first, therefore it is true of the second; being true of the second, it is true of the third; and so on, *ad infinitum.*

There are cases in which the successive induction only brings any term within the general rule, when two, three, or more of the terms immediately preceding are brought within it. Thus, in the application of this method to the deduction of the well-known consequence of

$$x + \frac{1}{x} = 2 \cos. \theta, \text{ namely, } x^n + \frac{1}{x^n} = 2 \cos. n\,\theta,$$

it can only be shown that any one case of this theorem is true, by showing that the preceding two cases are true: thus its truth, when $n = 5$ and $n = 6$, makes it necessarily follow when $n = 7$. In this case the two first instances must be established (when $n = 1$ by hypothesis, and when $n = 2$ by independent demonstration), which two establish the third, the second and third establish the fourth, and so on.

An instance of mathematical induction occurs in every equation of differences, in every recurring series, &c.

INDUCTION (ἐπαγωγή), as defined by Archbishop Whateley, is 'a kind of argument which infers respecting a whole class what has been ascertained respecting one or more individuals of that class.' According to Sir William Hamilton the word has been employed to designate three very different operations:—1. The objective process of investigating particular facts, as preparatory to Induction, which he observes is manifestly not a process of reasoning of any kind; 2. A material illation of a universal from a singular, as warranted either by the general analogy of nature or the special presumptions afforded by the object matter of any real science; 3. A formal illation of a universal from the individual, as legitimated solely by the laws of thought and abstracted from the conditions of any particular matter. The second of these operations is the inductive method of Bacon, which proceeds by means of rejections and conclusions, so as to arrive at those axioms or general laws from which we may infer by way of synthesis other particulars unknown to us, and perhaps placed beyond reach of direct examination. (*Nov. Org.*, 'Aph.,' c. iii., c. v.) Aristotle's definition coincides with the third, and induction 'is an inference drawn from all the particulars.' (*Prior. Analy.*, ii., c. xxiii.) The second and third processes are improperly confounded by most writers on logic, and treated as one simple and purely logical operation. But the second is not a logical process at all; since the conclusion is not necessarily inferrible from the premiss, for the *some* of the antecedent does not necessarily legitimate the *all* of the conclusion, notwithstanding that the procedure may be warranted by the material problem of the science, or the fundamental principles of the human understanding. The third alone is properly an induction of logic; for logic does not consider things, but the general forms of thought under which the mind conceives them; and the logical inference is not determined by any relation of causality between the premiss and conclusion, but by the subjective relation of reason and consequence as involved in the thought. The inductive process is exactly the reverse of the deductive; for while the latter proceeds from the whole to the part, the former ascends from the part to the whole: since it is only under the character of a constituted or containing whole, or as a constituent and contained part, that anything can become the term of logical argumentation. Of these two processes, Professor Hamilton gives the following figures:—

Induction.	Deduction.
X Y Z are A.	B is A.
X Y Z are whole B.	X Y Z are under B.
∴ whole B is A.	∴ X Y Z are A.
Or,	Or,
A contains X Y Z.	A contains B.
X Y Z contains B.	B contains X Y Z.
∴ A contains B.	∴ A contains X Y Z.

This confusion of material and logical induction led *Gillies* and others to insist on the sameness of the Baconian and Aristotelean induction; while Campbell and Dugald Stewart, who totally mistook the value of all logical inference, yet rightly maintained their difference.

By Aristotle induction and deduction are viewed as in certain respects similar in form; but in others as diametrically opposed, the latter being an analysis of the whole into its parts, by descending from the more general to the more particular; but the former ascends by a synthetical process from the parts to the whole. The logicians who misapprehended the nature of induction reduced it to a deductive syllogism of the third form, and thereby overthrew the validity of all deduction itself, since the *latter is* only possible by means of the former, which legitimates the proposition from which its reasoning proceeds.

Again, the Aristotelean induction was drawn from all the particulars, whereas the confusion which Professor Hamilton has pointed out gave rise to a division of the inductive process into perfect and imperfect, according as the enumeration of particulars is complete or incomplete. The latter gives only a probable result, whereas the *necessity* of the conclusion is essential to all logical inference, as its demonstrative stringency depends upon the form of the illation, and not upon the truth of the premisses.

(*Recent Publications on Logic; Edinburgh Review*, April, 1833.)

INDUCTION. [BENEFICE, p. 219.]

INDULGENCE is a power claimed by the Roman Catholic church of granting to contrite and confessed sinners remission of the penalty, or part of the penalty, which they ought to suffer here or hereafter in expiation of their sins. The indulgence does not remit the guilt, 'culpa,' nor the eternal punishment awarded to the impenitent sinner, but only the temporal penalty which the repentant sinner, after having duly confessed his sins and received absolution, has still to undergo either in this world or in purgatory, according to the belief of Roman Catholics. [CONFESSION.] In the early ages of the church repentant sinners after confession had to undergo public punishment, often very severe in proportion to their offences; such punishments however were occasionally mitigated by the 'indulgence' of the bishops, who, in particular cases, abridged the austerities enjoined by the canons, or commuted them for works of charity and pious exercises. Such was the origin of indulgences. (Maldonat, *De Indulgentiis; Bibliothèque Sacrée*, par les Pères Richard et Giraud, article 'Indulgence;' Lingard, *History of England*, vol. iv., p. 95.)

Several of the early fathers of the church, such as St. Cyprian (*De Lapsis*) and Tertullianus (*De Pudicitia*), complained of the abuse of this practice in their time, and especially that simple priests presumed to grant indulgences; which was the exclusive privilege of bishops, and that bishops themselves granted them with too much facility. The canonical or ceremonial penalties becoming in course of time disused, together with the practice of public confession, the indulgences which continued to be granted afterwards were understood to remit that part of the penance to be undergone in purgatory which was equivalent to the canonical penalty which would have been awarded by the early church. (Maldonat.) 'The faith of Catholics,' says Maimbourg (*Histoire du Luthéranisme*, vol i.), 'has always been that the Son of God has conferred on his church the power of relieving the penitent sinner not only from the bonds of his sin by the merits of Christ's passion applied to him in the sacrament of confession, but also from the punishment which he would suffer, either in this world or the next, as a satisfaction to the divine justice for offences committed after baptism. Hence St. Paul, at the request of the Corinthians, remitted to the incestuous man whom he had excommunicated, the remnant of the penalty incurred for the crime; hence the bishops of the earliest ages gave peace to apostates, and reconciled them to the church by abridging the time of the criminal penance through the intercession of martyrs, and in virtue of their sufferings, joined to those of the Saviour of the world, who rendered them precious in the sight of God.' The 'Bibliothèque Sacrée,' above quoted, contains a most elaborate article on the subject of indulgences, divided into eight sections, namely, 1, On the name and nature of indulgences. 2. On the various sorts of indulgences. 3. On their virtues and effects. 4. On their truth and foundation. 5. On the causes of indulgences. 6. On the subjects or persons to whom indulgences are applied. 7. On the conditions and dispositions required in order to obtain the benefit of the indulgences. 8. On the abuse of indulgences. We may observe on this last point that indulgences are granted in some cases to those who give money for the building of churches and other pious purposes; but that the sale of or traffic in indulgences has been severely reprobated by many councils, and that the bulls of indulgences granted by the Pope contain the clause that 'if any thing be given as the price of this indulgence, the indulgence itself becomes null.'

INDUS. [HINDUSTAN.]

INDUS (the Indian), a constellation of Bayer, situated between Sagittarius and the South Pole.

Character.	No. in Catalogue of Lacaille.	No. in Catalogue of Astron. Soc.	Magnitude.
α	1676	2417	3
β	1691	2463	4
γ	1731	2533	5
δ	1764	2604	5

INEQUALITY. (Astronomy.) For convenience, the average motion of a planet or satellite, supposed to be made in a circle which has the average distance of the body from the sun or primary for its radius, is the first object of calculation when the place of the body at some future time is to be predicted. All the alterations which are rendered necessary by the unequal motion of the planet are called inequalities. [GRAVITATION; LUNAR THEORY; PLANETARY THEORY, &c.]

INE'RTIA. This word means something equivalent to the modern English sense of inactivity, or rather of incapability, and expresses that property of matter by which it does not change its own state of rest or motion, but requires for that purpose the action of some external cause, to the magnitude of which the change is in proportion. Previous to some remarks upon the use of this word, we shall give at length the third definition of Newton's Principia, from which the common usage of it is derived 'The *vis insita*, or innate force of matter, is a power of resisting by which every body, as much as in it lies, endeavours to persevere in its present state, whether it be of rest or of moving uniformly forward in a straight line. This force is ever proportional to the body whose force it is; and differs nothing from the inactivity of the mass, but in our manner of conceiving it. A body, from the inactivity of matter, is not without difficulty put out of its state of rest or motion. Upon which account this *vis insita* may, by a most significant name, be called vis inertiæ, or force of inactivity. But a body exerts this force only when another force, impressed upon it, endeavours to change its condition,' &c.

We could wish that the use of this word were entirely exploded, and for the following reason. When a term is proposed to stand for a property, mode of being, or condition of existence, about which we know nothing except that certain phenomena always occur under certain circumstances, such a proposition may be listened to, on condition that there is one distinct phenomenon or class of phenomena which wants a distinctive name, and also on condition that the word is to be used in a purely characteristic, and not in a doctrinal or explanatory, sense. Thus the word impenetrability [IMPENETRABILITY], though likely to cause misconception, as pointed out in the article cited, is nevertheless a good word to those who know how to use it, and a necessary word to those who desire to describe and reason on our knowledge of matter. It conveys to the mind, by one act of separation or abstraction, the notion of a cause for a phenomenon which might be conceived to exist independent of the other properties of matter. We can imagine impenetrable space, not endowed with mobility, colour, or any other accident of matter. But with the word inertia as used by Newton, we do not describe any quality of matter, but supply a term of causation for matter itself, so far as those properties are concerned which are studied in mechanics. What is the *matter* of a work on pure statics or dynamics? That which obeys certain three laws of motion, or presents phenomena which are of a certain threefold description. What word, according to Newton, should be used as a term of causation to remind us that the first law of motion arises from something inherent in the constitution of matter? The inertia, or vis inertiæ. What for the second law? The inertia. What for the third law? Still the inertia. Consequently, this inertia is literally nothing but an expression of the incapability of matter to obey any other laws except those which it really does obey; and the policy of admitting such a term is not merely a question of mechanics. Need we accompany every fundamental term of every science by another, which merely expresses that there must be some reason why the thing signified has the collection of properties which it is found to possess, and not any other? We think the answer must be in the negative, in which case the word matter itself may be substituted for inert substance, the two phrases being perfectly interchangeable in every work on mechanics. [MOTION, LAWS OF.]

If the word Inertia be admitted at all as one of distinction, it must be to separate the object of geometry from that of mechanics. In the former we consider space only; that is, bounded portions of space: in the latter we suppose this bounded space to have inertia. But the distinction is quite sufficiently made without the introduction of a synonyme. In geometry we consider space without reference to the question, whether the space be vacuum or matter; in mechanics we consider matter.

Thus much for the use of Inertia in a scientific sense: in many popular writings we find it applied as a sort of explanation of the properties of matter, which are so and so *because* matter has inertia. Since this vicious application of words is not by any means confined to the case before us, it is needless to enlarge upon it.

There is one use of the word inertia which is convenient and harmless, namely, as part of the phrase MOMENT OF INERTIA. If we imagine a material system which admits of revolution about a fixed axis, it is obvious that the more closely the matter of which it is formed is collected about the axis the less resistance will be offered to the production of rotatory motion. The law of this resistance will be explained in the article alluded to.

INFANT, a person under the age of twenty-one, whose acts are in many cases either void or voidable. As a general rule, an infant cannot make any binding contract, though to this there are some exceptions: thus an infant may bind himself to pay for his necessary meat, drink, apparel, physic, and such other necessaries, and likewise for his good teaching and instruction. (*Co. Litt.*, 172.) But where an infant is living in his father's house and under his care, he is not liable even for necessaries. Necessaries for an infant's wife are necessaries for him.

Since the article AGE was published, the statute 1 Vic., 26, has been passed, by the 7th section whereof persons under age are incapacitated from making a will of personal property, which before the passing of this act they were competent to do.

It should also be observed, that an infant, how young soever he may be, and even a child in the womb, or, as it is technically expressed, *en ventre sa mere*, may be appointed an executor: but the statute 38 Geo. III., c. 87, disqualifies an infant who is appointed *sole* executor from exercising the office during his minority; and administration with the will annexed must be granted to the infant's guardian, or to some other person, until the infant is of full age.

An infant en ventre sa mere is supposed in law, for most purposes, to be a person in being.

INFANT SCHOOLS. [SCHOOL.]

INFANTICIDE. The practice of putting infants to death has existed from the remotest periods on record, though the motives for the act have somewhat varied. In some at least of the states of Greece the destruction of those who were born weak or deformed was either commanded or allowed. In Rome children were exposed or put to death, not only with the view of removing those who might throughout life have remained a burden to their friends and useless to the state, but to prevent the too rapid increase of the population. The propagation of Christianity first checked the practice; and A.D. 315, Constantine the Great provided for the maintenance of the offspring of those who were themselves destitute, and imposed severe punishments upon cruel fathers. It prevailed however to a slighter extent till the reign of Valentinian, who 'included such murders in the letter and spirit of the Cornelian Law.' (Gibbon, *Decline and Fall.*) Among the contemporary barbarous nations, the same motive, and the sacrifices required for their deities, induced the same crime to even a greater extent.

In modern times, the practice, though it is not anywhere sanctioned or commanded by law, is yet permitted in many countries. In China a large proportion of the female population are put to death as soon as they are born. Among the Hindus it was practised to a very great extent, till the marquis of Wellesley, when appointed Governor-General of India, used every possible exertion to put a stop to it. By the perseverance of Major Walker and others his endeavours were successful, though unhappily for only a short time, for Bishop Heber tells us that 'since that time things have gone on very much in the old train, and the answer made by the chiefs to any remonstrances of the British officers is, "Pay our daughters' marriage portions, and they shall live."' (*Narrative of a Journey in Upper India*, and *Hindu Infanticide*, by E. Moor, F.R.S, 1811; including Walker's *Report.*) Of the island of Ceylon, Heber also remarks that in 1821 'the number of males exceeded that of females by 20,000; in one district there were to every hundred men only fifty-five women, and in those parts where the numbers were equal the population was almost exclusively Mussulman.' Here also, as in Hindustan, the difficulty and expense of educating female children, and the small probability of their marrying without some dowry, while a single life is deemed disgraceful, are the motives leading to the perpetration of the crime. Amongst the Mohammedans the practice is not discountenanced, though the necessity for it is greatly lessened by the habit of producing abortion, which almost universally prevails. In the numerous islands of the Pacific, infanticido is practised to such an extent, that somo of them have at times, when pestilence has contributed its influence, been nearly depopulated. When Cook visited Otaheite, he found its population to be upwards of 200,000; but in the early part of this century it was reduced to between 5000 and 6000, and this principally from the practice of murdering their offspring. Mr. Ellis (*Polynesian Researches*) says that he does 'not recollect having met with a female in the island, during the whole period of his residence there, who had been a mother, while idolatry prevailed, who had not imbrued her hands in the blood of her offspring.' We have similar accounts from nearly all the northern parts of America, from Hudson's Bay, Labrador, Mexico, &c.; but it is most gratifying that in all, one of the first and greatest blessings which have followed the introduction of Christianity and civilization has been the decrease or complete cessation of this abominable custom.

In more civilized lands, although infanticide is regarded with the deepest abhorrence, and is visited with the extreme severity of the law, the expense and trouble of maintenance, and the fear of shame and loss of reputation, are motives sufficiently powerful for the occasional perpetration of the crime.

It is one of the most difficult questions of Medical jurisprudence to discover and establish the murder of a child lately born. The chief points for decision are, 1st, whether the infant, the subject of inquiry, was born dead or alive; and 2nd, whether its death was the result of violence or of natural causes.

To establish the former point it is necessary to prove first that the infant was not born before the end of the sixth month after conception, because before that time a fœtus cannot be deemed capable of maintaining an independent existence, or to be what is called *viable*. This being proved from the size and form of the child, the decision whether it were born alive or not must generally rest on the condition of the lungs and heart, in which certain remarkable changes are produced as soon as respiration in the air has commenced. In the fœtus in utero and in the still-born child the lungs are of a dark purplish or chocolate colour, nearly like that of the liver; they are small, and occupy only a small part of the cavity of the chest, in which they lie close against the spine; they have a firm solid consistence like liver, and their edges are sharply lobed. In the child which has breathed the lungs are of a florid red or rosy hue; they nearly fill the chest, and are found on opening it to be almost in contact with its front wall; their substance is soft, spongy, and light—they crepitate or crackle when pressed, frothy fluid may be squeezed out from an abundance of minute cellules, and their edges and lobes, instead of being sharp, are smoothly rounded off. If the child has breathed *fully* for some minutes after birth, these characters will be quite sufficient to decide the point in question, but in more difficult cases the weight of the lungs and their specific gravity require to be examined. At the same time that the air enters the lungs in respiration, a much larger quantity of blood is sent to them from the heart [HEART] than had before circulated through them, and they therefore become considerably heavier. Ploucquet has on this ground proposed what is called the Static Lung Test, which is applied by comparing the absolute weight of the lungs with that of the whole body. By subsequent observers it has been determined that the weight of the lungs of still-born children is somewhat less than $\frac{1}{70}$ of that of the whole body, and that of the lungs of children that have breathed, rather more than $\frac{1}{35}$. This difference, though not sufficient to make this test by itself decisive, is yet of much importance as an addition to other evidence, and is especially to be considered in connection with the hydrostatic test which is founded on the specific gravity of the lungs. As the air and blood enter the lungs at the same time, their relative weight is *diminished* although their absolute weight is increased; so that a portion of the lung of a still-born child is heavier than a portion of the same size from a child which has breathed. The former is heavier, the latter lighter than water; and hence a simple test is obtained by observing whether the lungs of the infant under examination will float or sink when thrown into a vessel of water. When carefully employed, these two tests cannot fail to decide whether the child has breathed or not, but there are circumstances which may in some degree obscure the evidence to be drawn from them. First, there are those circumstances which may cause the lungs of a child which has never breathed to float in water. A certain degree of putrefaction may do this, by the quantity of gas which is generated in their tissue. This however cannot take place until the whole body of the infant is extremely putrid, for the lungs are amongst the organs which remain longest unaltered after death. Nor could a competent person fail to discover the difference between lungs rendered light by putrefaction and those which had breathed; the former present large bubbles of gas on their surface, which may be squeezed out by pressure under water, and when this has been done, the portion of lung to which they were attached will immediately sink. In some very rare cases emphysema of the lungs is produced during birth, but this also can at once be known by the air being contained in large bubbles, from which it may be pressed out. Lastly, the lungs may have been artificially inflated after death, but in this case the alteration of colour and volume, though produced in the same manner as in natural respiration, are only partial; some portions of the lungs are spongy and ruddy, but others are solid and livid. All the doubt that might arise from any of these circumstances may be removed by cutting up the lungs into small portions and squeezing each piece firmly under water: if natural respiration has been performed, the smallest portion of lung, unless torn by the continued pressure into mere shreds, will continue to float; but in every other case the air may be so completely expelled that every portion will sink. In no case moreover, except whore natural respiration has taken place, will the absoluto weight of the lungs be increased; for in no others does the increased flow of blood from the heart take place.

On the other hand, there are very rare cases in which, though the child was born alive, the lungs will not float. They may be diseased, or the infant may have been too feeble to breathe completely, but in both these cases the same plan of cutting each lung into small pieces and testing each will remove all doubt, for there will be at least some portions into which the air has entered sufficiently to inflate them completely. The static and hydrostatic tests therefore, when carefully employed together, will certainly prove whether the child have breathed, but thoy afford no evidence as to whether it was murdered or not. For, it may have breathed during birth, and have died before it was completely born; or, on the other hand, it may have lived for a short time without breathing. These cases are however exceedingly rare, and their occurrence is so clearly indicated by tho appearances found on the body, that they can never embarrass the evidence that would be given.

The signs of a child having lived after birth, which are to be found in the heart and other parts, need here be only alluded to [HEART]; for they afford no positive information unless life has continued for at least a day, and then the lungs alone will always suffice for decision. Neither need we here consider the evidence required to prove whether a child born alive was murdered, or died from natural causes, for it must be similar in all respects to that which is necessary in cases of homicide.

Law relating to Infanticide.—If the result of tho evidence be that the child was born alive, and that it was destroyed, the offence is murder, and punishable accordingly. [MURDER.]

So also if a woman be quick with child (that is, if she has felt the child move within her), it is murder if she take, or any person administer to her, or use any means to procure abortion. But in cases where the woman is not quick with child the offence is felony, and punishable at the discretion of the court by transportation for any term not exceeding fourteen or less than seven years, or imprisonment with or without hard labour for any term not exceeding three years; and if the offender be a male, to be once, twice, or thrice publicly or privately whipped (if the court shall think fit), in addition to such punishment, (9 George IV., c. 31.)

The murder of bastard children by the mother was considered as a crime so difficult to be proved, that the statute 21 James I., c. 27, made the concealment of the death of a bastard child absolute evidence that it had been murdered by the mother, except she could prove, by one witness at least, that it had been actually born dead. This cruel law was mitigated by the 43 George III., c. 58; and now, by the statute 9 George IV., c. 31, sec. 14, the concealmont of the body of a bastard child is declared to bo a misdemeanor, and made punishable by imprisonment for any term not exceeding two years, with or without hard labour.

These are the regulations of the English law directly designed to prevent infanticide. There are however institutions in this country, as well as many other European countries, which have been founded with the view of restraining the commission of the crime, of which an account is given in the article FOUNDLING HOSPITALS: but the history of these establishments shows that though they may have rendered infanticide less frequent, they have by no means tended to preserve the lives of illegitimato children; for in all of them, except the London Foundling Hospital, which is a comparatively wealthy establishment, their records show an astonishing amount of mortality, in some cases as high as eleven-thirteenths.

The course of legislation for the prevention of infanticide, and the existing laws upon the subject, which have been established in most of the countries of which we have any knowledge, are clearly and concisely stated in Dunlop's edition of Beck's 'Elements of Medical Jurisprudence,' pp. 185-194.

INFANTRY is a name given to the soldiers who serve on foot. It is immediately derived from the Italian word *fante*, which, though in strictness denoting a child, is in general applied to any young person. From the latter word comes *fantaccino*, and this is the origin of *fantassin*, a name which was once so commonly applied to a foot-soldier. During the time that the feudal polity was in vigour the numerous dependants of the nobility served in the wars, for the most part, on foot; and being called children, because they were so considered with respect to their patron lords, or to the towns from whence they were drawn, the word infantry became at length the general name for that species of troops. Boccaccio, who wrote in the fourteenth century, dosignates by tho word *fanteria* the men who marched on foot in rear of the cavalry.

Among the antient nations of Europe the foot soldiers constituted the chief strength of the armies. In the best days of the Grecian and Roman states battles were mainly won by tho force and discipline of tho phalanges and legions, and the number of the infantry in the field far exceeded that of the cavalry. The latter were then, as at present, employed chiefly in protecting the wings of the army and in completing the victory which had been gained by the former. It may be remarked also that most of the writers on tactics, from Folard downwards, express a decided preference in favour of the infantry.

The French historians agree that the antient Franks, when they left the forests of Germany, were accustomed to march and fight on foot; and that they persevered in this practice even after they had obtained possession of the country of the Gauls, which abounded with horses. In this country also the greater part of the Anglo-Saxon forces consisted of infantry, the cavalry being formed of the thanes, or rich proprietors of the land: the infantry were divided into heavy and light armed troops; the former being provided with swords and spears and large oval shields, and the latter having only spears, clubs, or battle-axes.

But soon after the time of Charlemagne the institutions of chivalry began to be generally adopted in the kingdoms of Europe. These led to frequent and splendid exhibitions of martial exercises on horseback in presence of the sovereigns and assembled nobles; and the interest inspired by the achievements of the knights on those occasions was naturally followed by a high regard for that order of men. By degrees the cavalry, which was composed of persons possessing rank and property, and completely armed, acquired the reputation of being the principal force in war; and the foot soldiers, ill armed and disciplined, were held in comparatively small estimation.

From the capitularies of the French kings of the second race it appears that the foot soldiers who served in the armies of France consisted of slaves and freed serfs: the latter were either peasants or artificers, who, for the benefit of the army, occasionally exercised their particular trades, as shoeing horses, forming intrenchments, &c.; and, in action, like tho men of the inferior class, were employed as skirmishers or light-armed troops. Similarly the infantry of this country, for some time after the Conquest, consisted of the yeomanry, vassals and dependants of the feudal tenants; and occasionally foot soldiers were engaged by the kings, under indentures, to serve in the wars. The English troops at that time wore a plain iron helmet called a *bacinet*, and a linen doublet stuffed with wool or cotton their arms were generally pikes, but frequently they had swords and battle-axes.

Under the third race of kings in France the possessors of fiefs were not compelled to furnish infantry for tho armies; and it appears that this duty was then imposed on the towns. The troops thus raised were obliged to serve only in or near the towns to which they belonged; or, if they were marched to a considerable distance from thence, they received pay. In the reign of Philip Augustus this militia must have been very numerous; for in some districts it was formed into legions, and was commanded by persons of distinction. At the battle of Bovines (1214) the municipal militia formed the first line of the French army, but it was defeated by the German infantry which was more numerous, and even then of better quality than that of France.

In 1448 Charles VII. instituted the militia denominated *Francs Archers*, which consisted of 16,000 foot soldiers armed with bows. But this body existed only about 40 years, when it was suppressed by Louis XI., who formed a standing army of 10,000 French infantry, to which were joined 6000

Swiss; and subsequently Charles VIII. added a large body of Lansquenets, or German infantry. The reputation of the native troops in France seems to have been then at a low ebb; for Brantôme, in his *Discours des Colonels*, describes them as being mostly the refuse of society—men with matted hair and beards, who for their crimes had had their shoulders branded and their ears cut off. On the other hand the Swiss soldiers were inured to discipline; they were protected by defensive armour and formed into deep battalions, in which state they were able to render the shock of cavalry entirely unavailing. Large divisions of these troops accompanied the army of Charles VIII. into Italy, in 1494, where their good conduct and discipline greatly contributed to raise the reputation of the infantry to its antient standard.

The superiority of this class of troops consists in their being able to act on ground where cavalry cannot move; and it is obvious that the latter must, at all times, have been nearly useless in the attack and defence of fortified castles or towns. Even when the cavalry were held in the highest estimation it was sometimes found convenient for the knights to dismount and act as infantry. Froissart relates that at the battle of Cressy the English troops were formed in three lines, consisting of men-at-arms who fought on foot and were flanked by archers. At Poictiers and Agincourt also the men-at-arms engaged in a similar manner.

The Spanish soldiery, probably from being almost constantly engaged in warfare with the Moors, had early acquired considerable reputation; and the gallantry of the troops on foot, in keeping the field after the cavalry had retired, has been supposed, though this opinion of the origin of the name is now rejected as fanciful, to have been commemorated by the designation of infantry, which was bestowed upon them, it is said, in consequence of their having been headed on that occasion by an Infanta of Spain. The great share which the Spanish forces had in the wars carried on both in Italy and Flanders during the reigns of Ferdinand, Charles V., and Philip II.; their steady discipline, and the success which resulted from the association of musketeers with pikemen in their battalions, caused the infantry of Spain to be considered, during many years, as the best in Europe. But the rivalry in arms between the Emperor Charles V. and Francis I. of France, and the connection of Henry VIII. of England with both, led, in the several states of those monarchs, to the adoption of the improvements which had been introduced by the Spaniards. It may be added that the practice of keeping up standing armies composed of men trained in the arts of war under a rigid system of discipline, together with the universal adoption of the musket, has now brought all the infantry of Europe to nearly the same degree of perfection.

The British army at present comprehends, besides the militia, 99 regiments of regular infantry; 3 regiments of foot guards; a rifle brigade and the Ceylon rifle regiment; 2 West India regiments; the royal regiment of artillery and the corps of engineers and marines.

INFECTION is the contamination of the atmosphere or other inert substances by the deleterious or offensive qualities of malaria, the matter of contagion, effluvia from putrid animal or vegetable substances, &c. Some of these are at once recognised by the smell, or by chemical analysis, but the presence of others is known only by the diseases which they produce. The same means however may be applied in many cases for preventing the injurious effects of both classes.

The most important and valuable method of disinfection is ventilation, and, whatever other may be added to it, this should never be neglected. The apartment, or whatever requires to be purified, should be exposed to a constant and free current of fresh air, till every trace of odour is completely expelled, or as long as any emanation is going on. The reputation of chlorine, acids, lime, charcoal, &c., as disinfectants, depends on their property of decomposing the offensive gases which are so often mixed in the atmosphere with the matter of infection, but it is questionable whether they have any influence on the infectious particles themselves. However as the emanations from putrid substances render the body peculiarly liable to the reception of infection, some of these means should be employed where any offensive smell is present. The best is chlorine, which has of late completely superseded the use of tho others; the chloride of lime should be poured over any thing from which the odour is emitted; it should be sprinkled about the floor and on the walls; or shallow vessels containing it should be exposed to evaporate in the air; or pure chlorine should be disengaged in the form of gas from the materials from which it is manufactured. [CHLORINE.] Fumigations with aromatic substances, as camphor, &c., are perfectly useless, only serving to conceal the smell, but having no influence either on it or the infectious particles. Perfect cleanliness is of the greatest importance; every portion of the room or house should be carefully and frequently washed with hot soap and water; clothes and everything removable should be immersed in hot water, and after being well washed, should be exposed for a long time to the open air, or sprinkled with chloride of lime; the walls and ceilings should be whitewashed, and beds, bedding, &c., cleaned and exposed in the open air. Dr. Henry has rendered it probable by numerous experiments that the infectious qualities of substances which cannot be conveniently washed, as trunks, packages of valuable merchandise, &c., may be sufficiently destroyed by exposing them to a dry heat of 200° for not less than an hour.

INFEROBRANCHIA'TA, the third order of *Gastropods* in the system of Cuvier, who describes them as having nearly the form and organization of *Doris* and *Tritonia*, but remarks that their branchiæ, instead of being placed on the back, are arranged in the form of two long suites of leaflets on the two sides of the body under the advanced border of the mantle. He records two genera, *Phyllidia* and *Diphyllidia.*

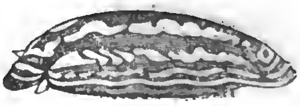
Phyllidia.

Mantle naked, and most frequently coriaceous; no shell. *Mouth* a small proboscis, with a tentacle on each side; two other tentacles come forth above two small cavities of the mantle. *Organs of Generation* under the right side forward. *Heart* towards the middle of the back. *Stomach* simple, membranous; *intestine* short. (Cuvier.)

M. de Blainville describes the body of the genus *Phyllidia* as oblong and rather convex; the head and the foot hidden by the border of the mantle; four tentacles, the two upper ones retractile in a cavity which is at their base, the two lower buccal; mouth without an upper tooth; a lingual denticulated mass; branchial laminæ all round the lower border of the mantle, except in front; vent at the posterior and mesial part of the back; orifices of the organs of generation in a common tubercle at the anterior fourth of the right side.

Example, *Phyllidia pustulosa.*

Locality, the Indian Seas, where the other species have also been found.



Phyllidia pustulosa.

Diphyllidia (Linguella? Leach).

Branchiæ nearly the same as in *Phyllidia*, but the mantle is more pointed behind; the head, which is demicircular (la tête, en demi-cercle), has on each side a pointed tentacle and a slight tubercle; vent on the right side. (Cuvier.)

M. de Blainville thus describes *Linguella*, which both Cuvier and himself seem to consider as identical with *Diphyllidia.*

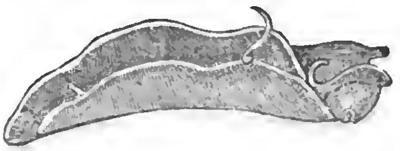
Body oval, very much depressed, the mantle projecting beyond the foot on all sides, except in front; head uncovered. Branchial lamellæ oblique, and only occupying the two posterior thirds of the inferior border of the mantle; vent inferior, situated at the posterior third of the right side; orifices of the organs of generation in the same tubercle, at the anterior third of the same side.

Example, *Linguella Elfortii* (De Blainv.), *Diphyllidia Brugmansii?* (Cuv.)

M. de Blainville says that the locality is unknown. Cuvier says that *Linguella Elfortii* appears to him not to be different from his *Diphyllidia Brugmansii.*

M. de Blainville further says that it is probable that the genus established by M. Rafinesque under the name of '*Armina*' does not differ much from *Linguella.* In his 'Additions and Corrections' to his 'Manuel' he says that

M. Otto has discovered a species of *Linguella* in the sea of Naples.



Linguella Elfortii. (De Blainv.)

M. Rang observes that *Diphyllidia*, *Linguella*, and *Arminia* being identical, Cuvier's name should be preserved: the two subsequent names should consequently be omitted.

INFINITE, INFINITY, INFINITESIMAL, INFINITESIMAL CALCULUS. The word infinite is literally 'without bounds,' and when applied in an absolute sense to magnitude means that its quantity is utterly unlimited, so that there is no conceivable and determinable magnitude but what is less than the infinite magnitude.

The notion of infinity is therefore at first purely negative, but it does long remain so: for we are forced upon what we take the liberty of calling a definite notion of infinity, by our consideration of time, space, and number. We cannot, if we would, annihilate our conception of space, or confine it within certain limits; nor can we suppose duration to have an end. Even if we imagine our own annihilation we cannot rid ourselves of the idea of something else existing, with the permanent conception of unbounded space and time. If we try to conceive all sentient existence at an end, we know from reasoning that we ought to suppose also the annihilation of space and time: but the constitution of our minds will not permit it, and as long as we exist to think, even about our own non-existence, the reality of space and time will prevent our conceiving their destruction. Whether the preceding be good or bad metaphysics is perfectly indifferent in an article on the use of the word infinite in the exact sciences: the ideas expressed, true or false, are those which will, in the first instance, present themselves to the mind; and those who object to one method of expression will embody the same thoughts in another.

The other extreme in the scale of quantity is the perfect absence of all magnitude, expressed in the word 'nothing' or the technical term 'zero.' It is necessary to treat the two together in mathematical reasoning, since all difficulties which belong to the one term belong equally to the other. We have also to consider the words 'infinitely small' as well as 'infinitely great.'

There are three distinct methods of proceeding in regard to the employment of these terms in mathematical reasoning. Firstly, we have those who would use the words 'infinite' or 'nothing' in their absolute sense, relying upon the reality of the conception which they have of the things signified by them. Secondly, there are others who would entirely banish the use of the words, because in their absolute sense they do not represent assignable magnitudes. Thirdly, others admit the use of the words, guarding them by definitions which point out the processes in the expression of the results of which they may be employed.

To the first it is answered that the absolute use of ∞ and 0 (the mathematical symbols of infinite magnitude and absence of all magnitude) in the same manner as symbols of definite quantity, is extremely liable to lead to error; which was never avoided by the advocates of this system, except by abandoning their theory, and applying in practice the maxims alluded to under the third of the preceding heads. The absurdity of an absolute and unrestricted use of these terminal symbols may be very easily shown, if it be maintained that they are to be used precisely as other symbols. For example, it will readily be conceded that if a times x be y, and if b times x be y, then a and b must be equal. Now twice an infinite magnitude is infinite, and three times an infinite magnitude is infinite, therefore 2 and 3 must be asserted to be equal. The advocates of the unrestricted use of ∞ and 0 avoid such results by a method of selection which amounts to keeping within the definition presently to be noticed.

To the second of the three sects above mentioned it may readily be conceded that they have a right to refuse any branch of mathematical reasoning, so far as themselves only are concerned. But we deny that the code of mathematical controversy contains any such axiom as that 'mathematics is the science of assignable magnitudes only,' by which to claim the submission of an opponent. The general rule is, that mathematical demonstration exists wherever there is logical deduction from universally obvious maxims with respect to magnitude. Nor does the word 'universally' here mean that such maxims must have been obvious to every individual of the human race. If so there would be no such thing as mathematical demonstration: for there have been found instances in which persons have denied that the sum of all the parts makes up the whole. It would not be very easy to lay down a rule by which it should be determined what fraction of dissent is fatal to an axiom, but the following appears to us to be the practice. When any individual who has been successful in advancing the mathematical sciences, and whose talent and originality are widely known, disputes what is usually received as a first principle, it is customary for subsequent writers on the same subject to preserve his objections, and place them before the reader. If two or three such persons unite in an objection, the fact of there being a majority of the same class on the other side would not save the principle attacked from being considered as dubious. All differences which affect results are very soon settled; but those which only array one mode of attaining a certain conclusion against another, depending as they do for the most part upon the manner in which fundamental and indefinable terms are understood, are generally perpetuated from one age to another. Now it is a proposition which is very rarely disputed, that the science of mathematics is conversant with more than assignable magnitude, and that the notion of infinity, though requiring to be used with care, is one with regard to which sound and obvious maxims of reasoning may be laid down.

We proceed to state these principles, that is, to enunciate the method followed by the third of the sects mentioned. If we look at the manner in which we derive the notion of infinity, we shall not find any one who imagines that he absolutely grasps infinite space, time, or number, by one single and independent conception of his mind. To space, space may be added, to this again space may be added, and so on without limit, until the space thus accumulated is greater than any definite space [INDEFINITE] which was named at the outset of the process. From thence comes the notion of infinite: we cannot imagine the greatest possible space, because any space, however great, being distinctly conceived, we can as distinctly conceive a greater. Consequently the phrase 'space is infinite,' whatever more it may imply, certainly may be allowed to stand for an abbreviation of the preceding two sentences. And in like manner, if we see a conclusion—which we can nearly attain by the use of a large magnitude, more nearly by the use of a larger, and so on without limit, that is to say, as nearly as you please, if we may use a magnitude as large as we please, but which is never absolutely attained by any magnitude however great—then such conclusion may be said, for abbreviation, to be absolutely true when the magnitude is infinite. It may appear to some as if the conclusion, under the preceding circumstances, is really true when the magnitude is infinite: this may or may not be the case, but the mathematical use of the word infinite does not require the question to be raised. The convention under which that term is introduced demands that the preceding conditions shall be fulfilled, and excludes the word whenever they are not fulfilled: those who think that the fulfilment of the conditions makes that which we call a convention a necessary consequence, meet on common ground with those who would reject the absolute notion of infinity. The former are allowed their own words, and their own result, together with their own method of arriving at it; the latter are not required to use the word infinite, except as an abbreviation: to the mere collocation of the letters which compose that word they can hardly object, and the conditions of its introduction are precise and intelligible. We shall now give a few instances of the development of propositions in which the word infinite appears.

1. When x is infinite, A is equal to B. This may be said in abbreviation of the following:—When x is great, A is nearly equal to B; A may be made as nearly equal to B as you please if we may take x as great as we please; but no value of x, however great, will make A absolutely equal to B.

2. A finite quantity a, divided by an infinite quantity, is

nothing. If x be divided by a comparatively great quantity, the quotient is small; this quotient may be made as small as you please, if we may take the divisor as great as we please; but no divisor, however great, will make the quotient absolutely equal to nothing.

3. Every circle is a regular polygon of an infinite number of sides. An inscribed polygon of a large number of sides nearly coincides with the circle; a polygon may be made to coincide with the circle as nearly as you please, if its number of sides may be as great as we please: but no polygon, however great its number of sides, can absolutely coincide with the circle.

4. When x is infinite A and B are both infinite; but A is infinitely greater than B. This may be said when if x increase, A and B both increase, so that A and B may both be made greater than any quantity you name, provided we may then make x as great as we please: provided also that A increases faster than B, so that when you name any number, however great, we, being allowed to make x as great as we please, can make A contain B more than that number of times.

5. When $x = a$, z is infinite. This may be said when z is great, if x be nearly equal to a, and may be made as great as you please, if x may be made as nearly equal to a as we please: provided that, however near x may be to a, z has still an assignable value.

The preceding instances are sufficient to show what is meant when the terms 'infinity,' 'infinite,' or 'infinitely great,' appear: we now proceed to the correlatives 'nothing,' 'infinitely small,' 'evanescent,' &c. The independent use of the term 'infinitely small,' as laid down by some writers, is yet more difficult than that of infinitely great. If A be an assignable magnitude, x is said to be infinitely small when it is so small that it is absolutely incomparable to A, so that $A + x$ and A may be taken as equal. Now, unless x be absolutely equal to nothing, this cannot be; so that the infinitely small quantity, as thus defined, can have no magnitude whatever. Here we seem to rest, not in an absurd, but in a useless conclusion: for what possible benefit can arise from inventing a new word to stand for the *nothing* by which two equal magnitudes differ. A little further consideration of the term 'nothing' will here be necessary.

There is one process of arithmetic which yields an absolute zero, namely, subtraction. From a take a, and nothing remains. Consequently, in considering the idea of the absence of all magnitude, we usually refer it to the result of that process by which it is directly and unambiguously obtained. But from no other process of arithmetic does this idea arise, except by the same train of ideas which leads us to the use of the word infinite. We cannot, for example, obtain the quotient 'nothing' by dividing one finite magnitude by another; we can make the result small, smaller, as small as we please, but not absolutely nothing. When therefore we consider an equation made by addition and subtraction of terms, the absolute result 0 may be used without reservation: thus, $2x + 3 = a$, and $2x + 3 - a = 0$, may be written for each other without any particular examination of the symbol 0. But in any other case we can only consider 0 as the limit towards which we approach by an interminable succession of diminutions, no one of which is ever final, corresponding to the interminable succession of augmentations by which we attain the notion of infinite. In strict analogy therefore with our former proceeding (mutatis mutandis, we repeat our words) if we see a conclusion—which we can nearly attain by the use of a small magnitude, more nearly by the use of a smaller, and so on without limit, that is to say, as nearly as you please by the use of a magnitude as small as we please, but which is never absolutely attained by any magnitude however small; then such conclusion may be said, for abbreviation, to be absolutely true when the magnitude is nothing. The sentences immediately following the first occurrence of the preceding words may now be repeated, only changing 'infinite' and 'infinity' into 'nothing.'

But in the meanwhile the term infinitely small does not appear, and its use seems to be superseded by that of the word 'nothing.' And it is true that 'nothing,' introduced under the preceding conditions, might supply the place of an infinitely small quantity. But since there is an absolute use of the term 'nothing,' derived from subtraction, to which the mind clings, and of which we do not find the like in connexion with the term infinity, we shall, after some further explanation, use the term infinitely small instead of 'nothing.'

Our explanation of the term infinite will readily show the meaning of the following assertion; two infinitely great quantities may have a finite ratio. As follows:—when A and B are great their ratio may be nearly, say that of 10 to 7; when they are still greater they may be still more nearly in that ratio, and so on; and their increase may be so regulated that the greater they become the more nearly is their ratio that of 10 to 7; or as nearly as you please, if they may be as great as we please. Similarly, strictly remembering the preceding conditions for the introduction of the word 'nothing,' we may allow of the introduction of the following phrase:—two nothings may have a finite ratio. This means that A and B, both diminishing together, may diminish in such a way that when both are small their ratio may be nearly, say that of 5 to 3; when they are still smaller they may be still more nearly in that ratio, and so on: and their diminution may be so regulated that the smaller they become the more nearly is their ratio that of 5 to 3; or as nearly as you please, if they may be as small as we please.

But the idea of two nothings which have a finite ratio, however strictly defined in accordance with the preceding conditions, shocks even many of those who can grasp the method of using the word 'infinity.' The absolute nothing of subtraction has possession of the field, and it is not worth while to contest it for the use of a word. The term 'infinitely small' therefore supplies the place of 'nothing' whenever the latter is introduced under the conditions correlative to the conditions under which the use of infinitely great is allowed. But it must be remembered that if the infinitely small quantity thus introduced is to be added to or subtracted from a finite quantity it makes no change in the latter; just as if it were the nothing of arithmetic. A few instances of the development of propositions will now be given.

1. When A is infinitely small B is infinitely great. As A diminishes B increases, and B can be made as great as you please, if A may be taken as small as we please.

2. An infinitely small arc of a curve is equal to its chord. The smaller the arc the more nearly are the two in the ratio of 1 to 1; and the ratio may be made as nearly as you please that of 1 to 1, if the arc may be taken as small as we please.

3. Of two infinitely small quantities, one may be infinitely smaller than the other. When two magnitudes, A and B, diminish together, the smaller they are made the greater may be the ratio of A to B, in consequence of B diminishing much faster than A; and it is possible that A may be made to B in as great a ratio as you please, if both may be made as small as we please. The sine and versed sine of an angle are instances. Both diminish without limit with the angle; but the smaller the angle the greater the number of times which the sine contains the versed sine; and this to any extent whatever.

Infinitely small quantities thus used have been called infinitesimals, and a succession of infinitely small quantities, each of which is infinitely smaller than the preceding, is said to be a series of infinitesimals of different orders. Such a series is x, x^2, x^3, &c., in which, by making x sufficiently small, any one may be made to contain the next as often as we please. The infinitesimal calculus is a name sometimes given to the differential calculus, when presented by means of the theory of infinitely small quantities, in the manner originally propounded by Leibnitz.

The preceding considerations refer to the substance of nearly all the disputes which have arisen about the first principles of the differential calculus [DIFFERENTIAL CALCULUS]; and the different systems noticed in that article (with the exception of that of Lagrange [FUNCTIONS, THEORY OF]), spring out of different views of the manner of presenting the same idea.

In the article ANGLE we have taken notice of the circumstance that an extension of the word 'equal' to infinite spaces which coincide, would allow of a proof of the well-known assumption of Euclid. [PARALLELS.] Let us suppose two equal angles having their sides infinitely extended. We have then two infinite spaces, of which it may readily be proved that either may be made to coincide with the other throughout its whole extent. And if any two angles be taken, and their infinite spaces be drawn, it may be easily shown that the infinite space of the greater angle is greater than the infinite space of the less. The comparison of such infinite spaces is therefore possible, consistently with perfect clearness in the meaning of the terms employed, and a simplicity of reasoning which would convince any one who is capable of the most ordinary thought. Had Euclid been accustomed to the modes of thinking which involve the idea of infinite magnitude, under any form whatsoever, it may be reasonably suspected that he would have admitted the following axiom, 'Magnitudes which can be made to coincide in all their parts are equal,' as applicable to infinite as well as finite spaces. Not having done so, the adherence to his standard has to this day excluded the only proof of the theory of parallels which does not assume the axiom of Euclid or an equivalent. For this demonstration see PARALLELS.

INFLAMMATION (from *inflammo*, to burn). When any part of the body is preternaturally hot, red, swollen, and painful, such a part is said to be inflamed, or in a state of inflammation; and when these symptoms prevail to a certain extent, or affect very sensible parts, that general constitutional disturbance called fever is excited.

Inflammation may be either acute or chronic, circumscribed or diffused, common or specific. The term common, or healthy inflammation, is applied to all those inflammations which occur in a person otherwise healthy, which run a regular course, are usually of an acute character, and terminate in one of the conditions hereafter to be described. Specific, or unhealthy inflammation, unless produced by the direct action of a morbid poison, as that of Syphilis, Variola, &c., never takes place in a healthy individual, but is always modified by some pre-existing peculiarity or abnormal condition of the system, frequently hereditary, and is generally chronic. Although pain, heat, redness, and swelling, characterize inflammation in its most ordinary forms, it is by no means uniformly attended with all these symptoms; this is a circumstance which depends on the anatomical structure of the part affected, and on the duration and kind of the inflammation.

Terminations.—Inflammation is said to terminate in three ways:—by resolution, suppuration, and mortification. By the first, which is the most frequent mode of termination, is meant a gradual subsidence of the swelling, a diminution of the heat, pain, and redness, and an abatement of the fever; the parts return to their natural size and colour, and no pus or matter is formed. Suppuration is said to have taken place when the inflammation goes on to the formation of pus; the swelling then becomes more prominent, of a shining red colour, and soft in the centre; if now no artificial opening be made, the matter obtains exit through one or more orifices produced by the absorption of the walls of the cavity in which it is contained, and the abscess, in popular language, is said to have burst. Mortification is the least frequent but most severe mode in which inflammation can terminate, and usually is productive of great constitutional disturbance; when it is the result of a high degree of inflammation, the attendant pain is exceedingly severe, the bright red colour of the part becomes livid, and vesicles form on its surface; complete death of the part then takes place and the pain abates, but the pulse is small and feeble, and great prostration of strength, with troublesome hiccup, are the constant attendants.

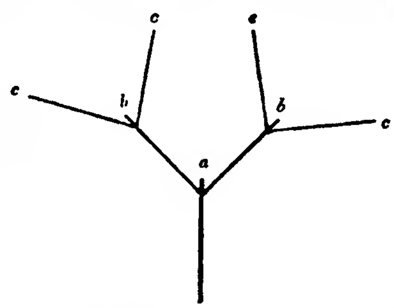
Causes.—The remote or exciting causes of inflammation are produced either by mechanical violence or by the action of chemical or other agents; but it sometimes occurs spontaneously, or without any perceptible cause for its production. With regard to the proximate cause, this is a question which is not so easily solved; it has occupied the attention of pathologists from the earliest times, and the number of theories on this subject attest the number of those who have interested themselves in the inquiry. The older pathologists imagined that all inflammations were produced by a fluxion, or flow of certain humours to a part, and the peculiar nature of the swelling was supposed to depend upon the kind of humour; thus blood produced phlegmon, bile produced erysipelas, &c. After the discovery of the circulation of the blood by our immortal Harvey, Boerhaave appears to have been the first who applied the discovery to the solution of this complicated question: he supposed that the minute blood-vessels became obstructed by the viscidity of the blood, or where this viscidity did not previously exist he imagined that the larger globules of the blood passed into the small vessels and blocked them up. But change in the consistence of the blood being found inadequate to explain all the phenomena of inflammation, it was supposed that the vessels themselves contributed chiefly to its production, and the doctrine of spasm of the extreme arteries began to prevail. Mr. Hunter considered inflammation to be a restorative principle by which injured or diseased parts are repaired, and the act of inflammation he regarded as an increased action of the vessels, which at first consists simply in an increase or distention beyond their natural size. This increase he imagined to depend upon a diminution of the muscular power of the vessels; and the blood he supposed to circulate through them more quickly than in the natural state; but several of the assumed facts of Mr. Hunter have since been found to have no existence, and even at the present day opinions are still divided on this interesting but perplexing subject. Whatever difference of opinion exists as to the cause of inflammation, we believe all are agreed on the plan to be pursued in its reduction: this consists in the removal of all exciting causes, the abstraction of blood generally and locally, the administering of such medicines as act either by lowering the circulation generally or increasing particular secretions, and in the employment of local emollient or sedative applications.

INFLEXION. [DIFFRACTION.]

INFLEXION. A point of contrary flexure [FLEXURE, CONTRARY] is sometimes called a point of inflexion.

INFLORESCENCE, in plants, is the manner in which their flowers are arranged. A flower being a body analogous to a leaf-bud, with a similar origin, and capable, under particular circumstances, of reverting absolutely to that condition, it follows that the branching of that part of a plant which bears flowers should be of the same nature as that which bears leaf-buds, and therefore not in need of special explanation. But as the formation of the flower out of the materials of a leaf-bud is accompanied with many deviations from the habitual development of its parts, so is the disposition of the branches of inflorescence often in a similar way a deviation from the habitual method of arranging those parts.

Inflorescence may be considered as regular or centripetal, and irregular or centrifugal: in the former all the parts are formed successively without interruption; in the latter the parts are subject to various interruptions and derangements in the progress of their formation. In centripetal inflorescence the external flowers of a disk, or the lowermost of a cone, are first developed, and consequently first expanded; and hence the course of unfolding proceeds from the circumference to the centre, or, which is the same thing, from the base to the apex. In centrifugal inflorescence the axis of growth is arrested in its progress by the formation of a flower-bud, as at *a*, in the accompanying diagram; two lateral points then develop from below *a*, and lengthen to *b*, where a new flower-bud appears, and stops the growth; two other lateral points are produced from below *b* and lengthen to *c*, where a new flower-bud again arrests the progress of development; and so on. In



this case it is clear that *a* in the centre, being first formed, will expand before *b b* and *c c c c*; that *b b* will in like manner open before *c c c c*, and in the same way all the others: hence the order of expansion of the flowers is from the centre to the circumference. To this kind of inflorescence the word *cyme* is usually applied. It occurs in the common Elder, the Laurustinus, &c.

The centripetal inflorescence, in its simplest state, is merely a branch bearing flowers instead of leaf-buds, as in the Hyacinth and the Ornithogalum: if the flowers are sessile, it is then called a *spike*; if stalked, a *raceme*. If the branch of the spike or its axis is so much contracted as to become a broad disk, as in the Dandelion, or Daisy, or common Artichoke, the inflorescence is called a *head* or *capitulum;* if the same thing happens to a raceme, the *umbel* of Astrantia, Fennel, Parsley, &c., is the result. Let the flower-stalks of the raceme be branched or racemose, and the *panicle* is produced. To these primary forms of inflorescence all others are referrible, as simple and generally unimportant varieties.

INFLUENZA (La Grippe, *Fr.*). Influenza is the name given by the Italians to an epidemic catarrh, which has spread more extensively than any other epidemic; and this universality of its attacks, together with the greater severity of its symptoms, principally distinguishes it from common catarrh. It attacks all ages and conditions of life, but is seldom fatal except to the aged, or to those previously suffering from or having a tendency to pulmonary disease. Notwithstanding the great frequency of this epidemic, it is remarkable how little variety there has been in its symptoms, and the records of cases which occurred in 1510 nearly resemble those which have been observed during its latest visitations. The following are the symptoms which most generally characterize it:—the person is seized with slight chills, weight and pain, sometimes severe, are felt over the eyebrows, there is an increase of the lacrymal and nasal secretions, with loss of appetite, prostration of strength, a weak frequent pulse, dyspnœa, hoarseness, and cough. When death has taken place, the post mortem appearances have revealed acute inflammation of the mucous membrane lining the air passages, or pleurisy and pneumonia. The duration of the disease varies from one or two days to a fortnight, but great debility often remains behind for many weeks, and in some epidemics relapses have been frequent.

Several epidemics of influenza have been remarkable for affecting the mucous membrane of the alimentary canal as well as that of the organs of respiration. The cases occurring towards the subsidence of the epidemic are generally less severe than those at its commencement.

The history of this disease is curious. When once it has made its appearance it pursues a regular course from one country to another, from continent to continent, across seas and over mountains; but this course, although regular as regards each epidemic, yet varies somewhat with most. In 1510 its course was in a north-westerly direction; in 1557 due west, attacking whole populations almost on the same day; in 1580 from east and south to west and north, and was complicated with plague, but France was the only European country infected that year with the latter. That of 1729 was very fatal in London; Lowe says more persons died of it than at any one time since the plague of 1665. In the month of September, 1729, 1000 weekly were carried off by it in the metropolis. The epidemic of 1803 travelled from south to north.

These epidemic visitations have taken place most frequently in the spring and autumn, but have seldom remained at one place longer than six weeks.

On the exciting causes of this, as of all other epidemics, we must confess our ignorance. Some have attributed it to the sudden changes of weather; others to a particular morbid principle, different from but resident in and conveyed by the air; and others again to contagion. The first of these hypotheses is evidently untenable, for atmospheric changes as great and sudden have taken place as some of those observed to precede the breaking out of the epidemic, and yet none has appeared; and an epidemic has occurred without being preceded by any apparent atmospheric peculiarity; the sensible state of the air too preceding and accompanying the same epidemic has been different in different places. The doctrine of contagion, although it has had more advocates than either of the former hypotheses, does not appear to us to rest upon any better foundation; the instances of isolated individuals and districts, together with ships' crews in the open sea, being attacked, and the very sudden and almost instantaneous manner in which whole populations have been seized, which was particularly remarkable in the epidemic of 1557, seem to set at nought all ideas of contagion being the cause, not to mention the insufficiency of this view to explain whence the first individuals attacked contracted the infection. It remains then to examine the validity of the second hypothesis, viz. the existence of a morbid principle resident in and conveyed by the air. Now the very doubts on any subject which give rise to theories for explaining the phenomena connected with such subjects presuppose the want of any direct proofs or evidence of a tangible shape; and if, putting aside the idea of the epidemic we are speaking of being caused by any deleterious or unwholesome quality of our food, we allow the atmosphere to be the medium of conveyance of the morbid principle, we must admit that all endeavours hitherto made with the view of demonstrating such principle have only afforded negative results; neither does it appear that there is any one spot on the earth whence it emanates. However great the discordance of opinion on the cause of this malady, all physicians of eminence have agreed remarkably in their testimony as to the general rules and principles of practice. Notwithstanding the inflammatory nature of this disease, bleeding is ill borne, and can rarely be employed with safety, much less with benefit; and persons who have been subjected to this operation recover more slowly than others, and remain in a debilitated condition much longer. In severe cases, emetics at the commencement have been found useful, either in cutting short the disease or in moderating its violence. Mild aperients administered with caution, the exhibition of antimonial and saline medicines, and a cool temperature, constitute the means which experience has found to be most efficacious.

INFORMATION, an accusation or complaint exhibited against a person for some criminal offence. It differs from an indictment [INDICTMENT] principally in this, that an indictment is an accusation found by the oath of a grand jury, whereas an information is simply the allegation of the officer who exhibits it. Informations are of two sorts: those which are partly at the suit of the king, and partly at that of a subject; and secondly, such as are in the name of the king only. The former are exhibited for numerous offences inferior to felony, as wilful and corrupt oppression by a justice of the peace, libels, conspiracies, &c., and are filed by the master of the crown office. The latter are filed by the attorney-general at his own discretion, and are called ex-officio informations. The former kind, which are called criminal informations, can only be filed by leave of the court of King's Bench, and the application for leave must be supported by affidavits which the party complained of has an opportunity of answering. When an information of either kind is filed, it must be tried in the usual way by a petit jury in the county in which the offence was committed (4 Bl. *Com.* 307; 4 and 5 Will. and Mary, c. 18.)

When it is necessary for the court of chancery to interfere with the regulation or management of any charity, the attorney-general, on the relation of some informant (who is called the relator), files an information in the court of chancery for the purpose of bringing the case before the court.

If the office of attorney-general is vacant, the solicitor-general has power to file informations.

INFUNDI'BULUM. [BRAIN.]

INFUSIONS are solutions of some of the principles of vegetables, generally in water, but occasionally in other vehicles. When water is employed, it may either be hot or cold. It is customary to use warm water, but in many instances cold is preferable. Where cold water is used, it is necessary to continue the digestion longer than when it is warm. The vegetable substances may either be fresh or dried; when the former, they are to be cut into pieces; when the latter, bruised or very coarsely powdered, never reduced into a fine powder. The water being poured on the substance employed, is to be allowed to stand in a covered vessel for a space of time varying with the nature of the article submitted to maceration. It must be strained, and is then fit for use. Infusions generally spoil soon, more particularly if warm water be employed, or if the substance contain starch or other fermentable ingredients. Sometimes alcohol is added, after straining, to assist in keeping the infusion, or to increase its powers. Hard water should if possible be avoided in the preparation of infusions.

INFUSO'RIA. This term has been applied to the numerous minute animals found in water, which are commonly called animalcules.

The invention of the microscope by Hooke revealed the existence of myriads of living creatures whose presence was before unknown; and this instrument has shown that a drop of water, though it may appear to the naked eye to be perfectly clear, is perhaps swarming with living beings. Ehrenberg (whose labours have principally contributed to the knowledge of the true nature and structure of the infusory animalcules) has described species which are not larger than from one-thousandth to one two-thousandth of a line in diameter, and which are separated from one another by intervals not greater than their own size. A cubic inch of water may thus contain more than 800,000 millions of these beings, estimating them only to occupy one-fourth of its space; and a single drop (measuring not more than a line in diameter) placed under the microscope will be seen to hold 500 millions, an amount perhaps nearly equal to the whole number of human beings on the surface of our globe.

If a single drop of water thus swarms with life, what incalculable numbers of animalcules must be contained in every stagnant pond or lake, and in the sea.

History.—When Linnæus arranged all the organized beings known to him in the 'Systema Naturæ,' the structure of these minute animals was not sufficiently understood to enable him to distribute them according to their relations in his several classes; he therefore placed them at the end of his last class Vermes, in a genus which he denominated *Chaos*. Othon-Frederick Müller first separated them as a distinct order; and as the greater number of animalcules had been detected in liquids, in which vegetable or animal matters had been dissolved by infusion, he gave them the name *Infusoria*. Müller described many species, and acquired a considerable knowledge of the structure and organization of these minute beings; but he did not base his arrangement of the different genera on their varieties of structure, but only on the differences of their external form. Gmelin, in the thirteenth edition of the 'Systema Naturæ,' adopted Müller's arrangement, as also did Lamarck and Cuvier, who only altered the divisions and subdivisions of the class without changing the mode of arrangement or adding any new facts respecting the structure of these animals. Bory de St. Vincent formed a new classification; but he also based his system on their external forms, which later investigations have shown to possess little importance as distinctive characters, for two species very unlike in external form and appearance may be almost identical in internal structure.

No new facts of importance respecting the organization of the Infusoria were discovered after the publication of the work of Müller in 1773-74, till Dr. Ehrenberg of Berlin directed his attention to the subject. He made numerous observations on the internal structure of these animals by means of feeding them with particles of colouring matter, which he diffused in the water which contained them. The substance which he found to answer this purpose in the most satisfactory manner was pure indigo. (The indigo of commerce always contains white lead, which killed the animals.) It was necessary to use colours not chemically combining with water, but only diffusible through the fluid in a state of minute subdivision, so that the coloured particles might be seen passing through the body of the animal. By using these means he arrived at the following conclusions respecting the anatomical structure of the Infusoria, which have been verified by other observers.

Digestive System.—Distinct organs for performing the functions of digestion may be demonstrated by means of a powerful microscope in all the species. Ehrenberg says, 'All true Infusoria, even the smallest monads, are organized animal bodies (none consisting of a homogeneous jelly), and distinctly provided with at least a mouth and internal nutritive apparatus.' Cuticular absorption, the mode in which nutrition was generally supposed to take place by Müller and other naturalists, has never been observed by Ehrenberg. The form of the alimentary canal is very various. In the most highly organized tribe of these animals, named *Rotifera*, there is generally a simple stomach, situated in the anterior part of the body, communicating with an œsophagus and intestinal canal, which extends nearly the whole length of the body, and dilates at its anal extremity into a pouch or cloaca (for the reception of the ova and seminal fluid) previous to its termination at the surface of the animalcule. In the simpler forms of these animals the alimentary canal mostly has the appearance of a long intestinal tube, which traverses the greater part of the body, and is furnished with a number of cœcal appendages or stomachs, which are connected with the main canal of the intestine by tubes of different lengths and diameters. The whole of the tissues of the animalcules being naturally transparent, these cavities can only be seen when filled with coloured fluids, the colouring particles of which may be observed to enter at the mouth, and to be conveyed from thence immediately to the stomachs. The mouth in the Infusoria is either furnished with serrated mandibles, as in almost all the Rotifera, and as it has been lately shown in many of the polygastric animalcules, or it is a simple unarmed opening; but in both cases it is surrounded with numerous vibratile cilia, or delicate hair-like processes, which perform a very important part in the economy of these animals; for they may be considered as the principal organs of taste, touch, and propulsion; and they have been also supposed to act in respiration, by bringing successive portions of water into contact with the body of the animal. When a drop of coloured fluid is put into water containing these animalcules, currents are seen to be excited in all directions by the rapid motion of the cilia, which form a crown round the anterior part of the body: these currents, which are indicated by the movements of the particles of colouring matter, are seen to converge towards the mouth of the animal, and the body, which was previously transparent, becomes dotted with a number of distinctly circumscribed circular spots, which are the gastric cavities. From one hundred to two hundred of these sacs may be counted in the course of the intestine of some species. When they are filled with colouring matter the common intestinal tube is usually quite empty and transparent, which may have been one reason why these numerous stomachs were mistaken by Müller for ova.

The anus may generally be easily distinguished from the mouth by its discharging the colouring particles in masses, cohering together, and not in a state of minute division, as they entered by the mouth. The position of the anus is very various; in the greater number it is at the posterior extremity of the animal; but in some species it is situated close to the mouth, and the two orifices may even open into a common fissure. In some of the minutest forms of infusoria no anal orifice or intestine has been discovered, though there is a distinct mouth and stomach; and it has been supposed that the same orifice may here perform the functions of both mouth and anus; but this is not probable.

Muscular System.—No distinct fibres have been detected in the simpler or polygastric forms of Infusoria, but in the Rotiferous species several narrow bands of transparent greyish-white fibres may be seen traversing longitudinally the clear gelatinous bodies of these animals. Those bands are plainly muscular, for they may be observed to shorten and become broader on one side, and to be lengthened and attenuated on the other when the animal throws itself into lateral contortions.

Generative System.—Reproduction has been observed to take place among the Infusoria in various manners; but though numerous observations have been made on this subject, much is still involved in obscurity. The viviparous, oviparous, and gemmiparous or fissiparous forms of generation have all been observed by Dr. Ehrenberg, and two of these modes have been seen to take place in the same animal at different periods of its existence. The higher group of the Rotifera is always hermaphrodite; and the species are mostly oviparous, and never gemmiparous, or spontaneously dividing into two or more distinct animals, as is frequently observed among the polygastric forms.

Vascular System.—The organs of circulation in the polygastric infusoria are wholly unknown; and it is only in some of the species of the Rotiferous division, particularly in the *Hydatina senta*, that any distinct traces of what are considered vessels have been observed: these are a series of transverse lines of a whitish colour encircling the body of the animal, which appear to terminate at right angles in a longitudinal line or vessel, of similar appearance but larger size, running down the back.

Respiratory System?—Ehrenberg has detected in some species of Infusoria several small vibratory moving bodies, which are placed in two longitudinal series in the cavity of the body; he regards them as internal branchiæ, which are acted upon by water admitted into the interior of the animal; but this supposition as to the function of these organs must be considered as requiring further proof.

Nervous System.—In the polygastrica no nervous filament has yet been detected, though they are generally provided with eyes; but the Rotifera have several ganglionic bodies surrounding the œsophagus, which send off slender filaments differing in their arrangement from both the vessels and muscles; and in the middle of the body of some species small isolated knots or ganglia are found suspended to the long nervous filaments which communicate with the œsophagal ganglia. These small abdominal bodies are very delicate and simple, and give rise to other minute filaments; they are always free and unattached, and placed in the same spot; and they have distinctly the form of ganglions and nerves, and move in a passive manner with the movement of the muscles.

The eyes of the Rotifera appear as one, two, or even several spots, generally of a red colour, placed on the fore part of the animal, either before the rotatory organs or behind them: they are immediately connected with the nervous system, Ehrenberg having detected a direct communication between the red points and tho œsophagal ganglia. The Infusoria show that they possess the sense of vision by the mode in which they pursue and capture their prey.

Classification.—Ehrenberg has separated from what he calls the true Infusoria several families of animalcules which were formerly included in the same class. The principal genera thus separated are *Spermatozoa*, *Cercaria*, and *Vibrio*, which are now considered by some as part of the class Entozoa, and are divided into two families, named *Cercariadæ* and *Vibrionidæ*. In the article ENTOZOA we briefly mentioned the Spermatozoa, or Seminal Cercariæ, which are the only species of this group of animalcules that can properly be classed among the internal parasites, as they alone are constantly found in the bodies of other animals.

The Cercariæ found in vegetable infusions have an ovoid or cylindrical body, furnished with a tail, which is not so long as in the Zoosperms; and in some of the species a mouth, and eye-liko specks of a dull red colour have been observed on the anterior part of the body; but in none of them has the polygastric structure been seen, though the *Cercaria Lemnæ* is stated to havo a simple alimentary canal. The family of the *Vibrionidæ*, so named from their darting or quivering motion, includes the eel-liko microscopic animalcules which abound in stale paste, vinegar, &c., together with others which are parasitic on living vegetables, where they have excited particular attention, from the damage which they occasion to ears of corn, as tho *Vibrio Tritici*, which infests the grains of wheat, and occasions the destructive disease called ear-cockle, or purplos. The Vibrionidæ, as well as the Cercariadæ, differ from the true Infusoria not only in the absence of internal stomachs, but also of external cilia, which prevents them from exciting any currents when placed in coloured water.

The true Infusoria have been separated into two distinct divisions: the *Polygastrica*, which have numerous internal stomachs and a very simple structure (no vascular or nervous systems having been yet detected), and the *Rotifera*, *Rotatoria*, or wheel animalcules, named from the singular rotatory or wheel-like organs which surround the mouth; these organs are formed of one or more circles of cilia, which, when in motion, have the appearance of toothed wheels turning round on their axes, first in one direction, and then in the opposite. The rotatoria, besides being more highly organized than the polygastrica, have more perfect external forms, a separation into head, trunk, and tail being distinguishable in many species.

On account of the difference in the perfection of structure between the two groups of infusory animals, they have been separated and placed in distinct divisions of the animal kingdom by some naturalists. Mr. Owen makes the polygastrica the lowest class of the sub-kingdom *Acrita*, and places the rotifera in the division *Nematoneura*. Dr. Grant ('Cyclop. of Anat.') separates them in the same manner, placing the polygastrica in his lowest group *Cycloneura*, and the radiata among the *Diplo-neura*. Ehrenberg, who retains both forms of infusoria in one class, subdivides the sections polygastrica and rotifera into many minor groups, which are founded upon the modifications of different organs: first as to the form of the intestine, whether it is straight or curved, complete or imperfect; secondly, he considers the varieties of the organs of mastication or dental apparatus; thirdly, many of the infusoria have the integuments naked; others are furnished with a crustaceous or horny covering; but both among the rotifera and polygastrica the naked and coated species are intimately connected together, and very often entirely agree with one another in nternal and external structure, with the single exception of the consistency of their covering. These characters however, though not separating the animals into distinct divisions, are used as subordinate means of classification; and Ehrenberg has formed two parallel series, named *Nuda* and *Loricata;* which correspond to certain of the *Gymnodes* and *Crustodes* of Bory St. Vincent. The number of loricated polygastrica is very small, but among the rotifera they bear a nearer proportion to the naked species. For the details of classification and the enumeration and description of the numerous genera and species of infusory animalcules, we must refer to Ehrenberg's work on the Infusoria.

Habitation, &c.—These animalcules are not only met with in water containing large quantities of organic matter in solution, but in common sea-water, stagnant fresh water, and well water which has been exposed for a short time to the air. Ehrenberg found a few species in the subterranean water of mines: he met with several in silver mines in Russia at the depth of 56 fathoms below the surface; but he never succeeded in detecting any in atmospheric waters, having many times carefully examined the dew-drops, which are so plentifully deposited during the night in hot climates. With respect to the origin of these beings, it has been thought that they are generated spontaneously; but as they never make their appearance in fluids secluded from the atmosphere, we may suppose that ova of exceeding minuteness are always floating in the air, and only require to meet with a proper medium to develop themselves. It is no argument however against the theory of spontaneous production that when once formed they are capable of reproducing their species, which they will do with exceeding rapidity. Ehrenberg calculated that in 20 days a single individual of the *Hydatina senta* may increase to a million. He has observed the species of the rotifera to live for that period, and has kept some of the polygastrica alive for a fortnight: the existence of these animalcules cannot therefore be so ephemeral as some have supposed. Their rate of increase is favoured by a plentiful supply of food and warmth. These animals live on fine particles of animal or vegetable matter in solution in water, and the larger species devour the smaller animalcules.

FOSSIL INFUSORIA.

Ehrenberg has detected an immense number of fossil animalcules, principally in siliceous deposits near Berlin. Most of the species are so well preserved that they can be minutely investigated. Some specimens of siliceous rock brought from the Isle of France, which he examined, were found to consist almost entirely of the shells of infusory animals chiefly belonging to species still living; those from the Isle of France were chiefly marine, but the greater number of remains found near Berlin belonged to recent fresh-water species. The slaty Tripoli of commerce and some other forms of slate, as the polishing slate of Bilin in Bohemia (which forms whole strata), consist almost entirely of the remains of minute infusory animals.

INGA, a genus of plants of the natural family of Leguminosæ, which, though it has been separated from Mimosa, yet contains upward of one hundred species. These are found in the tropical parts of Asia, Africa, and America. They are distinguished by their legumes being broadly linear, compressed, and one-celled. The seeds are usually covered with pulp, more rarely with farinaceous matter or a pellicle. The species form shrubs or trees, and are commonly unarmed. The flowers are in spikes, or are capitate, and of a red or white colour. From the number of species in this genus, as well as in Acacia and Mimosa, and from their having been removed from one to the other, there is some confusion in the synonymes. A few of the useful species have been further separated into the genus Parkia: but many still remain which are important in the countries where they are indigenous, either for astringent properties, like many Mimosas and Acacias, or for the edible nature of the fecula or pulp which surrounds their seeds. Thus, *I. cochliocarpus* has bitter and astringent bark, which is used in tanning and also in medicine. It is taken to Portugal, where it is called the Brasilian Bark, and used even as a substitute for that of the Cinchona. Martius distinguishes from this species, which he calls *I. Jurema*, another which he has named *I. astringens*, and of which the bark has similar properties. The bark of these trees is considered by some authors to be the *Cortex Astringens Brasiliensis* of old pharmacopœias. *I. salutaris* is another astringent species, a native of New Granada, of which the bark is much used in the form of decoction for various complaints in which astringents are indicated, and for the same purposes as ratany root. Some of the species, as before mentioned, are esteemed for the sweetish edible pulp with which their seeds are surrounded, as *I. dulcis* in India, and *I. insignis* in the province of Quito, where it is called *Guabo*, or *Guabas*, but *Pacaes* in Peru. So *I. Camatchili*, according to Perrotet, is similarly esteemed in Manilla, and *I. Faroba* in Western Africa, in the neighbourhood of the Senegal. Several other species, though less conspicuously, possess the same properties as have been shown to characterise the foregoing.

INGATESTONE. [ESSEX.]

INGOLSTADT, a town and fortress of Bavaria, the history of which can be traced to the year 806, was the most important fortress in Bavaria till the fortifications were destroyed by the French in the year 1800. As the situation of this place renders it of peculiar importance for the defence of the country, many thousand men have been for some years past employed in erecting works which when completed will make it a fortress of the first class. The town is well built, with long broad streets, situated in a fertile country on the Danube, over which there is a stone bridge. It is a dull place, without any trade. It has nine churches and two nunneries The principal buildings are the chief parish church, the magnificent edifice formerly the Jesuits' college, and the antient university, which was founded in 1472, and transferred to Landshut in 1800. It has 6000 inhabitants. 48° 45′ 50″ N. lat., 11° 25′ 31″ E. long.

INGROSSING is an offence at the common law against trade. It is described by the statute 5 and 6 Ed. VI., c. 14, to be getting into their hands, by buying, &c. (except in the ways mentioned in the statute), corn or other dead victuals with intent to sell them again. The punishment for this offence, and the alteration which the law has undergone with respect to it, are stated in the article FORESTALLING.

INGULPHUS, the author, or pretended author, of a work entitled 'Historia Monasterii Croylandensis' (the History of the Monastery of Croyland, or Crowland, in Lincolnshire), which has usually been considered one of the most valuable of our antient historical monuments. The facts of the life of Ingulphus are nearly all found in this work, and in the continuation of it by Peter of Blois. According to the account there given, Ingulphus was the son of English parents, was born in London about the year 1030, and was educated, first at Westminster, and afterwards at Oxford, where he speaks of having imbued himself especially in the study of the philosophy of Aristotle and the rhetorical books of Tully. It was apparently before he went to Oxford that he obtained the notice of Edgitha, or, as he calls her, Egitha, the queen of the Confessor, whom, he tells us, he used often to see when, being yet a boy, he went to visit his father, who lived in the palace (in regis curia morantem). The queen, he says, when she met him, used to examine him in grammar and dispute with him in logic, and never dismissed him without some pecuniary mark of her favour or ordering him to be taken to have something in the buttery. His proper introduction to court however did not take place till some years after this. 'When,' he says, in another place, 'I had become a young man (adolescentior), disdaining the poverty (exiguitatem) of my parents, I became every day more and more impatient to leave my paternal lares, and, affecting the palaces of kings or princes, to be invested and clothed in soft and splendid raiment.' He accordingly contrived to get himself introduced to Duke William of Normandy when that prince visited the court of the Confessor in 1051, and he made himself so acceptable to William, that he took him with him on his return to the Continent, and made him his prime-minister, with unbounded power, which Ingulphus confesses that he did not exercise with much discretion. However, after some years he relinquished this situation to accompany Sigfrid, duke of Mentz, on a pilgrimage to the Holy Land, which turned out a very disastrous adventure. On his return, Ingulphus became a monk in the abbey of Fontenelle, in Normandy. Here he remained till 1076, when he came over to England on the invitation of his old master, now seated on the throne of that country, and was appointed abbot of Croyland. Through the favour of the king and Archbishop Lanfranc he was enabled to be of great service to this monastery, which was indebted to him both for the re-edification of its buildings, destroyed two centuries before by the Danes, and for a great extension of its privileges and immunities. Here he resided till his death, on the 17th of December, 1109. A tract on the miracles of St. Guthlac (the patron of Croyland) is attributed to Ingulphus; but the only work claiming to be his that is now extant is his History already mentioned. This production was first printed in an imperfect form in Sir Henry Savile's 'Rerum Anglicarum Scriptores post Bedam Præcipui,' fol., Lond., 1596, and Francof., 1601; it was printed entire, along with the continuation by Peter of Blois, in the 'Rerum Anglicarum Scriptorum Veterum Tomus Primus,' fol., Oxon., 1684 (commonly called Fell's, or the first volume of Gale's Collection). In this last edition the work of Ingulphus, which is in some degree a history of the kingdom as well as of the monastery of Croyland, and extends from the year 664 to 1089, fills 107 pages; and the continuation, extending to 1117, twenty-five more. Scarcely any of our early histories contains so many curious incidents and notices as are found in this work; and until very lately its authenticity does not appear to have been suspected. A very formidable attack however has recently been made upon its claims to be regarded as anything better than 'an historical novel,' a mere monkish invention or forgery of a later age, by Sir Francis Palgrave, in an article in the 'Quarterly Review' for June, 1826 (No. 67, pp. 289, &c.).

INJUNCTION. An injunction is a writ issuing by the order and under the seal of a court of equity, and is of two kinds, remedial and judicial.

The remedial writ is used for the following purposes among many others: to restrain parties from proceeding in other courts, from negotiating notes or bills of exchange, to prevent the sailing of a ship, the alienation of a specific chattel, to prevent waste by felling timber or pulling down buildings, the infringement of patents or copyright, to repress nuisances, and to put an end to vexatious litigation. It is impossible here to enumerate the variety of cases in which a plaintiff in equity is entitled to the relief afforded by the writ of injunction.

The remedial writ of injunction is again distinguished as of two kinds, the common and the special injunction, both of which are obtained on motion.

The common injunction is generally obtained by the defendant's not appearing after being served with a subpœna, or not answering in due time. The special injunction is commonly obtained *ex parte*, and behind the back of the defendant (as the phrase is), without any service of subpœna. But either kind of injunction may be moved for after the defendant has answered the plaintiff's bill, and on the merits of the case as appearing from the defendant's answer; and if a special injunction has been obtained *ex parte*, the defendant may immediately move to dissolve it on affidavits, and before he puts in his answer. If the defendant is residing abroad, and the plaintiff supports the material facts alleged in his bill by an affidavit, the court will at once grant the injunction to restrain the defendant from committing or continuing acts injurious to him.

As a general rule, no injunction will be granted except there is a bill already filed, though there have been cases specially circumstanced where this rule has been dispensed with; but it is scarcely going too far to say that these precedents would not now be followed.

A court of equity frequently refuses an injunction where it acknowledges a right, as where the conduct and laches (neglect) of a party complaining have led to the state of things that occasions the application.

Special injunctions, as already observed, are usually obtained before appearance upon motion in court supported by a certificate of the bill having been filed, and an affidavit verifying the material circumstances alleged in the bill of complaint; but in pressing cases, where the court is not sitting, the process will be granted upon petition supported in like manner.

If the defendant has not entered his appearance to the bill, notice of the application for a special injunction need not be given to the defendant, unless the court directs a notice to be given to him.

Special injunctions, as above observed, are also obtained upon the merits disclosed by the answer in those cases which do not appear to be of so urgent a nature that mischief may ensue if the plaintiff were to wait until the bill is answered. The special injunction granted upon the merits after answer continues until the hearing of the cause

The writ called the common injunction only stays proceedings at common law, and in the first instance it only stays execution, and does not stay trial if issue be joined; but it may by affidavit be immediately extended to stay trial.

The common injunction and the injunction extended to stay trial continue in force until the defendant has fully answered the plaintiff's bill, *and* the court has made an order to the contrary. The defendant therefore cannot apply to dissolve this injunction until he has put in a full answer; but the special injunction before answer continues until answer *or* further order, and consequently the defendant may move upon affidavits to dissolve a special injunction before putting in his answer.

It would be useless, in an article of this description, to state the various rules which govern the practice of the courts as to granting, extending, continuing, or dissolving injunctions. They are laid down at length in the various books of practice, and do not admit of compression.

The judicial writ of injunction issues subsequently to a decree, and is a direction to yield up, to quit, or to continue the possession of lands, and is described as being in the nature of an execution. This writ however is virtually abolished by the statute 11 Geo. IV. and 1 Wm. IV., c. 36, sec. 11, rule 19, which gives the writ of assistance at once, in such cases rendering the intermediate steps by injunction, attachment, &c. unnecessary.

The Roman Interdictum was in many respects similar to the injunction. [INTERDICT.]

INK, for the various purposes to which it is applied, is composed of very dissimilar ingredients. It may be treated of under the heads of *Writing Ink, Printers' Ink, Indian Ink, Marking Ink, and Sympathetic Ink.*

Writing Ink.—The writing ink of the antients was essentially different from that which is now employed. Its basis was finely-divided charcoal, mixed with some mucilaginous or adhesive fluid: it was much less destructible than modern writing ink, and more resembled printers' ink, both in the nature of its colouring ingredient and indestructibility.

Writing ink is now a chemical compound, and not a mere mechanical mixture. Its basis is proto-gallate and proto-tannate of iron, which by oxidizement becomes per-gallate and per-tannate; and it is owing to the oxygen of the air effecting this change gradually that recent writing is of a comparatively light colour, and that it subsequently becomes black.

Many processes have been given for preparing writing ink: the common ingredients are galls and sulphate of iron; in fact, while printers' ink may be considered as a black paint, writing ink may be regarded as a black dye. We shall not copy the different modes which have been adopted. The following, which is recommended by Mr. Brande, gives, he says, an excellent ink, and it possesses the merit of greater simplicity than most others:—Aleppo galls, bruised, 6 ounces; sulphate of iron, 4 ounces; gum arabic, 4 ounces; water, 6 pints. Boil the galls in the water, then add the other ingredients, and keep the whole in a well-stopped bottle, occasionally shaking it. In two months strain and pour off the ink into glass bottles, to be well corked. To prevent mould, add one grain of corrosive sublimate, or three drops of creasote, to each pint of ink.

Mr. Brande observes, that, 'In making good writing ink the great object is to regulate the proportion of sulphate of iron to the galls. If it be in excess, although the ink may at first appear black, it becomes subsequently brown and yellow. Hence some time should elapse before ink is used after the ingredients are put together, in order to be tested from time to time, and the combinations perfectly regulated.' Gum is added to retain the colouring matter in suspension, to prevent too great fluidity in the writing, and to protect the vegetable matter from decomposition. Logwood and other vegetable astringents have been tried, but do not yield a permanent ink.

When writing has through age become yellow and very indistinct, it is because the vegetable matter has decayed, and mere rust, or peroxide of iron, is left. By carefully applying infusion of galls the writing may be rendered blacker and more legible. This method was successfully adopted in deciphering the MS. of Gaius. [GAIUS.]

Modern writing ink, unlike the antient, is readily destroyed by chlorine, acids, and alkalis. Indeed, according to Mr. Brande, if paper has been made from inferior rags bleached by excess of chlorine, the ink, however good, will be ultimately discoloured.

Sulphate of copper is occasionally added to ink, and some direct it to be prepared with the addition of vinegar; but these substances are rather injurious than otherwise.

A blue writing ink has been lately introduced: its exact composition we are unacquainted with; but the basis appears to be Prussian blue.

Indian Ink.—The cakes of this ink are made of lamp-black and size, or animal glue, with the addition of perfumes or other substances not essential to its quality as an ink. It is used in China with a brush, both for writing and for painting upon paper of Chinese manufacture. It is used in Europe for designs in black and white, in which it possesses the advantage of affording various depths of shade, according to the degree of dilution with water. The common lamp-black of the shops is not sufficiently fine for the purpose; it requires to be made with peculiar care.

Printers' Ink is of two kinds: for letter-press printing and for copper-plate printing. Printers' ink is prepared by boiling linseed or nut oil in an iron pot; and if it does not take fire of itself, it is kindled, and suffered to burn for about half an hour; the flame is then extinguished by closely covering the vessel, and the oil is by this operation found to have acquired the necessary drying quality, after being again boiled. It is then mixed with a proper quantity of lamp black, when black ink is required; if red ink be required, the colouring matter employed is vermilion, for finer works. Copper-plate printers' ink is made with oil which is less boiled, and the charcoal used is stated to be Frankfort black, made from vine twigs.

Marking Ink is employed for marking linen: it is a solution of nitrate of silver, written with a pen upon the fabric to be marked after it has been moistened with an alkaline solution, as potash or soda. By this process oxide of silver is precipitated upon and combines with the cloth so as to be scarcely removable by any reagent which does not also destroy its texture.

Sympathetic Inks are such as are invisible until heat is applied, and then, by the chemical change induced, the writing becomes visible. The most remarkable of these is that prepared from cobalt, called Hellot's sympathetic ink, which is a chloride of the metal. When the written paper is held to the fire so as to evaporate the water, the *letters* become green. [COBALT.]

INN. [BAVARIA.]

INNOCENT I. succeeded Anastasius I. as bishop of Rome in the year 402. He wrote to the emperor Arcadius in favour of St. John Chrysostom, who had been deposed from his see and exiled from Constantinople. When Alaric marched against Rome, Innocent proceeded to Ravenna in order to induce the emperor Honorius to make peace with him, but meantime Alaric entered Rome and plundered it. He urged more than any of his predecessors the claims of the see of Rome to a superiority over the whole Western Church, and the style of his letters in addressing bishops is remarkably imperious. He also issued a decretal against the marriage of priests. The bishops of Africa having applied to him to confirm their decrees against the Pelagians, he willingly complied with their request. He died in the year 417, and was succeeded by Zosimus. Innocent's letters and decretals have been collected and published by Constant.

INNOCENT II., Cardinal Gregorio Papi, was elected by his party, after the death of Honorius II. in 1130, but another party elected a candidate who took the name of Anacletus II. An affray between the adherents of the two followed this double election, and Innocent was obliged to leave Rome and repair by sea to France. That kingdom as well as several Italian states acknowledged him as pope, but Roger of Sicily, the conqueror of Apulia, took part with Anacletus, who in return crowned him king of Sicily and Apulia, in 1130, at Palermo. Innocent meantime crowned the king of Germany, Lotharius, at Liege, as king of the Romans, and Lotharius in 1133 marched with troops into Italy to put an end to the schism by placing Innocent on the see of Rome, which he entered, and was himself crowned emperor by Innocent in the Basilica of the Lateran. Anacletus however shut himself up in the castle St. Angelo, and the emperor, not being able to dislodge him from thence, left Rome, followed by Innocent, who withdrew to Pisa, where he held a council, at which St. Bernard was present, and in which Anacletus and his partizans were excommunicated. In September, 1136, Lotharius marched again into Italy with numerous troops, followed by a number of German bishops and archbishops, and after having held his court in the plains of Roncaglia, where he published a law concerning the tenure of fiefs, he fought his way in the following spring into Lower Italy, defeated Roger, and obliged him to withdraw to Sicily, took Capua, Benevento, Bari, and other towns, while Innocent entered Rome and again took possession of the Lateran. Lotharius however soon after died, and in 1138 Anacletus died also. The party of the latter, supported by Roger, elected another antipope styled Victor IV., who was soon after persuaded by St. Bernard to resign his claims, and thus restore peace to the church. Roger however continued hostile to Innocent, for which he was excommunicated in the second council of the Lateran, but Innocent, having gone as far as San Germano with a body of troops to meet Roger, was surprised and taken prisoner by him. This led to a peace, by which Innocent acknowledged Roger as king and his son as duke of Apulia. It was then that the city of Naples first acknowledged Roger as its sovereign. In 1139 Arnaldo da Brescia began to preach at Rome, but being banished from that city, he repaired to France. [ARNALDO DA BRESCIA.] The remaining years of Innocent's pontificate were disturbed by a war between the Romans and the people of Tibur, and by a revolt in Rome itself, when the people, excited perhaps by the partizans of Arnaldo, assembled on the capitol, re-established the senate, and asserted their independence. In the midst of these troubles Innocent died, in September, 1143, and was succeeded by Celestine II.

INNOCENT III., Cardinal Lotharius, son of Trasimund, count of Segni and of Claricia, of a noble family of Rome, was unanimously elected in 1198, after the death of Celestine III. He ascended the papal throne at the vigorous age of thirty-seven, possessed of very great abilities, indefatigable industry, and a firm resolve to raise the papal power, both temporal and spiritual, above all the churches, principalities, and powers of the earth; and he very nearly accomplished his purpose during the eighteen years of his pontificate. He had distinguished himself while at the Universities of Paris and Bologna in the studies of philosophy, theology, and the canon law, and also by several written compositions, especially by his treatise 'De Miseria Conditionis Humanæ.' The gloomy ascetic views which he took in this work of the world and of human nature show a mind filled with contempt for all worldly motives of action, and not likely to be restrained in forwarding what he considered to be his paramount duty by any of the common feelings of leniency, conciliation, or concession, which to a man in his situation must have appeared sinful weaknesses. His ambition and haughtiness were evidently not personal; he was in this respect more disinterested than his prototype, Gregory VII. His interest was totally merged in what he considered the sacred right of his see, 'universal supremacy,' and the sincerity of his conviction is shown by the steady uncompromising tenour of his conduct, and by a like uniformity of sentiments and tone throughout his writings, and especially his numerous letters. (Innocentii III. *Opera*, and his *Epistles* and *Decretals*, published separately by Baluze, in 2 vols. fol., Paris, 1682, with a fairly written biography of Innocent by an anonymous contemporary.)

External circumstances favoured Innocent's views. The emperor Henry VI., king of Italy, and also of Sicily, had lately died, and rival candidates were disputing for the crown of Germany; whilst Constance of Sicily, Henry's widow, was left regent of Sicily and Apulia in the name of her infant son Frederick II. Innocent, asserting his claim of suzerainety over the kingdom of Sicily, confirmed the regency to Constance, but at the same time obtained from her a surrender of all disputed points concerning the pontifical pretensions over those fine territories. Constance dying shortly after, Innocent himself assumed the regency during Frederick's minority.

At Rome, availing himself of the vacancy of the Imperial throne, he bestowed the investiture on the prefect of Rome, whom he made to swear allegiance to himself, thus putting an end to the former, though often eluded, claim of the Imperial authority over that city. In like manner, being favoured by the people, ever jealous of the dominion of foreigners, he drove away the Imperial feudatories, such as Conrad duke of Spoleti and count of Assisi, and Marcualdus marquis of Ancona, and took possession of those provinces in the name of the Roman see. He likewise claimed the exarchate of Ravenna, but the archbishop of that city asserted his own prior rights, and 'Innocent,' says the anonymous biographer, 'prudently deferred the enforcement of his claims to a more fitting opportunity.' The towns of Tuscany, with the exception of Pisa, threw off their allegiance to the Empire, and formed a league with Innocent for their mutual support. It was on this occasion that Innocent wrote that famous letter, in which he asserts that 'as God created two luminaries, one superior for the day, and the other inferior for the night, which last owes its splendour entirely to the first, so he has disposed that the regal dignity should be but a reflection of the splendour of the papal authority and entirely subordinate to it.'

In Germany, Innocent, acting as supreme arbitrator between the rival aspirants to the Imperial crown, decided at first in favour of Otho, a Welf, on condition of his giving up to the Roman see the disputed succession of the countess Mathilda, but some time after he agreed to an arrangement between Otho and his rival Philip, whom he acknowledged as emperor. Philip being murdered in 1208, Otho resumed his claims, and was crowned by the pope at Rome, but having displeased Innocent in the business of the countess Mathilda's succession, the pope quarrelled with him, and Otho having invaded part of Apulia and of the Papal territory, Innocent excommunicated and deposed him, and proposed to the electors in his place his own ward Frederick of Sicily, who repaired to Germany, and after a gallant struggle obtained the crown shortly before the death of his late guardian the pope.

Innocent, at the beginning of his pontificate, wrote a long epistle (209 of B. 11) to the patriarch of Constantinople, and other letters to the emperor Alexius, with the view of inducing the former to acknowledge the supremacy of the see of Rome, and although he failed in this, he had soon after, by an unexpected turn of events, the satisfaction of consecrating a prelate of the Western church as patriarch of Constantinople.

The Crusaders, whom Innocent had sent forth, as he thought, for the reconquest of the Holy Land, after taking Zara from the king of Hungary, for which they were severely censured by the pope, proceeded to attack Constantinople, and overthrew the Greek empire. [BALDWIN I., *Emperor*.] All this was done without Innocent's sanction, but when Baldwin wrote to him acquainting him with the full success of the expedition, Innocent, in his answer to the marquis of Montferrat, forgave the Crusaders in consideration of their having brought about the triumph of the holy church over the Eastern empire. Innocent sent also legates to Calo Johannes, prince of the Bulgarians, who acknowledged his allegiance to the Roman see. (Innocentii III. *Epistolæ*.)

Leo king of Armenia received likewise Innocent's legates, who bestowed upon him the investiture of his kingdom. Innocent also excommunicated Svercum, who had usurped the kingdom of Norway.

Innocent was very strict and uncompromising in his notions of morality and discipline. He repressed venality and irregularity wherever he discovered them. He excommunicated Philippe Auguste of France because he had repudiated his wife Ingerburga of Denmark, and had married Agnès de Meranie; and after a long controversy the pope obliged the king to dismiss Agnes and to take Ingerburga back. The king of Leon, having married his cousin, the daughter of the king of Portugal, was likewise excommunicated, and as he would not submit, and was supported in his resolution by his father-in-law, Innocent, by means of his legates, laid both kingdoms under an interdict.

John of England having appointed John de Gray, bishop of Norwich, to the vacant see of Canterbury, Innocent would not approve of him, and bestowed the canonical investiture upon Stephen Langton, and the monks of Canterbury would receive no other archbishop. In a fit of rage John drove away the monks and seized their property, for which the whole kingdom was laid under an interdict; and as John continued refractory, the pope pronounced his deposition, released his vassals from their oath of allegiance, and called upon all Christian princes and barons to invade England and dethrone the impious tyrant, promising them the remission of their sins. In 1213 Philippe Auguste prepared an army for the purpose; John however had also a gallant force ready to repel the foreigners, but dastard as he was, and conscious of the little attachment he deserved from his subjects, he allowed himself to be frightened, and he subscribed an instrument laid before him by Innocent's Italian envoy Pandulph, purporting that John would submit to the pope's will in all things for which he had been excommunicated, and pay damages to the banished clergy. This was on the 13th of May, but on the following 15th, John having been meantime closeted with Pandulph, was induced to perform a much more extraordinary act. On that day John repaired to the church of the Templars at Dover, and on his knees before Pandulph took an oath of fealty to the pope, the same oath that vassals took to their lords. At the same time he delivered to the papal envoy a charter testifying that he, the king of England and lord of Ireland, in atonement for his offences, &c., not compelled by the interdict or any fear or force, but of his own free will, and with the general consent of his barons, surrendered to our lord the pope Innocent and his successors for ever the kingdom of England and lordship of Ireland, to be held as fiefs of the Holy See by John and his successors, on condition of their paying an annual tribute of 700 marks of silver for England and 300 for Ireland. Pandulph then undertook to forbid Philip of France attempting anything against a faithful vassal of the church.

Against those who separated themselves from the body of the Roman church, Innocent was stern and uncompromising. He considered heresy as the deadliest of sins, and its extirpation as the first of his duties. He sent two legates, with the title of inquisitors, to extirpate heresy in France. One of them, Castelnau, having become odious by his severities, was murdered near Toulouse, upon which Innocent prescribed a crusade against the Albigenses, excommunicated Raymond count of Toulouse for abetting them, and bestowed his domains on Simon count of Montfort. He addressed himself to all the faithful, exhorting them 'to fight strenuously against the ministers of the old serpent,' and promising them the kingdom of heaven in reward. He sent two legates to attend the crusade, and their letters or reports to him are contained in the collection of his 'Epistles,' especially 'Epistola 108 of B. xii.,' in which the legate Arnaldus relates the taking of Beziers and the massacre of 30,000 individuals of every age, sex, and condition. [Albigenses.] Innocent however did not live to see the end of the conflagration he had kindled. He held a general council at the Lateran in 1215, in which he inculcated the necessity of a new crusade, launched fresh anathemas against heretics, determined several points of doctrine and discipline, especially concerning the auricular confession, and sanctioned the establishment of the two great mendicant monastic orders, the Dominicans and Franciscans, the former to extirpate heresy, and the latter to preach sound doctrines and to assist the parochial clergy in the execution of their duties. In the same year he caused his legate in Germany to crown Frederic II. at Aix-la-Chapelle. In the following year Innocent fell ill at Perugia, and died in the month of July, at the early age of fifty-six. He was an extraordinary character, and in several respects the most illustrious among the many distinguished men who have filled the papal chair. His pontificate must be considered as the period of the highest power of the Roman See.

INNOCENT IV., Sinibaldo de' Fieschi, of Genoa, succeeded Celestine IV. in the year 1243. In the preceding bitter quarrels between Gregory IX. and the emperor Frederick II., Cardinal Sinibaldo had shown himself rather friendly towards the emperor; and the Imperial courtiers, on receiving the news of his exaltation, were rejoicing at it; but the experienced Frederick checked them by remarking: 'I have now lost a friendly cardinal, to find another hostile pope. No pope can be a Guibeline.' Anxious however to be relieved from excommunication, Frederic made advances to the new pope, and offered conditions advantageous to the Roman see; but Innocent remained inflexible, and suddenly leaving Rome, embarked for Genoa, whence he went to Lyon, where he summoned a council in 1245, to which he invited the emperor. Thaddeus of Sessa appeared before the council to answer to the charges brought by the pope against Frederic; and after much wrangling, Innocent would listen to no terms, but excommunicated and deposed the emperor, commanded the German princes to elect a new emperor, and reserved the disposal of the kingdom of Sicily to himself. In Italy the only consequence was that the war which already raged between the Guelphs and Guibelines continued fiercer than before; but in Germany some of the electors raised a contemptible rival to Frederic in the person of Henry, landgrave of Thuringia, who was defeated by Conrad, Frederic's son. At last Frederic died in Apulia, A.D. 1250; and Innocent, having returned to Italy, began to offer the crown of Sicily to several princes, one of whom, Richard of Cornwall, observed that the pope's offer 'was much like making him a present of the moon.' The pope at the same time excommunicated Conrad, the son of Frederic, who however came into Italy in 1252, took possession of Apulia and Sicily; and he dying two years after, his brother Manfred became regent, and baffled both the intrigues and the open attacks of the court of Rome. Innocent died soon after, at the end of 1254, at Rome, leaving Italy and Germany in the greatest confusion in consequence of his unbending hostility to the whole house of Swabia. He was succeeded by Alexander IV. (Raumer's *Geschichte der Hohenstauffen*, and the numerous historians of the popes.)

INNOCENT V., Peter of Tarantasia, succeeded Gregory X. in 1276, and died the same year, after a pontificate of five months.

INNOCENT VI., Etienne d'Albert, a Frenchman, succeeded Clement VI. in 1352. He resided at Avignon, like his immediate predecessors; but, unlike them, he put a check on the disorders and scandals of that court, which have been so strongly depicted by Petrarch, Villani, and other contemporary writers. He reformed the abuses of the reservations of benefices, and he enforced the residence of bishops on their sees. He sent to Italy as his legate Cardinal Albornoz, who, by skill as well as force, reduced the various provinces of the papal state, which had been occupied by petty tyrants. He sent back to Rome the former demagogue Cola di Rienzo, who, being still dear to the people, repressed the insolence of the lawless barons; but becoming himself intoxicated with his power, committed acts of wanton cruelty, upon which the people rose and murdered him in 1354. In 1358 the emperor Charles IV. was crowned at Rome by a legate deputed by Pope Innocent for the purpose. Innocent died at Avignon, at an advanced age, in 1362.

INNOCENT VII., Cardinal Cosmo de' Migliorati, of Sulmona, was elected at Rome, after the death of Boniface IX., in 1403. This was the period of what is called 'the Great Western Schism,' when there were two and sometimes three rival popes, each acknowledged by a part of Europe. Innocent's rival was Benedict XIII., who held his court at Avignon. [Benedict, Antipope.] After the election of Innocent a tumult broke out in Rome, excited by the Colonna and by Ladislaus, king of Naples, which obliged the pope to escape to Viterbo. Ladislaus however failed in his attempt upon Rome; and Innocent, having returned to his capital, excommunicated him. Innocent died at the end of 1406, after having made his peace with Ladislaus.

INNOCENT VIII., Cardinal Giovanni Battista Cibo, of Genoa, succeeded Sixtus IV. in 1485. He favoured the revolted Neapolitan barons against Ferdinand I. of Naples, in consequence of which the troops of Ferdinand ravaged the territory of Rome, but through the mediation of Lorenzo de' Medici and of the duke Sforza of Milan, peace was re-established between the two parties. Pierre d'Aubusson, grand-master of the order of St. John of Rhodes, having sent to Rome Zizim, brother of Bayazid sultan of the Turks, who had run away from his brother, and who was considered as an important hostage, the pope received him with great honour, but took care to secure his person. It was also during this pontificate that Giovanni de' Medici, son of Lorenzo, and afterwards pope Leo X., was made cardinal when only fourteen years of age. Innocent died in 1491, and was succeeded by Alexander VI. He enriched his natural sons; and the family of Cibo, which was already possessed of the duchy of Massa, became by a marriage alliance with the family of Malaspina possessed also of that of Carrara, which their descendants have retained till within our own times. [Carrara.]

INNOCENT IX., Giovanni Antonio Facchinetti, of Bologna, a man of learning and piety, was elected after the death of Gregory XIV., in October, 1591. He died two months after his election, and was succeeded by Clement VIII.

INNOCENT X., Cardinal Giovanni Battista Panfili, was elected in September, 1644, after the death of Urban VIII. He was then seventy-three years of age, and is said to have been in great measure ruled by his sister-in-law Donna Olimpia Maidalchini Panfili, who by all accounts was an unprincipled woman, very fond of money, and of aggrandizing her relatives. Innocent however displayed in several instances much firmness and justice and prudence, and a wish to protect the humble and poor against the oppressions of the great. He diminished the taxes, and at the same time embellished Rome. The people of Fermo on the Adriatic revolted against their governor, being excited by the local nobility and landholders, who were irritated against him for having by an edict of annona kept the price of corn low; the governor and other official persons were murdered. Innocent sent a commissioner with troops, and the guilty, without distinction of rank, were punished, some being executed, and others sent to the galleys. The district of Castro and Ronciglione, near Rome, was still in possession of the Farnese dukes of Parma, notwithstanding the efforts of Urban VIII. to wrest it from them. Innocent resolved to effect what his predecessor had failed in. Disputes about jurisdiction were continually taking place between the officers of the duke and those of the pope. Innocent having consecrated a new bishop of Castro who was not acceptable to the duke, the latter forbade him entering his territories, and as the bishop elect persisted, he was murdered on the road. The pope immediately sent troops to attack Castro, which being taken, he ordered the town to be razed to the foundations, and a pillar erected on the site, with the inscription 'Qui fù Castro.' The episcopal see was removed to Acquapendente, and the duchy was reunited to the papal state. Innocent died in 1655, and was succeeded by Alexander VII.

INNOCENT XI., Cardinal Benedetto Odescalchi, of Como, succeeded Clement X. in 1676. It is said that he had been a soldier in his younger years, though this has been denied by others. (Count Torre Rezzonico, *De Suppositis Militaribus Stipendiis Bened. Odescalchi.*) He was a man of great firmness and courage, austere in his morals, and inflexible in his resolutions. He took pains to reduce the pomp and luxury of his court, and to suppress abuses; he was free from the weakness of nepotism, and his own nephew lived at Rome under his pontificate, in a private condition. But his austerity made him many enemies, and his dislike of the then very powerful Jesuits still more. The principal event of his pontificate was his quarrel with the imperious Louis XIV. of France, on the subject of the immunities enjoyed by the foreign ambassadors at Rome. As this incident exhibits in a singular light the character of the times, it may deserve a few words of explanation. By an old usage or prescription the foreign ambassadors at Rome had the right of asylum, not only in their vast palaces, but also in a certain district or boundary around them, including sometimes a whole street or square, which the officers of justice or police could not enter, and where consequently malefactors and dissolute persons found a ready shelter. These 'quartieri,' or free districts, were likewise places for the sale of contraband articles, and for defrauding the revenue. This abuse had become contagious: several of the Roman princes and cardinals claimed and enforced the same rights and immunities, so that only a small part of the town was left under the sway of the magistrates. The classical advocates for this absurd custom quoted the example of Romulus, who made his new town a place of refuge for all the lawless persons of the neighbourhood. Innocent determined to put a stop to the abuse, and to be master in his own capital; he however proceeded at first calmly and with sufficient caution. He would not disturb the present possessors of those immunities, but he declared and made it officially known that in future he should not give audience to any new ambassador who did not renounce for himself and his successors all claim to the district immunities. Spain, Venice, and other states demurred at this very reasonable determination, but the death of the Maréchal d'Estrées, ambassador of France, brought the question to a crisis. Innocent repeated in a bull, dated May, 1687, his previous resolve. Louis XIV. appointed to the embassy the marquis of Lavardin, and told him 'to maintain at Rome the rights and the dignity of France;' and in order to support this dignity, he gave him a numerous retinue of military and naval officers, who were to frighten the pope in his own capital. Lavardin's entrance into Rome under such an escort resembled that of a hostile commander. He had also been preceded by several hundred reduced French officers, who had entered Rome as private travellers, but who took their quarters near the ambassador's palace, ready for any mischief. Innocent however remained firm; he refused to receive the new ambassador, and all the anger of Louis, who seized upon Avignon, and threatened to send a fleet with troops on the Roman coast, had no effect upon him. Lavardin, having remained eighteen months at Rome without being able to see the pope, was obliged to return to France with his credentials unopened. The quarrel was not made up till the following pontificate. But the district immunities of the foreign ambassadors at Rome continued partly, and with some modifications, till the beginning of the nineteenth century. The Piazza di Spagna and some of the adjacent streets were under the protection of the Spanish ambassador. Innocent died in August, 1689, and was succeeded by Alexander VIII. (Botta, *Storia d'Italia.*)

INNOCENT XII., Cardinal Antonio Pignatelli, of Naples, succeeded Alexander VIII. in July, 1691. He had a serious dispute with the Emperor Leopold I., who attempting to revive in Italy the rights of the Empire over the former imperial fiefs, which had, during the wars and vicissitudes of ages, become emancipated, published an edict, which was fixed up at Rome, in June, 1697, enjoining all the possessors of such territories to apply to the emperor for his investiture within a fixed time, or they would be considered as usurpers and rebels. This measure, if enforced, would have affected the greater part of the landed property of Italy, and also the sovereignty of its governments, and of the Roman see among the rest. The pope protested against the edict, and advised the other Italian powers to resist such obsolete pretensions, and, being supported by the court of France, he succeeded in persuading Leopold to desist from them. Innocent built the harbour of Porto d'Anzo, on the ruins of the antient Antium; he constructed the aqueduct of Civitavecchia, the palace of the Monte Citorio at Rome for the courts of justice, and the fine line of buildings at Ripagrande, on the north bank of the Tiber, below the town, where vessels which ascend the river load and unload. He also built the asylum, schools, and penitentiary of San Michele, and other useful works. Innocent was of regular habits, attentive to business, a lover of justice, and averse from nepotism. He died in September, 1700, at the age of eighty-six, and was succeeded by Clement XI.

INNOCENT XIII., Cardinal Michel Angelo Conti, succeeded Clement XI. in May, 1721. He was a man of prudence and experience of the world, and less wilful and headstrong than his predecessor. [CLEMENT XI.] He obtained of the emperor the restitution of Comacchio. His pontificate was short, as he died in March, 1724, and was succeeded by Benedict XIII.

INNS OF COURT AND OF CHANCERY. When the houses of law were first established seems very doubtful; but the fixing of the Court of Common Pleas at the palace at Westminster appears greatly to have contributed to their origin. This brought together a number of persons who (as Spelman says) addicted themselves wholly to the study of the laws of the land, and no longer considering it as a mere subordinate science, soon raised those laws to that pitch of perfection which they suddenly attained under the auspices of King Edward I. They purchased at various times certain houses between the city of London and the palace of Westminster, for the combined advantage of ready access to the latter and of obtaining provisions from the former. 'For their liberties and privileges' (observes Mr. Agard, in an essay written in the end of the seventeenth century), 'I never read of any granted to them or their houses: for having the law in their hands, I doubt not but they could plead for themselves, and say, as a judge said (and that rightly), that it is not convenient that a judge should seek his lodging when he cometh to serve his prince and his country.'

In Fortescue's time there were four inns of court and ten inns of chancery, the former being frequented by the sons of the nobility and wealthy gentry, and the latter by merchants and others who had not the means of paying the greater expenses (amounting to about 'twenty marks' per annum) of the inns of court. The first were called *apprenticii nobiliores*, the latter *apprenticii* only

On the working days, says Fortescue, in his 'De Laudibus Legum Angliæ,' most of them apply themselves to the study of law; and on the holy days to the study of Holy Scripture. But it appears that they did not entirely neglect lighter pursuits, for, says the same learned author, they learn to sing and to exercise themselves in all kind of harmony, and they also practise dancing and other noblemen's pastimes. He says they did every thing in peace and amity, and although the only punishment that could be inflicted (as is the case now) was expulsion, they dreaded that more than other criminal offenders fear imprisonment and prisons.

The inns of court, formerly called 'hostels,'* are Lincoln's Inn, the Inner Temple, the Middle Temple, and Gray's Inn.

Lincoln's Inn was formerly the mansion of one William de Haverbyll, treasurer of King Henry III., and subsequently passed into the hands of the bishops of Chichester, from whom the students rented it. It appears to have taken its present name from Henry Lacy, earl of Lincoln, whose house near Holborn had been for some time inhabited by students of law. In 1671 the society of Lincoln's Inn were honoured by the presence of his Majesty Charles II., who, together with the Duke of York, Prince Rupert, and many of the principal nobles of the land, was entertained in the hall of the inn, and subsequently they all became members of the society. The hall, a building 71 feet long by 32, was built in the reign of Henry VII.; on the windows and pannels are painted the arms of various dignitaries of the law, who have been members of the society. At one end is a picture by Hogarth representing Paul before Felix, and at the other a marble statue of Lord Erskine by Westmacott. The hall is used as a dining-hall for the benchers, barristers, and students in term-time, and as the lord chancellor's court in the vacation. There is also a chapel, a Gothic building, by Inigo Jones; the exterior has nothing to recommend it, but the interior is very striking, and the handsome carved oak, of which the screen and pews are formed, and the dark paintings on the windows, give the whole a very chaste and solemn appearance. Service is now performed here every morning at eight o'clock. A course of lectures was founded in 1768 by Dr. Warburton, bishop of Gloucester, for proving the truth of the Christian religion from the completion of the prophecies in the Old and New Testament: these lectures are delivered three times a year. A studentship, worth about 100*l.* a year, to be held for eight years, was founded by Christopher Tancred, Esq., for four students, to be educated in the study of the law at Lincoln's Inn. They are elected by the trustees for the time being of the Tancred Charities. A preacher and a chaplain are appointed by the benchers of the society. The library, which is open from ten till four, contains upwards of nine thousand printed volumes, besides a great many very valuable MSS., amongst others those of Sir Mathew Hale. It looks out on tho garden, which still forms a pleasant lounge, but doubtless has been much curtailed since the reigns of Henry VII. and Henry VIII., when, according to Mr. Lane, special enactments were made to prevent the students from hunting the rabbits in it.

The Inner Temple.—This inn, as well as the *Middle Temple*, owes its name to the Knights Templars, who appear to have established themselves here about the year 1185, and called their house the New Temple. After the dissolution of that order it was granted to the Knights of St. John of Jerusalem by king Edwsrd III., and was soon after, according to Dugdalc, demised by tbem to 'divers professors of the common law that oame from Thavyes Inn in Holburne.' The Temple was plundered in the rebellion of Wst Tyler by the mob, and nearly all the property of the professors and students, including their books and records, was carried away or destroyed. This accounts for our having very little authentic information of the early proceedings of the society. However it is certain that in the reign of Henry VIII. the members of the Temple had divided into two societies known by the names of the Inner and Middle Temple, which they then held of the crown at the same yearly rent they had formerly paid to the Knights of St. John. The Inner and Middle Temple have each a hall and a library. The hall of the Inner Temple is a fine room; it hss lately been renovated and in part rebuilt. It contains a few curious paintings. The new library occupies the first floor of a building erected in 1819, and forms a sort of continuation of the hall. The rooms are handsome and very conveniently fitted up, and look out on the Temple garden and the river. The collection of books, especially of law books, is very valuable. The library of the society of the Middle Temple is much inferior to that of the other societies; but the hall greatly surpasses the others both in size and splendour. It was begun in 1562, and finished about ten years afterwards; it is 100 feet long, 40 feet wide, and upwards of 60 feet in height. The roof and pannels are finely decorated, and the screen at the lower end is beautifully carved. The windows are of stained glass, representing the armorial bearings of different members of the inn; the one at the west end has a magnificent appearance when the sun shines. There are a few good pictures; amongst others, one of Charles I., by Vandyke.

The church, which is common to both societies, was founded by the Templars, upon the model of that of the Holy Sepulchre at Jerusalem, and was consecrated in 1185, and dedicated to the Virgin Mary. It is a beautiful specimen of Gothic architecture, consisting of a round tower at the western entrance, and three aisles running east and west, and two cross aisles. The tower is supported by six pointed arches, resting on four round pillars. The interior of the choir is fitted up with pews, which are equally divided between the members of the two inns. The roof is supported by pillars, which are striking for their simplicity and elegance. In the tower are tombs of eleven of the Knights Templars, but with the exception of one, Geoffry de Magnoville, afterwards earl of Essex, it is not known whom the effigies represent. The organ is one of the finest toned in Europe.

The principal clergyman of the Temple is called 'The Master of the Temple;' he is constituted such by the king's letters patent, without institution or induction. There are also a reader, who likewise holds the office of librarian, and a lecturer. The offices of preacher of Lincoln's Inn and Master of the Temple are almost sinecures, and are generally considered as stepping-stones to a bishopric.

The gardens of the Inner Temple are small, but from their situation on the banks of the river form a delightful promenade, to which the public are admitted in summer after six o'clock in the evening.

Gray's Inn is on the north side of Holborn. It takes its name from the Lords Gray of Wilton. Dugdale says that it was purchased from the Gray family by the prior and convent of Shene, in Surrey, and demised by them to the students in law, until their dissolution, when it was granted to the latter by the crown, at a fee-farm rent of 6*l.* 13*s.* 4*d.* The hall is very antient, and has a fine wooden roof. It is used in vacation as a court for the chief baron sitting in equity. The chapel is a neat little building; and the garden forms, with tho exception of the parks, one of the finest walks in London.

Besides these four inns of court, there are eight inns of chancery, which are a sort of daughter inns to the inns of court. They are now only used as chambers, and are principally inhabited by solicitors and attorneys. Two belong to Lincoln's Inn, namely, *Furnival's Inn* and *Thavye's Inn;* the former of these two has lately been rebuilt, and has a handsome front towards Holborn; it comprises upwards of 100 sets of chambers. Four belong to the Temple, *Clifford's Inn*, *Clement's Inn*, *New Inn*, and *Lyon's Inn*. All these are outside Temple Bar, near the Strand. The remaining two, *Staple Inn* and *Bernard's Inn*, belong to Gray's Inn. Most of the inns of chancery have a hall, in some of which dinners are provided and terms kept, as in the inns of court; but these terms do not qualify the student to be called to the bar.

Each inn of court is governed by its own benchers, or 'antients,' ss they were formerly called, who fill up the vacancies in their own body. Any barrister of seven years' standing may be a bencher; but that bonour is now usually conferred only on queen's counsel. At Lincoln's Inn the governing body is called the council, at the Temple the parliament. Their power is almost unlimited, certainly undefined, and many of their orders or enactments have from time to time been very arbitrary; but as most of them are now obsolete, with the exception of those that relate to 'calling to the bar' (which have already been alluded to in the article BARRISTER), we shall only refer the antiquarian reader to Sir William Dugdale's work, to which we are indebted for much of our information. There are one or two more modern works on this subject, but they are more or less abridgements of Dugdale.

INOCE'RAMUS (Sowerby; Goldfuss), a remarkable

* A gentleman's mansion was called hotel, or inn, as hôtel is now used in French.

genus of fossil Conchifera monomyaria, allied to Crenatula, Gervillia, &c., originally named by Mr. J. Sowerby in the 'Linn. Trans.' The name Catillus was given to the larger species by M. Brongniart. The two valves approach to equality; both are convex; the hinge-line straight, often extended into a wing, and thickened with many transverse grooves to receive a divided ligament; shell fibrous; beaks recurved. Inoceramus dubius occurs in the lias; I. concentricus in the gault; I. Cuvieri and many other species in the chalk.

INOCULATION is the insertion of a morbid fluid formed in the body of one person into that of another. It has however been more particularly applied to the practice of producing smallpox by removing a small quantity of the fluid formed in the pustular eruption on the skin of one person and inserting it beneath that of another. The latter (if he have not already suffered from the disease) will, after the lapse of from seven to ten days, be affected with it; but its severity, when thus engendered, is in a large majority of cases greatly mitigated, so that the proportion of those who die after inoculation is not greater than one in five hundred; while of those who receive the smallpox casually one perishes in every six.

The practice of inoculating for the smallpox was introduced into this country by Lady Mary Wortley Montagu, about the year 1721, her son having thus received the disease during her residence in Constantinople. It had long been practised in Turkey and other Eastern nations, and its utility was well known before its introduction into England, both in the south of Wales and in the Highlands. Mungo Park also found that it was habitually practised by the negroes on the Guinea Coast. It was very slowly adopted in this country, and it was not until it had been practised on six criminals (whose liberty was promised to them if they recovered, as they fortunately did) that it was generally received. It was then almost universally had recourse to, till the introduction of vaccination; but since that time it has most deservedly fallen into disuse. Indeed whatever were the merits of inoculation in lessening the severity of the smallpox in the person inoculated, it was probably on the whole productive of more harm than benefit, by introducing the disease (as it certainly often did) into a district previously free from its contagion; and thus, while it saved the life of one person, it became the cause of the death of many who caught smallpox from him. It is now very rarely practised, and when it is remembered that the proportion who die after inoculation is far greater than of those who die of smallpox after vaccination, and that there is great reason to believe that by the general adoption of the latter the smallpox may in time be completely exterminated, it may be a question whether the practice of inoculation ought not to be completely suppressed by law.

Of the other eruptive fevers, measles and scarlatina are communicable by inoculation, though with some difficulty and without the advantage of rendering the disease at all milder; but chicken-pox cannot be thus transmitted, and it is at present doubtful whether the exanthematous typhus fever can. Other cases in which diseases are produced by inoculation are treated of in separate articles, as HYDROPHOBIA, &c.

INOCULATION is an operation performed on numerous species of Exogenous plants, and, like grafting [GRAFTING], has for its end the vital union of one species or variety with another. This object may be effected by either of the two operations in the case of many species; but particular circumstances sometimes render inoculation the more proper method, as in the cases of the apricot and peach, which expand their leaves early in the spring, long before growth has commenced in the plum stock, on which they are generally worked. The grafts of such early vegetating trees are generally found to be exhausted before the stocks can contribute a sufficient quantity of fresh organized matter for completing the union. It is therefore found most advantageous to bud or inoculate them in the summer, when both scion and stock are in a state of equal vegetation.

Buds, like grafts, may remain alive for some time after having been inserted on their stock, and may even effect a sort of adhesion to it; but it is only when the alburnum of the two parts, in a nascent state, come in contact, that a permanently vital union is accomplished. Unless this be previously understood, the best instructions with regard to the performance of the operation will be liable to misapplication.

All buds have their origin in the medullary sheath, and are situated in the axils of leaves existing or that have existed; but when a bud has developed itself beyond the external bark, it begins to produce and send down layers of liber, and its connection with the medullary sheath is at that time destroyed. If the bud so detached be placed in favourable circumstances on the alburnum of another allied species, it will derive moisture from the cambium, and continue to vegetate till the granulations of cellular matter resulting from the effort of the stock to cover with fresh matter the part wounded by the introduction of the bud, meet with the alburnum elaborated by the inserted bud; the similar substances then coalesce, and the union may be termed complete. It may be here observed that the opening made for the reception of the bud should not be made too large, for the smaller the portion of bark raised the sooner will it become covered with fresh matter, and meet with that which is forming at the base of the bud.

The season for performing the operation is, generally speaking, from the beginning of July to the middle of August, the particular time varying according to the season. The best criterion is the state of the buds and the degree of cohesion between the bark and alburnum of the stock. If the buds on the young shoots have become so far perfectly formed outside as to bear separation from the branch, and if the bark of the stock can be freely raised, and exhibits an abundance of cambium in a fluid state, the operation may be proceeded with. If, on the contrary, the bark adheres rigidly to the alburnum, or is *set*, as it is technically expressed, there is little chance of success.

In the selection of buds it is necessary to distinguish those that are formed for blossom-buds and those that would produce shoots in the following season. For example, in the case of peach-trees trained against walls, no buds with only a single leaf at their base should be taken, for such, if the tree is in a bearing state, will only produce a blossom, even if it should remain on the tree; and when transferred it will either perish in winter or die after an imperfect development. On vigorous young trees in the open ground that are not in a blossoming state single *wood-buds* may be readily found, and they are preferable to all others. When a bud on a wall has two leaves at its base it will produce from thence one *wood-shoot* and a blossom-bud: in fact, although one bud is only apparent, yet there exist two; since every leaf has in its axil either a bud or the rudiments of one. Thus a shoot having buds with three leaves at their bases develops itself in the following spring, in the form of two blossom-buds and a wood-bud in the centre.

The operation of budding, or inoculation, is performed in various ways; but the best and most general is that called shield-budding or T budding, from the resemblance of the two cuts made in the bark of the stock to the two principal bars of the Roman letter T. In a smooth part of the stock a horizontal cut is made through the rind down to the alburnum; but care is taken that the incision only just reaches the alburnum. From the middle of this another cut is made downwards. The bud is then shaved off the shoot by entering the knife about half an inch below it, then cutting nearly half way through the branch immediately below where the bud is seated, and finally by slanting the knife outwards about half an inch above the bud. A portion of bark and young wood will thus be taken along with the bud; but the wood must be carefully separated by being dexterously jerked off *downwards* in the direction of the woody fibre, leaving only the small portion belonging to the base of the bud. If the wood were detached by pulling upwards, this minute formation of alburnum belonging to the bud would likewise be removed, and with it the *root*, as it is called, of the bud, or vital speck. This will sometimes happen, whichever way the wood is removed, and may be known by the appearance of a small hole below the external convexity of the bud. When this happens the operation must be repeated. The bud being thus prepared, and its bark pared so as to be easily introduced below that of the stock, and as much reduced as its immediate connection with the bud will permit, the bark of the stock is raised with the thin flat ivory handle of the budding knife by entering it at the angles formed by the transverse and perpendicular incisions above described, taking care not to disturb the bed of cambium; on the latter the bud, with its shield-like portion of bark, is placed, its upper part being then cut off, so as to coincide with the transverse section on the bark of the stock; the lips of the perpendicular incision are closed, or at least brought down upon the shield of the bud; and the whole is bound down with a strip of pliable matting, the point of the bud only being missed by the bandage. The latter must be untied and slightly re-tied, when the swelling of the stock indicates the necessity of the operation.

INOCULATION. [GRASS LAND.]

INQUEST. [CORONER.]

INQUISITION. [OFFICE, HOLY.]

INSANITY, mental alienation, lunacy, 'folie' of Esquirol, &c. Of the various ills to which man is subject none are more dreaded, and few so little understood, as that which involves the loss of his intellect. Nor can we wonder at our ignorance of the nature of this malady when we remember what mystery hangs over the workings of the mind in its healthy state. But even while our knowledge of the nature of the mind and its operations, and therefore of the exact condition on which insanity depends, remains so limited, much, it is to be hoped, may be done towards alleviating the miseries which mental disease induces, by investigating the causes which influence its prevalence, by inquiring into the best mode of restoring the mind to its healthy condition, and lastly, by learning to distinguish between those slight forms of mental disorder which amount to scarcely more than eccentricity or hypochondriacal fancies, and the more important states of disturbance of the intellect which render the subjects of them dangerous to themselves or others, and justify their seclusion from society and confinement in a lunatic asylum.

After a few words relative to the history of insanity, we shall consider its varieties and the characters which each presents, its causes, nature, and the definitions proposed to characterize it, the means of recognising it, and lastly, the mode of treatment.

It is probable that many of the unfortunate persons who are described in the Old and the New Testament as possessed by evil spirits were the subjects of insanity. The same may also be said of the soothsayers and ecstatic priestesses of Egypt and Greece. In later times the dependence of insanity on a diseased state of the mind, or rather of its seat and instrument, the brain, has been generally recognised, but the sense of horror originally excited by the idea of the possession by a demon still influences in some degree the feelings with which the insane are regarded. But it is gratifying to find, that, with the extension of real knowledge, views at the same time more philosophic and more humane are beginning to be adopted in relation to lunacy.

The variety of the forms of insanity is almost endless, but they may conveniently for the purpose of description be collected under the following heads:—1. Disorders of the feelings and propensities. 2. Delusions or hallucinations. 3. General derangement of the reasoning faculties. 4. Mixed forms, in which two or more of the preceding are combined; and 5, the state of imbecility or fatuity in which other kinds of mental disorder frequently terminate.

1. The first principal form which we have indicated constitutes what is termed 'moral insanity' by Dr. Prichard, who describes it as 'consisting in a morbid perversion of the feelings, affections, and active powers, without any illusion or erroneous conviction impressed upon the understanding; sometimes co-existing with an apparently unimpaired state of the intellectual faculties.' The character of the affection varies with the degree in which the different feelings are affected: sometimes jealousy and suspicion are the prevailing passions, causing their subjects to shun their dearest relatives and to live in constant misery, though at the same time they are able to reason correctly on any topic, and at times confess that their suspicions are groundless. Other persons are tormented by a constant fear and apprehension of some undefined danger or misfortune; and with this there is often a feeling of despair, a settled melancholy, frequently of a religious character. This state of despondency (combined with delusions, one of the most frequent kinds of insanity) is at its commencement often in a considerable degree under controul, and may be removed from time to time by the substitution of more cheerful feelings; but if the circumstances to which the individual is subjected be of a nature to depress or alarm, it becomes so aggravated as to lead to a loathing of existence and to suicide. The states which we have considered are generally marked by depression, but they are not unfrequently interrupted by fits of violence and preternatural excitement of short duration. In other cases this last state chiefly characterizes the disease. There is then a want of self-government; the expressions are unguarded and the conduct violent. M. Pinel records a characteristic instance of this, which he terms 'emportement maniaque sans delire.' It is a good example of moral insanity unattended with derangement of the intellect. 'A youth, the only son of a weak and indulgent mother, was the subject of uncontrolled caprice and passion. He was excited to acts of fury by any kind of opposition or remonstrance; he put to death a dog, horse, or any other animal which offended him; and excited broils in every public meeting which he joined. But when not led by his passion he enjoyed sound judgment, was fully competent to discharge all his duties, and was humane. At length he threw a woman, who had offended him, into a well, was prosecuted, and condemned to perpetual confinement in the lunatic asylum Bicêtre.' An inordinate degree of pride and vanity is often the prevailing characteristic of the feelings of a disordered mind; and it is generally attended with some delusion. A propensity to mischief, the destruction of all surrounding objects, is not uncommonly displayed by the insane; another degree of the same affection is the impulse to the destruction of life. Persons affected with this morbid excess of the destructive propensity have without doubt frequently suffered the punishment due to wilful murder; many persons have been known to complain of the impulse they felt to kill, and have even begged to be confined lest they should injure others. The propensity to theft also sometimes constitutes a marked feature of insanity. Dr. Prichard mentions having seen a lunatic who would only eat when he had *stolen food*, and whose keeper made it a constant practice to put into some corner within his reach various articles intended for his sustenance, in order that he might take them furtively. This propensity to steal is well known to have brought disgrace on members of rich and honourable families. *It is* probable that in many such cases there is an uncontrollable impulse to the act, independent of any anticipation of pleasure from the subsequent possession. An excess of the sexual feeling, with a want of control over the expressions, is occasionally a source of great misery. A female modest at other times will in a state of insanity use indecent language and by her conduct discover the grossest desires.

Though we have thus described disordered states of some of the feelings and propensities as varieties of 'moral insanity,' it must be remembered that generally the prevalence of any of these feelings in a morbid state is attended with some delusion or disorder of the intellectual faculties; while on the other hand it is exceedingly rare to meet with instances of delusion or of general insanity with a perfectly calm and natural state of the affections; when there is not a marked derangement or excited state of any one feeling or propensity in such cases, there is a strange perverseness of temper and disposition. The modification of madness which occurs in old people, and is designated 'senile madness' by Dr. Burrows, who has accurately described it, is a species of moral insanity. The moral feelings are perverted, and some of the passions in a state of excitement. 'The pious,' says Dr. Burrows, 'become impious; the content and happy, discontented and miserable; the prudent and economical, imprudent and ridiculously profuse; the liberal, penurious; the sober, drunken.' Passions which had long been dormant resume their sway, and cast shame mingled with pity over the years of *declining* age.

2. The term monomania has been proposed by M. Esquirol, and adopted by most writers on mental disorders, to designate those cases of insanity in which the mind is occupied by some illusion or erroneous conviction, the individual still retaining the power of reasoning correctly on matters unconnected with the subject of his delusion. The word 'melancholia' has been used in the same sense, which has given rise to the erroneous notion that insanity of this kind is necessarily of a gloomy character. It is rarely that the mind of the monomaniac is otherwise perfectly sound; there is generally combined with the delusion a morbid state of the moral feelings, and in many instances a great weakness of the reasoning faculty. The subject of the delusion is very various. It may have reference to the condition of the individual's own person; thus, some fancy that they have lost their head, others that their legs are not their own, but belong to some other person, others again that

they have the devil or some animal within them, that they are dead or that they are changed to some other form, &c. Monomaniacs subjects of the last delusion are thus described by Pope,—

> 'Unnumbered throngs on every side are seen,
> Of bodies changed to various forms by spleen;
> Here living tea-pots stand, one arm held out,
> One bent; the handle this, and that the spout:
> A pipkin there, like Homer's tripod walks;
> Here sighs a jar, and there a goose-pie talks.'

It is probable that in many cases of delusion regarding the condition of the body there is some morbid state of the nerves, causing a sensation which excites in a mind prone to insanity an idea which the reason is unable to correct. Another kind of delusion is that which characterizes the 'demonomania' of some writers. It consists in a belief in the presence of invisible beings whom the lunatic sees, hears, and converses with. Religious delusions are frequently of this character: the maniac sees and communes with the Almighty or with angels. Such ideas, being very often combined with despondency, lead to suicide. Others who are subjects of such delusions fancy themselves constantly followed by some person who has the purpose of injuring them. A third kind of delusion refers to unreal events which the individuals believe to have occurred, or consists in a belief in some absurdity which has no foundation except in the patient's imagination. Such a monomaniac was the gentleman who thought he had been confined in a castle, and corresponded with a princess by writing letters in cherry-juice. The delusions which most frequently take possession of the thoughts of the proud or vain madman are referrible to the head of those which arise from abstract ideas conceived in the mind being mistaken for realities. An ambitious dreamer may for a moment imagine himself a king, but it is only a lunatic who fails soon to perceive that he is such only in his own thoughts.

There is generally some connexion to be traced between the nature of the illusion and the former occupation of the monomaniac or the ideas which have chiefly engaged his mind. Thus a butcher is said to have fancied that he had a leg of mutton hanging from his nose; a youth, the son of an attorney, fancied himself suspected of a horrible crime, and that the officers of justice were following him; persons who have had their thoughts much directed to religious subjects imagine when they become insane that they have received a charge from the Almighty; that they are persecuted by the devil, &c. &c.

3. General derangement of the intellect presents many varieties and degrees; but the distinguishing character is that the faculties of the mind generally are disordered; the patient will not speak on any subject long without betraying the defect of his reasoning power. This will in one person merely lead to strange irrational conduct and conversation —its necessary consequences; in another it will be attended with loud and violent raving (mania); in a third there will be singing, and a gay cheerful air; while a fourth case will be characterized by a low muttering incoherence. This general insanity is most frequently attended with disturbance of the bodily health. The symptoms of mental excitement frequently increase in violence for a short time, then gradually subside into a more quiet state, which too often terminates in mental imbecility.

4. The mixed forms of madness are by far the most frequent. Moral insanity, the disturbance of the moral feelings and propensities, is generally attended with some degree of weakness of the reasoning powers, or with some delusion. The general derangement of intellect has combined with it an excited state of some of the feelings; and monomania in the pure form, a mental delusion without further disorder of intellect, is very rare.

5. The duration of insanity has no certain limits; the attack may last but a few weeks, or it may continue many years; it is not uncommon to meet in lunatic asylums with persons who have been insane twenty or thirty years. When the disordered state of the mind is thus protracted, it usually terminates in loss of the intellectual faculties. The state of imbecility, dementia, or fatuity, which then succeeds has many degrees. It commences by the loss of memory, particularly for more recent events; the mind receives impressions and perceives them, but the faculty of retaining them seems to be lost. It is this state which so frequently attends the advance of years, and gives warning of approaching decay, when the mind is otherwise sane. In the latter instance the faculties are exercised in a sound manner when the attention is roused, but frequently the words which were spoken but a few minutes previously are forgotten, though the memory for the events of youth is quite distinct. In a second degree of imbecility the power of directing the thoughts is lost; ideas come and go without order and independently of the will; questions are still heard and attempts are made to reply to them, but before the answer is half completed the train of thought is lost, and the mind and tongue wander to other subjects. In proportion as the mind becomes more and more weakened the external senses also become deadened; there is a carelessness of all that is going on around; life is reduced to the state of that of brute animals; the instincts alone guide the actions. The features are void of expression, the countenance vacant, the eyes wandering. At last even the instincts are lost; the miserable creatures seem almost unconscious of life; careless of the calls and wants of nature, they sit or lie motionless in one position, and frequently lose even the use of their limbs.

Disease in the brain may thus go on to the abolition of all the functions by which mind is manifested, without interfering with those other functions of the body on which mere existence depends. Insanity cannot be regarded as a very fatal disease. Of the lunatics at the asylum Bicêtre in the year 1822, one patient had been there 56 years; three had been confined upwards of 40 years; twenty-one more than 30 years; fifty upwards of 20 years; and one hundred and seven more than 10 years. Of those in Salpetrière seven cases had been admitted from 50 to 57 years. It is difficult to ascertain the proportional number of recoveries from insanity, so different are the statements made by different writers. While some authors have reported the cure of nearly 5 in 6 cases, others have estimated the proportion cured as less than 5 in 10; some have stated it to be as low as 5 in 15. The chance of recovery however varies very much according as the insanity is complicated or not with other disease; it is also influenced by the form of the disease, the period of its course, the age, sex, and constitution of the patient. Of the diseases which occasionally complicate insanity, epilepsy and paralysis are the most important. Whether paralysis affect the motion of the limbs or the speech only, the case is generally considered hopeless. The complication with true epilepsy, not mere convulsions from temporary cerebral excitement, is nearly equally unfavourable. It appears that the general derangement of the intellect is more curable than monomania, more especially in men. The state of imbecility is almost certainly incurable. The period of the disease at which it is brought under treatment has a very important influence on the chance of recovery. Of those who enter asylums soon after the commencement of the malady seven out of eight, or even nine out of ten, recover; while after the third year the probable proportion of cured is not more than one in thirty. The mean duration of cases terminating favourably seems to be from five to ten months. The age most favourable for recovery from insanity is the period from the twentieth to the thirtieth year; few recover after the fiftieth. Insanity is generally more curable in women than men. There is more hope of recovery when some secretion of the body is suspended which may be restored by medicine, or when a critical period, such as that of the appearance or cessation of the catamenia in women, is at hand; at such periods as those last referred to insanity has ceased after having persisted for many years.

During the period of convalescence there is great liability to relapse, but this diminishes with the increasing length of time during which the patient manifests no symptoms of unsoundness of mind. The more complete the recovery the more likely is it to be permanent; if the judgment be strong and the feelings neither depressed nor irritable, relapse is much less to be feared.

Causes.—Some individuals appear to be so prone to insanity that very slight causes are sufficient to induce it in them; or it is probable indeed that there is always some peculiarity in the constitution predisposing to it, since the apparent causes do not differ from those which, acting on other persons, produce other diseases and not insanity. Be this as it may, a tendency to mental and other cerebral afflictions is often observed to prevail in families, and to be transmitted from parents to offspring. An attack of insanity not only produces such a change in the system as to render it more prone to the disease than before, but the condition of the body, or rather of the brain, thus induced may be transmitted to the children. This fact is so well known that it is unnecessary to insist further upon it. The hereditary predisposition is said to be stronger when both parents have been insane. A remarkable circumstance relating to the hereditary transmission of insanity is that the form of the disease which affects different individuals of a family is often the same, and that it attacks them about the same age. It is an opinion generally adopted that intermarriage in families gives rise to the predisposition to mental disorder, as it certainly does to weakness of body and mind. Intermarriage must tend to strengthen or maintain original peculiarities of constitution, and therefore any predisposition to disease which may exist. It is almost impossible to ascertain the proportion of cases connected with hereditary predisposition, so much is it the desire and interest of families to conceal such a circumstance.

The proportion in which the sexes are affected with insanity varies very much in different parts of the world. In Great Britain and Ireland the proportion of males to females insane is stated to be as 13 to 12. In Italy also the number of male lunatics is greater than that of the females. But in France there are more females than males insane, in the proportion of 14 to 11. Calculating from statistical accounts derived from different parts of the globe, M. Esquirol found that the proportion of men to women insane is nearly as 37 to 38. The concurrent testimony of French and English physicians tends to show that the number of the male sex affected with lunacy, as compared with the female sex, is greater in the higher than in the lower ranks of society.

Insanity is rare, though it sometimes occurs, before the period of puberty. It is from the age of 14 to 17, when a great change is taking place in the system, and when the passions begin to be more active and more liable to excitement, that insanity becomes frequent. The liability to the disease increases up to the age of 40; and although the absolute number of persons in lunatic asylums of different ages from 40 upwards becomes less and less, yet if we take into consideration that the number of persons living at the more advanced ages is also much less, we shall be led to infer, not that the liability to insanity diminishes in old age, but, on the contrary, that it rapidly increases. An excellent paper by M. Esquirol on the statistics of insanity, in which the number of insane persons at the different ages is compared with the population of the same ages, shows this in a very striking manner.

Of the causes which excite the development of insanity in individuals predisposed to it, those which act on the mind are the most efficient. It will most frequently be found that immediately before the attack the patient has suffered some severe vexation or disappointment from family troubles, pecuniary embarrassment, &c. We have seen that insanity rarely shows itself before the age in which the mind is susceptible of strong feelings, and in which the passions are excited by strong interests. A calculation made by M. Pinel represented the proportion of cases produced by moral causes, as compared with those due to physical causes, to be, in a space of five years, as 464 to 219. In one of the largest of our English asylums the proportion of cases ascertained to have been excited by moral causes has been, during the years 1831 to 1836 inclusive, 431; those ascribed to physical causes, 291. The proportional influence of moral causes is however probably much greater than is here indicated; for in 454 cases admitted into the asylum to which we refer during the six years, no cause was assigned, and of these it must be presumed that a large number were due to moral influence. It is the slow and constant action of the depressing passions that is most instrumental in disordering the mental faculties; the violent and sudden passions much less frequently have this effect. Of the 431 cases produced by moral causes in the asylum from which we derive these facts, 289 were ascribed to trouble of mind from pecuniary distress or family disasters, grief, jealousy, disappointment, &c. Religious impressions are frequently instrumental in exciting complete derangement of the intellect in minds already sensitive and weak; 43 cases out of the 431 were traced to religious excitement. The other causes acting directly on the mind, which are more or less active in exciting insanity, are disappointed love (a not unfrequent cause in young females), fright (also acting chiefly on females), excessive study, and political excitement, which during the Revolution and succeeding years was a productive source of mental alienation in France; but cases from that cause are now comparatively rare even in that country, and of upwards of 1200 cases admitted during 6 years into an English asylum, 2 only were traced to political causes.

Of the physical causes of insanity those connected with circumstances which affect females only afford the greatest number of cases; 62 out of the 291 cases of insanity from physical causes were connected with parturition or nursing. Insanity occurring under such circumstances is termed puerperal mania, the frequency of which is not easily explained. Retardation of the appearance of the menses and their suppression are likewise occasional causes of insanity in females. The frequent dependence of mental disorder on intemperance, particularly in men, is a fact demanding much attention. Drunkenness is unfortunately a prevailing vice in England, and accordingly we find a much larger number of insane from that cause in the pauper lunatic asylums of this country than in those of France, where the abuse of intoxicating liquors is less general. Next to intemperance, the causes which act more directly on the brain itself, and give rise to inflammation or disturbance of the circulation in it, are the most influential in producing the predisposition to insanity, or in exciting it; such causes are blows on the head, fever, coup de soleil, &c. Epilepsy and, less frequently, apoplexy also lead to insanity. Lastly, any influences acting prejudicially on other parts of the body may indirectly affect the mental organ and disorder its operation.

Closely connected with the subject of the causes of insanity, and of equal importance, are the statistics of the disease. If we could ascertain all the important circumstances which accompany its greater or less prevalence in different countries, we might hope to be able to combat in some measure the evil, by adopting preventive measures. A general result, which appears to rest on correct information, is, that insanity is extremely rare in uncivilized nations, as among the natives of Africa and America. This cannot arise solely from passion less frequently disturbing their moral feelings and affections, though this is undoubtedly an influential circumstance. There seems to be an absence of the predisposition to many diseases among the uncivilized races. A less highly developed and less active condition of the brain may render it less prone to disease.

In Turkey, Spain, and Italy, insanity is comparatively less prevalent, if we may judge from the imperfect reports obtained from those countries, than in the more northern European nations and the United States of America. The proportion of lunatics to the population in England and France is, according to the calculations of Sir A. Halliday and M. Esquirol, about 1 to 1000. In Prussia the proportion, as stated by M. Jacobi, is about the same. But in Wales the proportion of insane to the population was estimated by Sir A. Halliday to be as high as 1 to 800, and in Scotland 1 to 574. In Norway too, a country somewhat similar in its physical character and in the condition of its inhabitants to Scotland, the estimate of the proportion of lunatics given by Dr. Holst is 1 to 551. A great and surprising difference is found to exist in the proportional number of insane in manufacturing and agricultural districts of England; the number being greater in the agricultural counties. This is an analogous fact to the prevalence of the disease in Wales and Scotland. There is certainly less call for the exertion of the intellectual faculties in the agricultural than in the manufacturing counties, and in Wales than in England; an explanation of the facts must therefore be sought in other circumstances. In the statistical calculations are included not merely the insane, but the idiotic from birth, and the excess in the number of unsound in mind in Wales, Scotland, and Norway, as compared with France and England, is due to the greater number of idiots, of which we can find some explanation in the hardships to which the poor of those mountainous and partly barren countries are exposed; idiotcy being a disease dependent on imperfect formation of the brain, and generally attended with other marks of an ill-developed organization. The greater liability of the agricultural population of England to insanity is less easily accounted for. The much greater degree in which insanity presses on the lower than on the higher classes of society, is another important consideration. One cause of this is undoubtedly the much less check which is put upon the spreading of the disease by marriage with individuals whose families have the predisposition in the lower than in the higher classes. Another may be the deprivations to which parents, and particularly pregnant females, are exposed. A third is the prevalence of intemperance among the poor. The opinion has prevailed in France as well as in England, that insanity is on the increase, but the data on which this supposition is founded cannot be implicitly trusted, for the greater number and better management of lunatic asylums at the present day cause many more persons to be conveyed to them, and thus placed within the reach of statistical research; while formerly many lunatics were allowed to wander about as beggars; many from shame, or fear of the horrors of the asylum, were concealed in private families; and somo, from ignorance, were punished as criminals.

The principal means of checking insanity, which the facts above detailed seem to suggest, are, 1, the prevention of the marriage of individuals predisposed by inheritance to the disease; 2, the improvement of the physical condition of the poor; 3, the encouragement of intellectual cultivation and amusements among the lower classes, as a means of checking intemperance and sensual indulgence generally; 4, a better education of the moral feelings in all classes of society, so as to discipline the passions and enable the mind to resist their disturbing influence.

Before entering on the consideration of the mode of detecting insanity, it will be necessary to inquire into the probable nature of the disease. We will first state the facts on which is founded the opinion that it is dependent on some disease in the brain. It is not requisite to offer any proof that the brain is, in the healthy state, the seat of the mental operations, the organ or instrument by which the mental principle, whatever it be, acts. Admitting this, we may naturally suppose that the cause which disturbs the functions of the mind has its seat in the same organ. Then again, although in many cases no change of structure can be found in the brain after death (which cannot surprise us if we remember the delicacy of the organ and the slight change that would be sufficient to disorder its action), yet it is certain that morbid appearances are found much more frequently in the brain than in any other part of the body of the insane after death. The commencement of the disease is generally accompanied by pain and other symptoms of inflammation or vascular fulness of the head. In some cases we perceive a distinct connection between marked disease of the brain and insanity, as where the latter affection supervenes on epilepsy or apoplexy. The physical causes too aro in many instances such as act directly on the brain; we allude to blows on the head, inflammation of the brain, coup de soleil, &c. Even the moral causes of insanity afford an argument in favour of the cerebral pathology of the disease; for the inordinate action of the brain which must attend the long continuance and great violence of a particular passion would be likely to excite diseased structure of the organ. The diseased states of other viscera, those of the abdomen for example, can only be regarded as consequences of tho insanity, or as accidental complications, or if they stand at all in the relation of causes, as acting only through the medium of the brain.

It being thus premised that the brain is the seat of the disease, can we recognise any particular character in the disordered reasoning and feelings of the insane which will afford us a means of defining it, and enable us to distinguish it from other disturbed states of the mind and senses? Many writers, led by some observations of Mr. Locke, have said that 'the insane reason correctly from erroneous premises.' But this definition includes those only who are the subject of some delusion, while there are many lunatics who have lost the power of reasoning correctly; hence some authors have added to the above definition the sentence 'or erroneously from correct premises.' The definition, founded on Mr. Locke's remark, applies very well to the state of mind of many monomaniacs, who frequently act quite reasonably on the supposition of the subject of their delusion being a fact; it is in their believing what a sound man must perceive to be false that their insanity consists. Thus many persons under the influence of particular states of the brain or the senses of vision have seen spectres, but, not believing in their actual existence, were not mad. The belief in things inconsistent with the laws of nature, with the combined evidence of all our senses, or with other known facts, shows a want of reasoning power, or, according to Dr. Conolly, a want of 'the comparing power;' the lunatic does not compare the evidence of one sense with that given by other senses, or with past impressions; if he did so, ho would detect his error. A madman fancies his legs are made of butter, and accordingly protects them from the sun and external force; but if he used his senses of touch and sight, and compared their evidence with the sensation which excited the erroneous idea, or with the idea itself, he would perceive its falsity. There are however, as we have said, many other cases in which, whethor combined with delusions or not, there is a defect of the reasoning power, the degrees of which vary from the state of the persons who are regarded merely as somewhat silly, to that of the imbecile or fatuitous. There is however another less frequent form of insanity, which depends neither on reasoning from erroneous premises nor on defect of the reasoning faculties; we allude to the state in which the moral feelings are so deranged or excited as to lead to acts which may be called insane, since the will has no longer the power of regulating them, and the individual cannot be looked upon as an accountable being. The definition adopted by Dr. Spurzheim and the phrenologists will include this last form of insanity. Insanity is by them stated to be 'an aberration of any mental power (an intellectual faculty, a moral feeling, or a propensity), from the healthy state, with an inability on the part of the individual to discern its unhealthiness or to resist it.'

In deciding what is and what is not insanity there will not be much difficulty if any illusion exist in the patient's mind, and its nature be known to the examiner; and when there is general derangement or defect of the reasoning powers, a careful examination will surely detect it. It is much more difficult to decide as to the existence of moral insanity when unattended with delusion or defect of the reasoning faculty, though the decision is here often of the greatest importance, as the honour or life of the individual depends upon it. No rules can be laid down for determining whether eccentric acts, or the commission of homicide, be the effect of an irresistible impulse or not; in all such cases however, the history, the dress, gestures, and manner of speaking, and the expression of the features of the individual, should be carefully attended to. In almost all insane persons there will moreover be found either symptoms of vascular excitement about the head, or an unhealthy state of the skin and of the different secretions.

There are however, as Dr. Conolly observes, two questions to be decided in every inquiry relative to the sanity of an individual. The first relates to the existence of unsoundness of mind; the second regards the treatment required, and especially the necessity of restraint, and the degree and nature of the restraint. With reference to the second question, the chief point to be considered is whether the patient be likely to injure his own person or that of others, or his own property or that of others. Medical treatment may be required in any case of insanity; but on the decision of the second question above indicated depends whether the patient shall be confined and deprived of controul over his property. It is from confounding the question of the existence of madness with that of the necessity of confinement that so much injustice has been committed; to prove a man insane has been synonymous with condemning him to imprisonment. But though a man believe his legs are not his own, or that he was present at the destruction of Jerusalem, he may be a perfectly harmless and even useful member of society: shall he therefore be deprived of his liberty and of the management of his property merely on account of a single delusion? [LUNACY.]

The treatment of insanity resolves itself into the medical and the moral. The medical treatment indicated and required at the commencement of the disease consists chiefly in the attempt to reduce increased vascular excitement or slight inflammatory action. It is seldom that any violent antiphlogistic measures are required. The same treatment may be called for during the course of the disease if the symptoms of cerebral excitement or inflammation return. Sometimes want of sleep is the most marked symptom, and opiates are given with benefit. In the more chronic conditions of the disease the medical treatment is chiefly directed to the restoration and maintenance of a healthy state of all the functions of the body, particularly of the secretions. A strengthening diet is requisite in some cases; cleanliness, fresh air, and exercise in all. The best asylums afford the means of employment for the insane in the open air; but this important requisite is still neglected in some large public institutions.

The moral treatment is now recognised as an important part of the management of the insane. Formerly a lunatic was regarded with horror, as a being who had lost all relation to society, and was to be treated as a wild beast; he was confined in a gloomy filthy cell, was loaded with chains, and shut out from all influences which could cheer his mind or lead it from the subject of its delusion. The first step in the great amelioration which has taken place was effected by the efforts of M. Pinel in France and the Quakers in England. The insane are now treated with humanity. The power of moral influences in restoring the healthy tone of the mind has been recognised as a principle, in carrying out which the chief means adopted are the following:—1. In many cases seclusion from society, chiefly with a view to remove the patient from the influence of the circumstances which produced the disorder, or which might keep up unhealthy trains of thought; but when the insanity is partial, consisting in a single delusion, this measure can scarcely be recommended, as it might, by shocking the mind, increase the malady. 2. Occupation and amusement of the mind in various ways, so as to divert the thoughts; this is an important circumstance in the treatment, and has been only recently attended to. Everything calculated to remind the patient of his state should be avoided; the apparatus of confinement kept from his sight, and the appearance of all objects rendered as cheerful as possible. 3. The moral influence of the physician has a powerful effect on the mind of the insane; kindness will gain their confidence, while a firm though mild manner is often sufficient to restrain the most violent outbreaks of rage, and render other means of restraint unnecessary. Chains are now generally discarded from the apparatus of the lunatic asylum, and even strait waistcoats and straps are seldom required. But while measures of bodily restraint should be avoided as much as possible, it is a safe and imperative rule to remove hurtful weapons and means of mischief from the reach of the insane. All irritation of mind by threats, &c. should be avoided. 4. The convalescent should be separated from the other patients in the asylum. 5. The insane should be classified, so as to separate the quiet and timid from the noisy and violent.

In the preceding portion of this article we have not made *idiotcy* the subject of separate consideration. It is scarcely necessary to say that while *fatuity* is the state of defective intellect produced by disease late in life, *idiotcy* is the original want or deficiency of mental power. Just as the imbecility of old age has various degrees, so there are various degrees of idiotcy. One of the worst forms is that presented by the Cretins, the deformed and imperfectly organized idiots met with in the valleys of Switzerland. Idiotcy generally depends on congenital disease, but sometimes it is produced by diseases affecting the brain in very early infancy. The more remote causes are probably imperfect nourishment of the parents, or some noxious influences acting on the mother during pregnancy; the same hereditary predisposition which gives rise to insanity seems also sometimes to be productive of idiotcy. The form and size of the head in idiots may be quite natural; in many cases however it is large and deformed; in others remarkably small, particularly in the region of the forehead. The bones of the head are sometimes very thick; the brain itself disorganized, or its cavities distended with fluid. [HYDROCEPHALUS.]

(Prichard, Conolly, Burrows, and Haslam, *On Insanity;* Pinel, *Sur l'Aliénation mentale;* Esquirol, *Sur les Maladies mentales;* Georget, *Sur la Folie;* Heinroth, *Die Störungen des Seelenlebens;* and Jacobi, *Sammlungen für die Heilkunde der Gemüthskrankheiten.*)

INSECTA, one of the classes of invertebrate animals. The Latin term *insecta*, like the Greek *entoma*, which has been applied to these animals, has reference to the insected, or divided, appearance of the body; hence the English name insect, the French *insecte*, and the German *insecten*. Invertebrate animals are divided by Lamarck* into two groups, which he calls 'animaux apathiques,' and 'animaux sensibles.' The latter, or the sensitive animals, contain six classes, of which insects are the first. According to Latreille's arrangement in the 'Règne Animal,' the class Insecta forms the third great division of articulated animals.

True insects may be thus defined:—*Articulated animals possessing six legs, two antennæ, two compound eyes; a small brain at the anterior extremity of a double medullary chord. Circulation effected by a pulsating dorsal vessel provided with numerous valves. Respiration by tracheæ, which form two lateral trunks, and ramify through the body; generation oviparous; two distinct sexes; adult state attained through a series of metamorphoses.*

Insects generally possess two pairs of wings; the trunk in the adult animal is usually composed of three chief

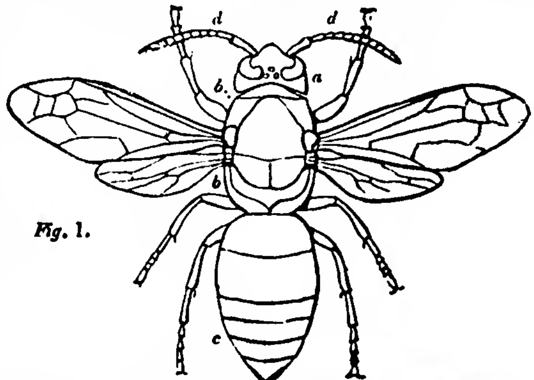


Fig. 1.

Fig. 1, the Hornet, magnified. *a*, the head (*caput*); *b, b*, the thorax; *c*, the abdomen; *d, d*, *antennæ*.

parts, the head (*caput*), thorax, and abdomen; or the trunk of an insect may be described as consisting of thirteen segments, of which one constitutes the head, three form the thorax, and the remaining nine compose the abdomen. The head includes the organs of sensation and manducation, and its principal parts have received the following names:—the *clypeus, vertex, occiput, genæ, canthus, gula, oculi, stemmata, antennæ*, and the *trophi*.

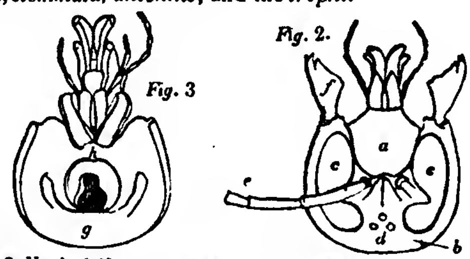


Fig. 2. Head of Hornet, magnified. *a*, the *clypeus*; *b*, the *vertex*; *c, c*, the eyes (*oculi*); *d*, the eyelets (*stemmata*); *e*, the antenna; *f, f*, *mandibula*. *Fig.* 3, the same, viewed from beneath: *g*, the *occiput*; *h*, the *gula*.

The *clypeus* is that part of the upper surface of the head which joins the labrum. It is called by Kirby *Nasus*, and in the *Lamellicornes* it is usually the foremost part of the head when viewed from above.

The *vertex* is the summit of the head.

The *occiput* is the hinder portion of the head, or that adjoining the thorax.

Genæ (the cheeks). 'Those parts which lie on the outer side of the anterior half of the eyes, and intervene also between them and the mandibula.'—Kirby.

Canthus, a name applied by Kirby to a process of the head which encroaches upon the eyes.

The eye in certain insects is encroached upon by a narrow process of the head in such a manner as to render it kidney-shaped, instead of its ordinary round form, and in some instances this organ is divided by the canthus into two parts.

Gula, the hindermost portion of the head beneath.

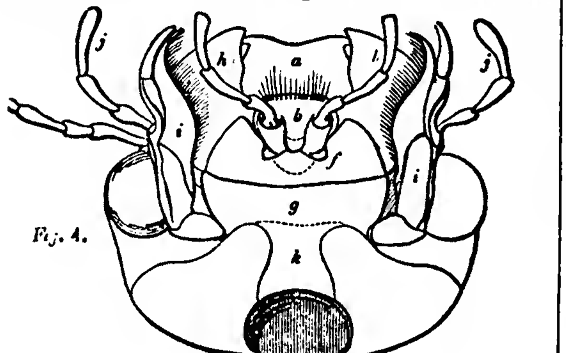
Oculi (the eyes). These are almost invariably two in number, placed one on each side of the head, and composed of hexagonal lenses.

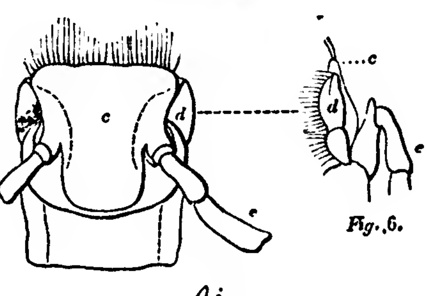
Stemmata (the eyelets). Minute simple eyes. They may be seen in the orders Hymenoptera, Orthoptera, and Hemiptera, and are generally placed vertically on the head. The larvæ of Coleopterous insects generally possess them, and they are usually placed on each side of the head close to the antennæ.

Antennæ. Jointed organs, two in number, most commonly springing from the upper surface, or side of the head near the eyes. These organs vary much in every way, not only in the various species of insects, but in the sexes of the same species they often differ.

* 'Histoire des Animaux sans Vertèbres,' tom. i., p. 381.

There is much difference of opinion as regards the use of these organs. Some have come to the conclusion, from anatomical researches, that they are organs of hearing, whilst others maintain they are organs of touch or smell. When however we see so much difference in the structure of the antennæ in insects, and perceive that some use them in touching surrounding objects, as is the case in many of the Hymenoptera (particularly the Ichneumonidæ, Bees and Ants), whilst others carefully avoid so doing, we are naturally led to the conclusion that they are used for different purposes in different insects. It is certain that insects possess the sense of smell, but in those insects which possess it apparently in the highest degree we can trace no similarity in the structure of the antennæ. A Silpha, a Staphylinus, and a common fly, appear to be equally attracted by the scent of a piece of putrid flesh, and yet their antennæ bear no resemblance. The same remark will apply to the antennæ of those insects which emit sound; the Grasshopper, the Sphinx atropos, many of the Cerambycidæ, and numerous other insects might be enumerated which emit voluntary sound, but their antennæ do not differ from those of the species to which they are most closely allied, and which emit no sound that we can perceive. As regards touch, there can be no doubt that the antennæ of many insects are used as organs of touch, and it appears highly probable that, through the means of the antennæ, some insects can perceive the state of tho atmosphere. The delicately plumed antennæ of the gnat, and of tho nocturnal





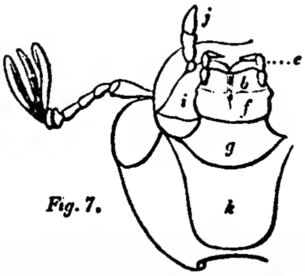


Fig. 4, Parts of the Mouth of a Water-beetle (*Dytiscus marginalis*). *a*, the *labrum*; *b*, *f*, and *g*, the *labium*; *b*, the *palpiger*; *f*, *mentum*; *g*, *stipes*; *h*, *h*, *mandibula*; *i*, *i*, *maxillæ*; *j*, *j*, maxillary palpi; *k*, jugulum. *Figs.* 5 and 6. The *Palpiger*, highly magnified (5, front view; 6, side view); *c*, *lingua*; *d*, *d*, *paraglossæ*; *e*, palpi-labiales. *Fig.* 7. Parts of the mouth of *Amphimalla solstitialis*. Corresponding letters refer to the same parts as in *Figs.* 4, 5, and 6.

Lepidopterous insects, seem to be well fitted for receiving impressions of this nature.

An antenna may be divided into the following parts:—

Torulus, 'The cavity or socket in which the baso of tho antenna is planted.'

Scapus, 'The first and in many cases the most conspicuous joint of the antenna.'

Pedicellus, 'The second joint of the antenna.'

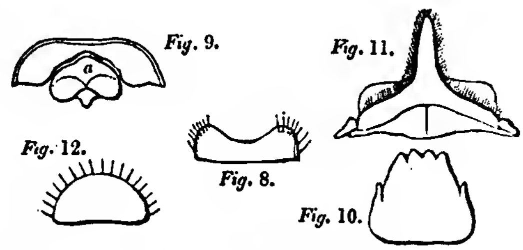
Clavola, 'The remaining joints taken together.'

In describing the species of the Curculionidæ, the term *Funiculus* is often used to designate that portion of the antenna between the long basal joint, or scapus, and the club (called *capitulum* or *clava*), which in these insects usually terminates the antenna.

Tho principal modifications in the form of antennæ are figured and described in the article Coleoptera.

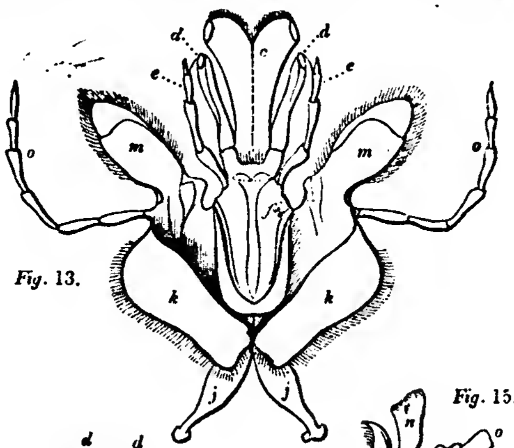
The *trophi*, or parts of the mouth (called by Fabricius *Instrumenta Cibaria*), consist of six principal portions:—The *Labrum*, *Labium*, *Mandibulæ*, and *Maxillæ*.

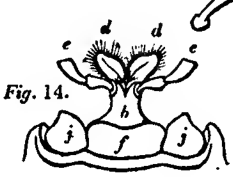
The *Labrum*, or upper-lip, is a corneous plate, which terminates the head anteriorly, and covers the mouth above, its posterior margin is united by a membranous hinge to the Clypeus.

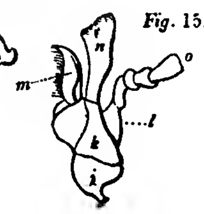


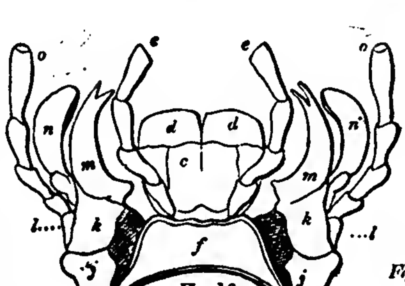
Figs. 8, 9, 10, 11, and 12, the *Labrum*, or Upper Lip, of various insects.

The most common form of the labrum is represented in *fig.* 8; it is however very variable in shape, and in the Lamellicornes, a tribe of Beetles which feed upon vegetable substances, instead of being of the ordinary horny texture, it is soft and membranous, and hidden beneath the clypeus (*fig.* 9, *a*). In some of the Cicindelidæ (predaceous insects) it is more or less elongated and notched at the sides and apex (see *fig.* 10). In the genus Cicindela a small projecting tubercle may be observed on the anterior margin









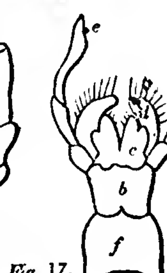


Fig. 13, *Labium* and *Maxillæ* of the Hornet. *Fig.* 14, *Labium* of *Cerambyx moschatus*. *Fig.* 15, *Maxillæ* of the same insect. *Fig.* 16, *Labium* and *Maxillæ* of a Locust. *Fig.* 17, *Labium* of another species of Locust. In all these figures the letters *b* refer to the *Palpiger*; *c*, *Lingue*; *d*, *Paraglossæ*; *e*, *Palpi-labiales*; *f*, *Mentum*; *j*, *Cardo* of Maxilla; *k*, *Stipes* of ditto; *l*, *Palpifer*; *m*, *Lacinia*; *n*, *Galea*; *o*, *Palpi-maxillares*.

of the labrum. In the Hornet (Vespa crabro) the labrum is produced in front into an elongated pointed process (*fig.* 11). In the Lepidoptera it is extremely minute, and the Hemiptera possess a long, slender, and pointed labrum.

The *labium*, or under-lip, is opposed to the labrum, and generally serves to close the mouth beneath.

The labium is a very complicated organ, consisting of several parts which are variously developed in the different tribes of insects, &c. There is much confusion in the nomenclature of these parts, especially as regards the portion which is to be considered the true labium; for although the whole apparatus is often called the labium, yet when treated of in detail most authors agree in applying this term to some particular portion, but differ as to which particular portion the term shall be applied, and consequently the neighbouring parts are differently named. The confusion has arisen from the circumstance of entomologists having applied the name labium to the whole apparatus, and likewise to a particular part of it. We shall therefore use the term labium to express the whole apparatus, and describe the several parts under the three heads *Palpiger*, *Mentum*, and *Stipes*.

Palpiger, or palpi-bearer. This name was first applied by Mr. Newman* to a portion of the part called *Lingua* by Kirby, and *Labium* by MacLeay and others. It will be used in this article as the name of the whole apparatus to which the labial-palpi are attached, including the *lingua*, *paraglossæ*, and *palpi-labiales*.

The several parts of the labium therefore will be thus divided:—

$$\text{Labium.}\begin{cases}\text{palpiger } (b). \begin{cases}\text{lingua } (c).\\ \text{paraglossæ } (d).\\ \text{palpi-labiales } (e).\end{cases}\\ \text{mentum } (f).\\ \text{stipes } (g).\end{cases}$$

If we examine the underside of the head of any insect in which the various parts of the mouth are well developed, the palpiger will be readily distinguished from the other two portions of the labium by its bearing a pair of palpi, the *palpi-labiales*. In *Dytiscus marginalis*, a common water-beetle, the palpiger is of a square form, or nearly so. The broad piece furnished with bristly hairs along its anterior extremity is the *lingua*. On each side of this piece there is a small plate (apparently divided), which has its posterior margin recurved, so as to lie close to the underside of the lingua, and furnished with a fringe of hairs. These small pieces we conceive to be the analogue of the parts called by Kirby *paraglossæ*, and which are distinct in the bees, wasps, &c. They also appear to represent the two leaf-like appendages at the apex of the palpiger in Cerambyx, the lingua here being nearly obliterated, and consisting only of an extremely minute divided process furnished with hairs.

The palpiger is not very distinct in the Hymenoptera; its appendages however are often greatly developed. In the hornet the lingua is very large, broad, and divided at the extremity; the paraglossæ are also large. The labial palpi are long, and composed of four joints. The lingua in many bees is of great length, and the paraglossæ are often long. The labial-palpi in the typical bees are flattened, and have the basal joint long.

Orthopterous insects have a well-developed palpiger: the lingua, paraglossæ, and palpi are distinct.

Mentum, or chin, by which we mean the part so called by Macleay, Westwood, and indeed most modern authors, but which is the *Labium* of Kirby and Newman.† The *Mentum* is the piece below the palpiger, and generally articulated to the stipes by a membranous hinge. This part is very variable in shape, and is consequently often referred to in descriptions of insects, or rather in definitions of the genera. It is generally distinct in Mandibulate insects.

In *Dytiscus marginalis* it is of a transverse form, and emarginated on the fore part. In the hornet, as well as in the bees, the mentum is long, and nearly cylindrical.

Stipes. This name is applied by MacLeay to that piece which is below the mentum. It is the *Mentum* of Kirby, the '*pièce prebasilaire*' of Straus-Durckheim, and the *Insertio* of Mr. Newman.

The stipes is generally soldered to the jugulum, so that its boundaries cannot be detected. Such is the case in the water-beetle, the head of which is selected to illustrate this

* See 'Entomological Magazine,' vol. ii., p. 71.

† Were we to follow most authors in applying the name labium to any *particular part* of the labial apparatus, we should certainly follow Messrs. Kirby and Newman in using it for the part above called mentum.

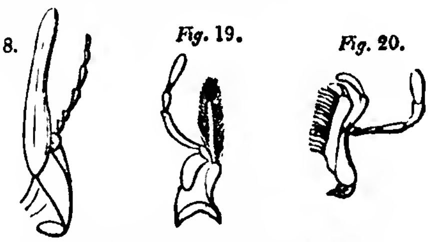
article. Its lower boundary is indicated in the figure by a dotted line. In the common cockchafer (*Melolontha vulgaris*) however it forms a well-defined piece. In *Amphimalla solstitialis* (*fig.* 7), an allied insect, it is also distinct. In the Hymenoptera the stipes is small, and generally of a triangular shape.

The Mandibles (*Mandibulæ*) come next under consideration. These, the representatives of jaws, are situated immediately below the labrum. They are two in number, and have a vertical motion.

In the *Mandibulata* the mandibles are almost invariably of a hard horny nature, often of a triangular form, or nearly so, and furnished with pointed processes (which have been compared to teeth) on their inner side.

In Carnivorous insects the mandibles are usually of moderate length, sharply pointed, and armed internally with acute processes. Wood-boring insects, such as the Cerambycidæ, have short stout mandibles, and in those insects which feed upon vegetable substances (the *Phyllophagi*, &c.) the mandibles often present a broad grinding surface on their inner side near the base.

Fig. 18. *Fig.* 19. *Fig.* 20.



Figs. 18, 19, and 20, *Maxillæ* of various insects.

The *Maxillæ*, or feeler-jaws, like the mandibles, under which they are placed, are opposed to each other horizontally. They are joined at their base to the labium, and distinguished by their giving attachment to the maxillary *palpi*, on which account Mr. Newman has applied to them the name of '*Feeler-jaws*.' The maxillæ are variable in form, and hence the characters of genera and larger groups are not unfrequently derived from them. A perfect maxilla presents five distinct portions: the *Cardo*, *Stipes*, *Palpifer*, *Lacinia*, *Galea*, and *Palpi-maxillares*.

Cardo (the hinge) is a small piece, often of a triangular form, upon which the maxilla sits. It is the insertio of Newman.*

Stipes (the stalk). Kirby applies this name to the 'corneous base of the maxilla, below the palpus,' and in his detailed account of this part refers both to the palpifer and another portion which is generally situated within the palpifer. We shall confine the name stipes to that part of the maxilla which is joined to the cardo, and is either within or below the palpifer. It is the maxilla, or disc, of Mr. Newman.†

Palpifer. This part, to the summit of which the maxillary palpi are always attached, is usually a narrow piece running parallel with and joined to the outer side of the maxilla at the base.

Lacinia (the blade). This is the chief part of the maxilla. It is situated above the stipes, is usually of an elongated pointed form, and furnished with bristly hairs along its inner margin, and generally has one or more pointed claws at the extremity—these claws are called the *Ungues*. The name lacinia is applied to this part by Mr. MacLeay, and according to Kirby it is the *Lobus Inferior*.

Galea (the helmet), or the *Lobus superior* of Kirby, is a lobe which is attached to the palpifer, and lies between the galea and the maxillary-palpi. It is jointed in the predaceous beetles, and resembles a palpus.

Palpi-Maxillares (the maxillary-palpi), joined organs, two in number, one to each maxilla, situated on the outer side of the maxillæ and springing from the palpifer.

In the order Diptera the maxillæ are long, slender, and pointed. In the Hemiptera they are still more slender, resembling bristles. The long slender proboscis of the Lepidoptera consists of the maxillæ. In the order Hyme-

* Mr. Newman has applied a new name to this part without sufficient reason, since it is well defined by Kirby. The name insertio is also objectionable, since it might create confusion, the same name having been also applied by Mr. Newman to a part of the labium.

† By the same rule that we do not apply the name labium both to the whole labial apparatus and at the same time to a part, we reject the name maxilla as applied to a *part* of the maxillary apparatus.

noptera the maxillæ are usually large, and when closed form a sheath which covers the various parts of the labium.

The oval apparatus, or trophi, of the various Haustellate orders of insects have each received names from Mr. Kirby. In the order Hemiptera the oval instrument is termed the *Promuscis*. The same part is termed the *Proboscis* in the Diptera, *Antlia* in the Lepidoptera, and *Rostulum* in the Aphaniptera. The several parts representing the *Mandibles*, *Maxillæ*, *Labium*, &c. have also received additional names in each of these orders, but we have already sufficient.

The term *Thorax* is applied to all that part of an insect which lies between the head and the abdomen, and to which the legs and wings are attached.

Fig. 21.

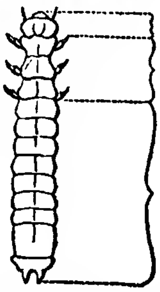


Fig. 21, Larva, showing the three segments of the thorax and the nine segments of the abdomen: a, the thorax; *b*, the abdomen.

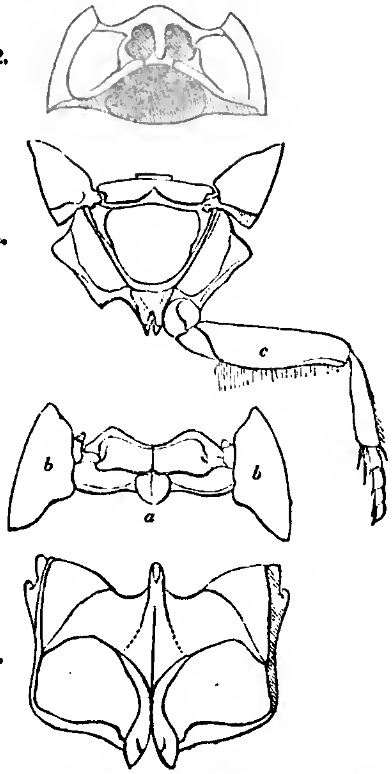
We have before said that the thorax is composed of three segments; these are generally distinct in those larvæ which do not resemble the perfect insect and which possess legs—such as the larvæ of the Lepidoptera, Coleoptera, and certain Hymenoptera (the *Tenthredinidæ*): here each of the segments in question possesses a pair of legs.

Fig. 22.

Fig. 24.

Fig. 23

Fig. 25.



Parts of thorax of a Water-beetle (*Dytiscus marginalis*). *Fig.* 22, the under-side of the *Prothorax*, called *Prosternum*. *Fig.* 23, the upper-side of the *Mesothorax*, called *Mesonotum*: *a*, the *scutellum*; *b.b*, basal portions of the elytra. *Fig.* 24, posterior view of the same: c, one of the middle pair of legs. *Fig.* 25, under-side of the *Metathorax*, called *Metasternum*.

The term *Prothorax* is applied to the foremost of the thoracic segments, *Mesothorax* to the next, and *Metathorax* to the hinder one, or that which joins the abdomen. In the perfect insect we find the three simple thoracic-rings of the larvæ replaced by the same number of segments, but each divided into several distinct parts; these three segments however are never uniformly developed, but generally two of them are more or less perfected and exert an inverse influence on the third, and sometimes one of the segments is greatly developed at the expense of the remaining portions.

The *Prothorax* bears the anterior pair of legs and is articulated to the head. It is large in the Coleoptera, and is the part called thorax in descriptions of insects of this tribe; it is likewise well developed in the Orthoptera and Hemiptera. In the Lepidoptera it forms a narrow ring, which is easily distinguished by the scales with which it is covered being erect, those on the next segment being adpressed. In the Hymenoptera the prothorax sometimes forms a distinct neck, but generally it is a narrow plate and extends back on each side to the base of the anterior wings.

The upper surface of this segment in termed by Burmeister the *Pronotum*, and by Audouin and MacLeay the Tergum of the Prothorax. The latter authors state that the tergum, when perfect, is composed of four parts, to which M. Audouin gives the names *Præscutum*, *Scutum*, *Scutellum*, and *Postscutellum*, so named according to their succession, commencing at that nearest the head of the insect. These parts however are seldom to be seen, unless it be in certain Orthopterous insects.

The underside of the Prothorax is called by Burmeister and Kirby the *Prosternum*, and by Audouin the Pectus of the Prothorax. To the Prosternum the legs are attached, and hence this part is always tolerably well developed.

Besides the above parts there is an internal piece called the *Antefurca*.

The *Mesothorax*, or middle segment of the thorax, is more complicated than the Prothorax, owing to its giving attachment to the anterior pair of wings in addition to a pair of legs. The mesothorax is well developed in nearly all insects, and in the order Diptera attains its largest size, and indeed forms the principal part of the thorax. Its upper surface is termed by Burmeister the *Mesonotum* (*Tergum* of Audouin), and the under part the *Mesosternum* (*Pectus*, Audouin).

Fig. 26.

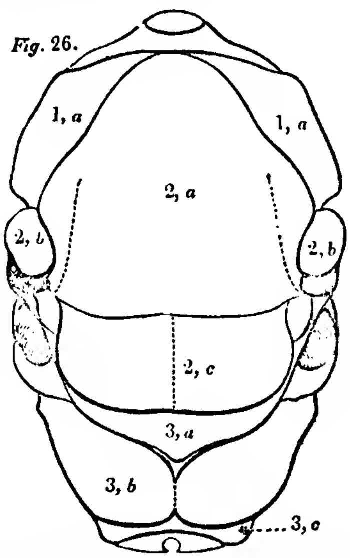


Fig. 26, Upper view of thorax of Vespa Crabro. 1, *Prothorax*; 2, *Mesothorax*; 3, *Metathorax*. 1, *a*, *scutellum*; 2, *a*, *scutum*; 2, *b*, *squamula*; 2, *c*, *scutellum*; 3, *a*, *præscutum*; 3, *b*, scutellum; 3, *c*, *postscutellum*.

Fig. 27.

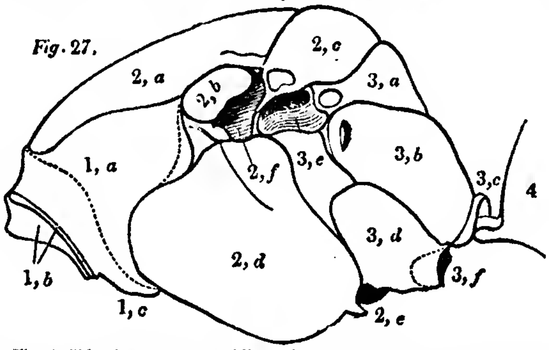


Fig. 27, Side view of thorax of Vespa Crabro. The figures and letters refer to the same parts as in *fig.* 26, to which may be added 1, *b*, *præscutum* and *scutum*; 1, *c*, situation of the anterior pair of legs; 2, *d*, *sternum*; 2, *e*, situation of the middle pair of legs; 2, *f*, situation of the anterior pair of wings; 3, *d*, *metasternum*; 3, *e*, situation of the posterior pair of wings; 3, *f*, insertion of posterior pair of legs; 4, *abdomen*.

At its maximum of development it consists of four pieces above and eight below, to which Audouin applies the names *Præscutum, Scutum, Scutellum,* and *Postscutellum,* to the upper pieces, or *Tergum;* and *Paraptera, Sternum, Episterna, Epimera,* and *Medifurca,* to the *Mesosternum.*

The *Metathorax,* as it bears the posterior wings, is well developed in those insects which possess them, but where they are wanting, as in the order Diptera, it is of small size. Its upper surface is called *Metanotum,* and the under surface *Metasternum.* When perfect it contains the same number of parts as the Mesothorax. To this segment are attached the posterior pair of legs.

The various parts of the thorax will perhaps be better understood by their being placed in a tabular form, thus:—

Thorax.	Prothorax.	Tergum, or Pronotum.	Præscutum. Scutum. Scutellum. Postscutellum.
		Pectus, or Prosternum.	Sternum. Episterna. Epimera.
		Furca, called Antefurca.	
	Mesothorax.	Tergum, or Mesonotum.	Præscutum. Scutum. Scutellum. Postscutellum.
		Pectus, or Mesosternum.	Paraptera. Sternum. Episterna. Epimera.
		Furca, called Medifurca.	
	Metathorax.	Tergum, or Metanotum.	Præscutum. Scutum. Scutellum. Postscutellum.
		Pectus, or Metasternum.	Paraptera. Sternum. Episterna. Epimera.
		Furca, called Postfurca.	

From the thorax we are naturally led to the wings and legs of insects.

The greater portion of the insect tribe possess four wings, some however only possess two, and others are quite destitute. These organs consist of two membranes * applied closely together, and enclosing numerous nervures or hollow tubes which contain tracheæ.

The various descriptions of wings may be described under the following heads:—*Elytra, Tegmina, Hemelytra,* and *Halteres.* The term Elytra is applied to the anterior wings, 'When they are without nervures and uniformly of a thicker and harder substance than membrane.' They are peculiar to the Coleoptera. [Coleoptera.]

Tegmina is the name applied to the upper organs of flight when of a uniform coriaceous texture, and furnished with nervures as in the *Orthoptera.* [Orthoptera.]

Hemelytra, the upper organs of flight when they are coriaceous at the base and membranous at the apex, as in the *Hemiptera.* [Hemiptera.]

The *Halteres* are two minute organs situated behind the wings of Dipterous insects, and supposed to represent the posterior wings; they consist of a slender stalk with a round or oval knob at the extremity. [Diptera.]

The legs in true insects are invariably six in number, but in certain butterflies the anterior pair are minute. Each leg consists of a *Coxa, Trochanter, Femur, Tibia,* and *Tarsus,* all of which parts are figured and described in the article Coleoptera.

The *Abdomen.*—Although the nine segments which compose the abdomen are generally distinct in larvæ, we seldom find more than seven or eight visible joints in the perfect insect, the remaining one or two being generally hidden, and in fact converted into parts of the organs of generation. The number of segments to the abdomen sometimes differs in the males and females of the same insect, as in the Aculeate Hymenoptera. As these segments in the perfect insect bear no organs of locomotion, they are of a more simple structure than those of the thorax, consisting chiefly of an upper plate called the *dorsum,* and an under plate called the *venter.*

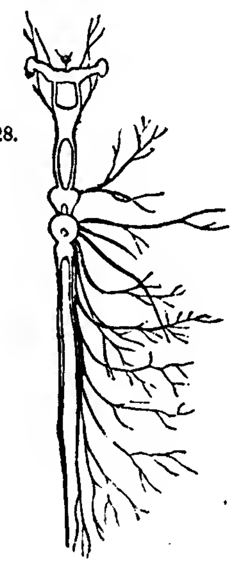
The substance of the abdominal segments is almost invariably less hard and more flexible than that of the head and thorax.

In the *Coleoptera* and *Hemiptera* where the upper parts are protected by Elytra or *Hemelytra,* they are softer than on the under surface which is exposed. In certain species however where the elytra do not cover the abdomen they are of the same substance throughout, as for instance, in the Staphylinidæ and several minor groups of Coleopterous insects. The articulation of the abdomen to the thorax offers some curious modifications, some of which are constant throughout whole groups, and hence afford distinguishing characters. When the abdomen is closely applied to the thorax it is termed *sessile;* and when the first segment, or more, is narrow and elongated, and forms a kind of stalk, it is termed *petiolate.*

The abdomen is often furnished with appendages at its extremity; thus in the earwig (in which Mr. Westwood discovered one more than the usual number of segments*) there is a pair of forceps which serve as weapons of defence, and in the male sex of *Panorpa,* where the apex of the abdomen is considerably elongated, there is also a pair of forceps. In the Dragon-flies there are small flattened appendages, and likewise in the Staphylinidæ, which are called *stylets.* Indeed the various kinds of appendages are too numerous to be here described, but are noticed in the accounts of the various groups of insects contained in this work. The modifications of the ovipositor are likewise noticed where they occur in the different groups. When it is of a long and compressed form, it is termed *ensate;* and when it consists of several tubes retractile within each other, like the pieces of a telescope, it is called *telescopiform.* The term *aculeiform* is applied to this organ in the Hymenopterous insects.

We now come to the internal anatomy of insects.

Fig. 28.



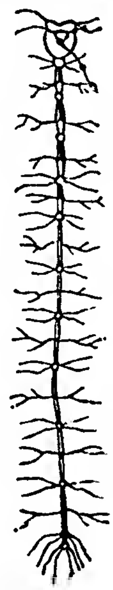


Fig. 29.]

Fig. 28, Nervous System of the Common Cockchafer (*Melolontha vulgaris*). *Fig.* 29, nervous system of a Caterpillar, or Larva.

First in importance is the *nervous system.* The *nervous system* in insects consists of a double nervous chord, which is situated in the ventral portion of the body (being the reverse in this respect to the vertebrate animals). This double chord is joined at intervals by ganglia, which in larvæ correspond in number to the joints of the body, *i.e.* thirteen. As the larva is about to assume the pupa state, the abdominal ganglia gradually approach the thorax, and consequently are nearer to each other, a circumstance owing to the longitudinal contraction of the segments at this time, at least such is the case in Lepidopterous larvæ. In the pupa state the ganglia are still more approximated, and the nervous chords are curved and distorted: the same number of ganglia however are generally to be found; but in the imago state of Coleopterous insects several of the ganglia have become confluent, so that the

* Immediately after it has left the pupa case the two membranes of the wings are distinct.

* See 'Transactions of the Entomological Society,' vol. i., p. 157.

number is considerably reduced. In the common cockchafer (*Melolontha vulgaris**), which may be taken as an illustration of the general character of the nervous system in insects, there is one large transverse ganglion in the head, consisting of two chief portions joined laterally, and which are expanded on their outer side to form the optic lobe. From this large transverse ganglion the two nervous chords extend downwards and backwards, and form a ring which encircles the œsophagus, beneath which they are united by the second ganglion. These two ganglia together send off the nerves which supply the various parts of the head and its appendages, the trophi, antennæ, &c. From the lower part of the second ganglion the nervous chords are continued to the thorax, where we find three large ganglionic masses, from which all the nerves which supply the thorax and abdomen have their origin.

For a detailed account of the nervous system the student must refer to the works of Lyonnet, Straus-Durckheim, L. Dufour, Burmeister, M. Herold, in the common white butterfly (*Pontia brassica*), and Newport, 'On the Anatomy of Sphinx ligustris.'

The *muscular system.* To enter into a detailed account of the muscles of insects would of itself require a long article; we will only observe at present, that the muscles in these animals, as in the higher orders, consist of a contractile portion and tendon.

The *digestive system* of insects is well developed, and consists of an intestinal canal, in which a crop, gizzard, stomach, and small intestine are generally distinct; but, as in the higher orders of animals, these parts vary according to the nature of the food.

Fig. 30.

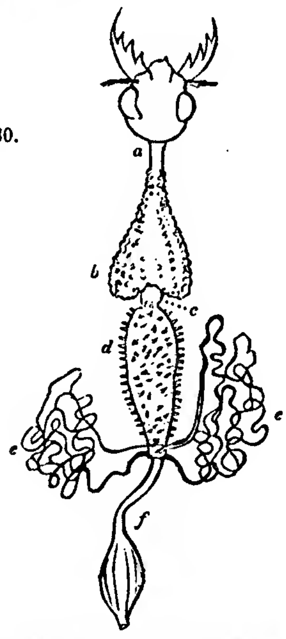


Fig. 30. Intestinal canal of Cicindela campestris. *a*, the œsophagus; *b*, the crop; *c*, the gizzard; *d*, stomach; *e*, *e*, the hepatic vessels; *f*, the small intestine.

In a predaceous beetle (*Cicindela*) the intestinal canal passes nearly straight through the body, the œsophagus dilates into a wide crop, which is succeeded by a minute gizzard, and then by the stomach, which, as well as the crop, is covered by numerous minute follicles; at the pyloric extremity of the stomach the biliary ducts pour their secretion into the cavity through four orifices, which are situated two on each side. The small intestine is short, and opens into a wide colon which terminates the canal.

In a vegetable-feeding insect the stomach is very voluminous and much convoluted, and the biliary ducts are proportionately long. In the common cockchafer these ducts have the secreting surface increased by innumerable minute secæ.

The salivary glands are distinct in many insects.

* A most splendid work, in which the anatomy of this insect is chosen for illustration, is published by Straus-Durckheim, and entitled 'Considérations Générales sur l'Anatomie Comparée des Animaux Articulés,' a work which almost equals in elaborate detail the wonderful production of Lyonnet, 'On the Anatomy of the Larva of Cossus.'

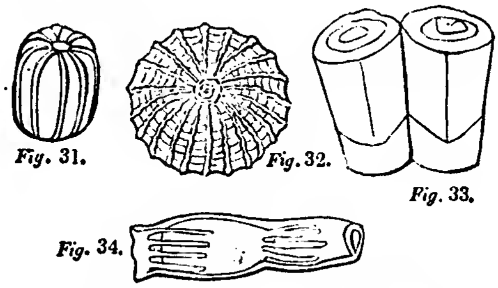
The next subject connected with the definition of an insect is the transformations which it undergoes before arriving at maturity.

All insects are true oviparous animals, with the exception of a few instances where the egg is hatched in the body of the parent, and again where they are born in the pupa state, both of which cases occur in certain species of the order Diptera.

From the egg the larva is hatched; this of necessity casts its skin several times during its progress to maturity, since this part never grows. See article BOMBYCIDÆ, where an account of the transformation of the silkworm is given.

When full grown the larva casts its skin for the last time, and in so doing comes forth in the pupa state; and after a time the skin of the pupa is burst by the animal within, which is now in what is termed the imago or perfect state.

The eggs of insects are extremely variable in shape: the more common form is oval; they are however often round, sometimes cylindrical. Those of the common white butterfly are conical. In many moths they are lenticular. The eggs of Hemerobius and several other insects are placed upon footstalks.



Figs. 31, 32, 33, and 34. Eggs of various insects.

The surface of eggs is generally smooth or nearly so, but it not unfrequently happens that they are uneven, and display a great variety of sculpture.

White, yellow, and green are the predominant colours of the eggs of insects: they are deposited in various situations, but always where the young larvæ may find appropriate food when hatched. Thus we often find them attached to the leaves or stems of plants. The Ichneumonidæ deposit their eggs in or on the bodies of caterpillars, and their larvæ when hatched feed upon these animals.

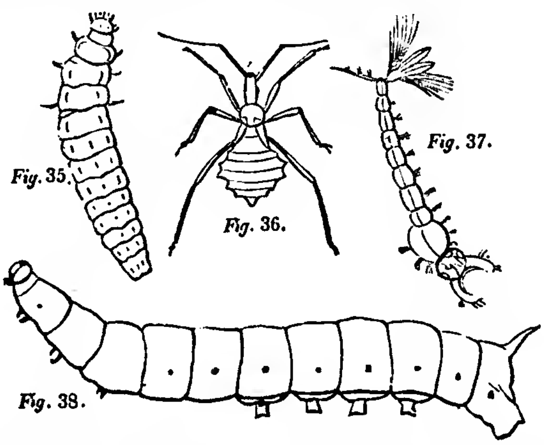


Fig. 35, a Coleopterous Larva (*Telephorus*). *Fig.* 36, Larva of an Hemipterous Insect (*Zelus*). *Fig.* 37, Larva of a Dipterous Insect (*Culex*). *Fig.* 38, Larva of a Lepidopterous Insect (*Sphinx*).

The principal variations in the larvæ of insects have been arranged in the following tabular form by Messrs. Kirby and Spence.*

I. Larvæ without legs.
  i. With a corneous head of determinate shape.
    Coleopterous and Hymenopterous *Apods*—*Culicidæ*. Some *Tipulariæ*, &c., among the *Diptera*.
  ii. With a membranous head of indeterminate shape (*Muscidæ*, *Syrphidæ*, and other Diptera.)

* See, 'Introduction to Entomology,' vol. iii, p. 144.

II. Larvæ with legs.
  i. With legs only and without an anal proleg. (Neuroptera and many *Coleoptera.*)
    1. Joints short and conical. (*Elater, Cerambycidæ.*)
    2. Joints long and subfiliform (*Staphylinus, Coccinella, Cicindela,* &c.)
  ii. Prolegs only (many *Tepulariæ,* and some subcutaneous Lepidopterous larvæ, &c.)
  iii. Both legs and prolegs (*Lepidoptera, Serrifera,* and some *Coleoptera.*
    1. Without claws (*Serrifera,* &c.)
    2. With claws (*Lepidoptera,* &c.)

In the *Pupa* state insects exhibit two principal modifications: those which in general form resemble their larvæ, and those which are wholly unlike their larvæ.

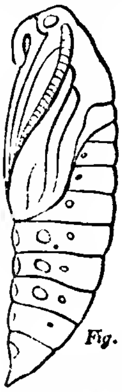


Fig. 39.

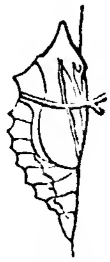


Fig. 40

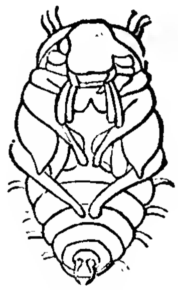


Fig. 41.

Fig. 39. Pupa of a Lepidopterous Insect (Sphinx). *Fig.* 40. Pupa of a Butterfly. *Fig.* 41, Pupa of a Beetle.

The former of these divisions Burmeister subdivides into *Incomplete Pupæ* and *sub-incomplete.* Incomplete Pupæ are those without alary appendages. To these belong the Lice (Pediculus and Cimex lectularius). Sub-incomplete Pupæ are those which possess rudiments of wings. These comprise all the pupæ of the winged genera of the orders *Hemiptera* and *Orthoptera.*

In the second division, comprising those insects in which there is a complete metamorphosis, the pupa, with very few exceptions, is inactive, and does not take the least nourishment. They are divided into *Pupa Coarctata,* or those which are covered with a case in which no traces of the future insect can be perceived, as in Musca and many other Dipterous insects.

Pupa obtecta, where the thorax and abdomen are distinct and enclosed in a horny case, as in the Lepidoptera; and

Pupa incompleta, where the parts are covered by a membrane, but distinct as in the order *Hymenoptera* and some Dipterous insects.

Classification of Insects.—As the various orders of insects are noticed under their respective headings, at present we will confine ourselves to the arrangement of these orders.

The orders of insects have been so variously arranged by different authors, that to give an outline of the views even of the more celebrated would occupy much space; we will therefore select the systems of three authors:—Firstly, that of *Linnæus,* whose subdivisions are founded upon the substance and position of the wings; next, that of *Fabricius,* where the parts of the mouth have been selected in the division of this class into orders; and lastly, that of *Burmeister,* where no particular part or character has been chosen, but where the orders are established upon an aggregate of characters.

The orders of insects are thus characterized by Linnæus:—

Superior wings crustaceous, with a straight suture . .	Coleoptera.
„ „ semicrustaceous, incumbent	Hemiptera.
All the wings with scales	Lepidoptera.
„ „ membranous, tail unarmed	Neuroptera.
„ „ membranous, tail aculeato	Hymenoptera.
Two poisers in the place of the posterior pair of wings . .	Diptera.
Without either wings or Elytra . .	Aptera.

Insects are divided by Fabricius into—

I.—*Insects with Biting Mouths.*

1. Eleutherata.—Maxilla free, uncovered, and palpigerous. (*Coleoptera.*)
2. Ulonata.—Maxilla covered by an obtuse galea or lobe. (*Orthoptera.*)
3. Synistata.—Maxilla geniculate at the base, and connate with the labium. (*Neuroptera,* &c.)
4. Piezata.—Maxilla corneous, compressed, often elongate. (*Hymenoptera.*)
5. Odonata.—Maxilla corneous, toothed, two palpi (*Libellulæ.*)
6. Mitosata.—Maxilla corneous, vaulted, not palpigerous. (*Myriopoda.*)
7. Unogata.—Maxillæ resembling scissors. (*Arachnida,* part.)
8. Polygonata.—Palpi mostly six; many maxillæ within the labium. (*Isopoda.*)
9. Kleistognatha.—Many maxillæ *without* the labium, closing the mouth. (*Brachyurous Decapod Crustacea.*)
10. Exochnata.—Maxillæ many *without* the labium, covered by palpi. (*Macrurous Decapod Crustacea.*)

II.—*Insects with Suctorial Mouths.*

11. Glossata.—Mouth with a spiral tongue between reflexed palpi. (*Lepidoptera.*)
12. Ryngota.—Mouth with a rostrum having a jointed sheath. (*Hemiptera,* Latr.)
13. Antliata.—Mouth with a haustellum without joints. (*Diptera, Anoplura,* and *Trachean Arachnida,* Latr.)

Burmeister's System.

I.—*Insecta Ametabola.*

The larva resembles the perfect insect, yet it wants wings, if the perfect insect be winged; the pupa *in this* case have their rudiments. It runs about and eats.

  a. With sucking mouths, which consist of four fine setæ lying in a sheath; palpi are wanting; four biliary vessels, and generally a free prothorax.

Order 1.—*Hemiptera.*

  b. With mandibulate mouths; mandibles and maxillæ distinct, the latter having palpi, and generally distinct large superior lip.

  α. Four unequal wings; the anterior pair leathery, or like parchment, the posterior pair folded longitudinally, and also once transversely; prothorax always free; many biliary vessels.

Order 2.—*Orthoptera.*

  β. Four generally equal and rarely unequal wings, never folded; or sometimes none at all. In the first case the nervures are usually reticulated, and there are generally many biliary vessels; in the latter case there are four biliary vessels attached to the intestine; prothorax sometimes free, sometimes not.

Order 3.—*Dictyoptera.*

II.—*Insecta Metabola.*

The larva consists of thirteen segments, either with or without legs; the pupa is inactive, or if it moves, it takes no food.

  a. Four equally large or equally long wings with reticulated nervures; mandibulate mouths; few biliary vessels, rarely more than eight; prothorax always free.

Order 4.—*Neuroptera.*

  b. Wings always unequal, the posterior pair sometimes wanting, rarely all.

  a. Mouths adapted to sucking.

    a a. Instead of posterior wings there are pediculated knobs; yet the wings are sometimes wholly wanting; four biliary vessels; larva without feet; a soft proboscis with several setæ and a pair of palpi; prothorax not free.

Order 5.—*Diptera.*

    b b. Four wings generally covered with scales; six biliary vessels; larvæ with feet and a distinct head; maxillæ forming a spiral tongue; prothorax not free but small, and closely connected with the mesothorax.

Order 6.—*Lepidoptera.*

β. Mouths with distinct biting mandibles.

a a. Four naked wings traversed by ramose nervures; larvæ generally without head and feet, but sometimes with both; many biliary vessels; prothorax not free.

Order 7.—*Hymenoptera.*

b b. Anterior wings in the form of horny elytra; larva with head, with or without feet; four or six biliary vessels; prothorax always free.

Order 8.—*Coleoptera.*

The first and second of the above classifications are by no means natural, nor were they intended so to be by their respective authors. The former was established when entomology was, comparatively speaking, in its infancy; and although Fabricius possessed a more intimate acquaintance with insects, yet he contended that an artificial classification should be adopted till further discoveries had cleared the way for their satisfactory development.

We cannot feel surprised therefore that these systems should have been superseded by others more modern.

The system of Burmeister is founded upon philosophical principles; we are not however prepared to agree with him in all instances. We allude more particularly to his order *Dictyoptera*, the species of which ought, we think, to be incorporated with the Orthoptora.

The mutual affinities and likewise the grade of perfection of the various orders, it appears to us, may be best expressed by arranging them in the following succession:—

1. Hymenoptera.	5. Hemiptera.
2. Coleoptera.	6. Homoptera.*
3. Orthoptera.	7. Lepidoptera.
4. Neuroptera.	8. Diptera.

Geographical Distribution of Insects.

Guided by animal forms, the globe may be divided into five portions: 1st, all that part north of lat. 30°; 2ndly, Africa and Arabia; 3rdly, India, including Java, Sumatra, and Borneo; 4thly, South America;† and 5thly, Australia, including New Guinea.‡

In each of those divisions of the globe there is a certain series of forms which predominate, and they are of so marked a character that an experienced entomologist, upon seeing a small *collection* from any one, would at once be able to state from which they originated, although he might be unacquainted with any *one* of the species it contained.

It must not be imagined however that each of these divisions contains forms peculiar to itself only, for there are many which occur in every country, although the *species* from any of the above-mentioned five divisions are almost always distinct. The following may be stated as general rules:—Great elevations have an influence on the forms. Insects, for instance, collected in a tropical country, but at a great elevation, do not resemble those of the plains below, but are of forms common in the first division. Water insects are not affected by climate to the same extent as those which are not aquatic in their habits. As yet there are very few water insects from distant countries which may not be referred to European forms.§ Among the very minute insects from various parts of the world, extra-European forms are proportionately more rare than among the larger species.

INSECTI'VORA. [Vol. vi., p. 306.]

INSESSO'RES, the name given by Mr. Vigors to the *Perchers*, the second order of Birds in his system, and, as the families of which it is composed are very numerous, he classes them in comprehensive sections or tribes, which he thus denominates:—*Fissirostres* (Cuvier), *Dentirostres* (Cuv.), *Conirostres* (Cuv.), *Scansores* (Auct.), *Tenuirostres* (Cuv.).

The Fissirostres, according to Mr. Vigors, include the *Meropidæ*, the *Hirundinidæ*, the *Caprimulgidæ*, the *Todidæ*, and the *Halcyonidæ*.

The Dentirostres include the *Muscicapidæ*, the *Laniadæ*, the *Merulidæ*, the *Sylviadæ*, and the *Pipridæ*.

The Conirostres comprise the *Fringillidæ*, the *Sturnidæ*, the *Corvidæ*, the *Buceridæ*, the *Loxiadæ*.

The Scansores consist of the *Ramphastidæ*, the *Psittacidæ*, the *Picidæ*, the *Certhiadæ*, and the *Cuculidæ*.

The Tenuirostres are composed of the *Nectariniadæ ?*, *Cinnyridæ*, *Trochilidæ*, *Promeropidæ ?*, and *Meliphagidæ ?*.

Mr. Vigors finds the following parallel analogies by which the tribes of the *Insessores* represent the different orders of the class:—

Dentirostres	. . . .	Raptores.
Conirostres	. . . .	Insessores.
Scansores	. . . .	Rasores.
Tenuirostres	. . . .	Grallatores.
Fissirostres	. . . .	Natatores.

Of these, the *Conirostres* are considered by Mr. Vigors the typical group. (See further, *Linn. Trans.* xiv. 425.)

The author of *Horæ Entomologicæ* conceives it to be demonstrated, that so far as relates to the analogies existing in nature between the orders of *Mammalia* and *Aves*, the *Primates* ought to be placed as analogous to the *Insessores*. Both are omnivorous. (See the memoir *On the Comparative Anatomy of certain Birds of Cuba*, by W. S. MacLeay, Esq., M.A., &c., in *Linn. Trans.*, xvi. 47.)

Mr. Swainson, in accordance with his opinion that the primary divisions of every circular group are five apparently, but three actually, gives the following table as illustrating the

Circle of the order Insessores, or *Perchers*.

1 *Typical Circle.*	Bill more or less conic, strong, slightly or not at all notched; mouth without bristles; feet robust, formed both for perching and walking. Omnivorous.		Conirostres.
2 *Subtypical Circle.*	Bill shorter and more compressed, with a distinct tooth-like notch; mouth generally defended by bristles. Insectivorous.		Dentirostres.
3 *Aberrant Circle.*	Bill entire; feet very short, not adapted for walking; position of the toes various.		Curtipedes.
	1. Feet formed for climbing.	*Scansores.*	
	2. Bill long; tongue extensile. Suctorial.	*Tenuirostres.*	
	3. Bill broad at the base. Feed upon the wing.	*Fissirostres.*	

The table of analogies set out by the same author is the same in substance with that of Mr. Vigors, differing only in the order in which the tribes and orders are placed. Mr. Swainson, who excludes *Man* from the Zoological circle, considers the *Insessores* to be analogous to the *Quadrumana.*

The Dentirostres, according to the last named author, include the families *Laniadæ*, *Merulidæ*, *Sylviadæ*, *Ampelidæ*, and *Muscicapidæ*, with their subfamilies.

His families of the Conirostres are *Corvidæ*, *Sturnidæ*, *Fringillidæ*, *Musophagidæ*, and *Buceridæ*, with their subfamilies.

Under the Scansores he comprises the *Rhamphastidæ*, the *Psittacidæ*, the *Picidæ*, the *Certhiadæ*, and the *Cuculidæ*, with their subfamilies.

The Tenuirostres are made to contain the *Meliphagidæ*, the *Cinnyridæ*, the *Trochilidæ*, the *Promeropidæ*, and the *Paradisiadæ*, with their subfamilies;

The Fissirostres, the *Meropidæ*, the *Halcyonidæ*, the *Trogonidæ*, the *Caprimulgidæ*, and the *Hirundinidæ*, with their subfamilies.

INSOLVENCY. [BANKRUPT LAWS OF SCOTLAND.] We reserved to this place a notice of the remedy called the process of *cessio bonorum*, or surrender of goods by an insolvent debtor to his creditors on oath.

This process is mentioned in the earliest records of the Scotch law, under the significant name of the *bare-man process*. It was considered in the local courts, and the benefit of it was allowed, as well by way of defence as by way of suit and action, the debtor swearing that he had not in goods or gear beyond five shillings and a plack, and that of all his gains thenceforth he should assign every third penny towards payment of his debt. (*Quon. Att.*, c. 7; stat. *Will.*,

* This order is considered by many entomologists as merely a portion of the order Hemiptera.

† The most southern parts of South America however contain distinct forms.

‡ These divisions of the globe will apply as well to the geographical distribution of birds and mammalia as to insects.

§ Some of the most conspicuous forms of the Dyticidæ, which are purely tropical, are those which do not live in the water, but on its surface. We allude to the Gyrinidæ.

c. 17.) But on the erection of the court of session in the beginning of the sixteenth century, the process was drawn thither, and remained there, not merely to the exclusion of the local judicatories, but as an *inner-house* process, or one to be determined only by the whole judges. It then also got the name of *cessio bonorum*, and began to be viewed through the medium of the canon and civil laws: the applicant's character was changed; he was no more a *bare man*, or in a condition of mere destitution; he was a *dyvour*, or spendthrift (from the French *devorer*, to squander or consume one's substance); and his state was infamous.

In pursuance of these principles the Court of Session passed an act of sederunt in May, 1606, appointing a pillory to be erected near the market-cross of Edinburgh, with a seat upon it, where all dyvours are once to be exposed on a market-day at noon, with a hat or bonnet of yellow to be worn by them constantly under the pain of three months' imprisonment, if apprehended at any time without the same. This, *the dyvour's habit*, was by the same authority soon afterwards changed, and appointed to be a coat or upper garment, whereof the one half shall be yellow, and the other half brown, with a cap or hood of the same. (*A. S.*, 26 February, 1665; 23 January, 1673.) It was also enacted that the pursuer of every process of *cessio bonorum* specially libel and prove how he became bankrupt (*A. S.*, 1 December, 1685); and shortly afterwards, by *A. S.*, 18 July, 1688, that he produce with his process a certificate under the hand of one of the magistrates of the burgh where he is incarcerate, bearing that *he had been the space of one month in prison*, without which certificate the process would not be sustained.

The consequence of such an oppressive course of legislation may be anticipated. Continuance in gaol was better than delivery on such terms; and accordingly the gaols of the kingdom were in course of time filled with miserable objects. To remedy this evil an act was passed in parliament in 1696, called the *Act of Grace*, which, on the preamble that 'generally the burghs of the kingdom are troubled and overcharged with prisoners thrust into their prisons, who have nothing to maintain themselves, but must of necessity either starve or be a burden on the burgh,' declared it lawful to the magistrates of burghs to liberate indigent debtors, if, after notice to them to that effect, the creditors failed to provide them aliment at the rate mentioned in the statute. But so entirely was the true source of the evil overlooked that in the same year an act was passed in parliament expressly forbidding the lords of session to dispense with the *bankrupt habit* in any case of *cessio bonorum*, unless the bankrupt's failing 'through misfortune' were libelled, sustained, and proved; and so late as the cases of *Drysdale*, 20 February, 1752, and *Dick*, 7 November, 1775, the court refused to dispense with the habit. Sounder and more humane notions began to prevail however, and generally the habit was in later times dispensed with by the court. These notions were unquestionably derived from England; and it is to the House of Lords, in its appellate jurisdiction, and to the British parliament, that the present state of the Scotch insolvent law, its restoration to its antient condition, is to be traced.

By 6 Geo. IV., c. 62, the Act of Grace, 1696, c. 32, was regulated and amended; and by 6 and 7 Will. IV., c. 56, the like was done with the process of *cessio bonorum*. The latter statute also abolished the 'bankrupt habit' entirely, and bestowed on the sheriffs a cumulative jurisdiction in *cessio* with the court of session.

The effect of a decree of *cessio* is not to discharge the debtor, but merely to relieve him from the operation of personal diligence or attachment of his person. It affords no protection against the attachment by his former creditors of any property which he may subsequently acquire by personal industry or otherwise, if the goods already surrendered fall short of extinguishing his debts.

INSOLVENT, a man who cannot pay his debts. [Bankrupt.] In this country statutes have from time to time been passed for the purpose of releasing from prison, and sometimes from their debts, persons whose transactions have not been of such a nature as to subject them to the Bankrupt Laws. These statutes have been passed for a limited time only, and have been continued by subsequent enactments.

The Insolvent Law of England was consolidated by the 7 George IV., c. 57, continued by the 1 William IV., c. 38, and since by annual statutes for one year. It is now somewhat modified by 1 and 2 Victoria, c. 110. The law is administered by commissioners appointed by the crown, in a court called the Insolvent Debtor's Court, and three of the commissioners from time to time make circuits and give their attendance at the assize towns or other places where prisoners may be ordered to appear.

By the 1 & 2 Vict., c. 110, no person shall be arrested upon mesne process in any civil action, except in certain cases specially provided for by the act. [Arrest.]

A person who is in prison charged in execution for any debt or damages, or otherwise committed as mentioned in the act, may within fourteen days after the commencement of the imprisonment petition the court for his discharge in the manner prescribed by the act, and he must in such petition state his willingness that all his real and personal estate and effects shall vest in the provisional assignee of insolvent debtors' estates; and if within twenty-one days after the like time he does not make satisfaction to the creditor at whose suit he is so charged or committed, such creditor (or other person mentioned in the act) may petition the court for an order vesting all the real and personal estate of the prisoner in such provisional assignee. When such petition has been filed, and the court has made the order above referred to, all the prisoner's real and personal estate, and everything which he may in any way acquire before his final discharge, is vested in the provisional assignee by virtue of such order when recorded, except the wearing apparel, tools, &c. of the debtor, not exceeding in the whole 20*l.* in value. The prisoner must also file a schedule of all debts owing by him, and of all his property. The court has power to appoint assignees for the management of the insolvent's estate, and on such assignees' assenting to the appointment, all the estate of the insolvent, which was vested in the provisional assignee, becomes immediately vested in such assignees for the payment of the prisoner's debts. After the court shall have adjudged the discharge of the insolvent, he is not liable to imprisonment for any debt in respect of which the adjudication was made. But any property which he may acquire subsequent to his discharge may be taken in execution, under the provisions of the act, for the payment of his unsatisfied debts; and if the property be of such a nature that it cannot be taken in execution, the court may imprison the insolvent till he conveys such property, as the court may direct, for the general benefit of his creditors. It is unnecessary to specify the various provisions of the insolvent laws. Their general object is to release the debtor from prison, to free his person from liability as to debts contracted previous to his discharge, but to make all his present and future acquired property available for the benefit of his creditors. Where new creditors have a claim on the insolvent's subsequently acquired property, which is of such a nature that it cannot be taken in execution, it may be necessary to apply to a court of equity, which in administering such estate of a deceased insolvent, will pay the creditors subsequent to the insolvency first, and then the creditors prior to the insolvency.

In cases where it is proved that the insolvent has fraudulently made away with his property, or that his debts were fraudulently contracted, the court does not discharge his person immediately, but has power to order him to be imprisoned for a period not exceeding three years from the date of his petition to the court for his discharge.

There is another statute in the English law (32 George II., c. 28), generally called the Lords' Act, from its having originated in the House of Lords, also continued and extended by subsequent enactments, which enable a debtor taken in execution for a debt not exceeding 300*l.* to obtain his discharge upon surrendering all his effects (except apparel, bedding, and tools of trade, not exceeding 10*l.* in the whole) to his creditors.

INSPIRATION. [Revelation.]

INSPIRATION. [Respiration.]

INNSPRUCK (rather INNSBRUCK, 'bridge over the Inn'), the capital of the principality of Tyrol, at the conflux of the Sill with the Inn, over which there are two bridges, is very romantically situated at the broadest part of the beautiful Innthal (Valley of the Inn), which is bounded on the north by a chain of mountains 7000 feet high. It has 10,800 inhabitants, with many considerable manufactures of silks, gloves, calicoes, and glassware, and has a great transit trade. It is the seat of the Austrian government of Tyrol and Voralberg, of the Diet, and of a university which was founded in 1672, afterwards abolished, and revived in 1826. It has 1100 students. The most remarkable edifices are the castle, with its garden and statues, the Franciscan church, containing the celebrated tomb of the emperor Maximilian, and other tombs of many archdukes. The grave of Andreas Hofer, and his statue by Scheller, are in this church. 47° 15′ 30″ N. lat., 11° 23′ 45″ E. long.

INSTINCT is a natural impulse to certain actions which animals perform without deliberation, and without having any end in view, and without knowing why they do it. (Beattie, *Mor. Sci.*, p. 1, c. ii., sec. 8.)

That the spontaneity of instinct operates unconsciously is fully established by observation. A calf butts with its head before its horns are grown; and the hen broods over the eggs of another species, or even simulated eggs, as patiently as over its own. Lastly, children in certain states of the body are observed to devour eagerly chalk and other earths which are the proper remedies for the disease, although they can have no knowledge of their beneficial nature. Generally indeed this involuntary direction of animal activity appears to be determined by certain organic states which give rise to a vague feeling of desire or aversion, whereby different species of animals are impelled to pursue or to avoid particular objects as necessary for carrying out the purposes of their existence.

In the civilized state of man it is extremely difficult to distinguish the effects of habit from the operations of nature, but from observation of the states of childhood and barbarism the ordinary instincts of the human species are apparently few in number. In children the action of sucking is generally considered instinctive, and, in a barbarous state, the first coming together of the sexes. The latter however has been denied by Hartley, as the former has by Priestley, who considers it to be purely mechanical, like the action of breathing, which Reid has incorrectly classed among instinctive actions. Besides these there are certain extraordinary instincts which are evoked by diseases, in consequence, it would seem, of a change in the mixture of the organical elements of the body. It is thus that the instinctive taste for acid drinks in the feverish patient, and the ravening of children for chalk, &c., which has been already noticed, is to be explained.

But it is in the brute creation that we meet with the most numerous examples of this original quality. The wasp, which does not itself feed upon flesh, and which knows not that a larva is to proceed from the egg which it has deposited in the sand, collects a number of green worms, and having rolled them up in a circular form, fixes them in the hole in such a manner that they cannot escape. The number of the worms so deposited is exactly proportioned to the time necessary for the growth and transformation of the wasp-worm into a fly, when it issues from the hole and is capable of procuring its own food. An instance of what we have termed extraordinary instinct is afforded by the nymphæ of the water-moth, commonly called cod-bait, which cover themselves by means of gluten with pieces of wood, straw, small shells, or gravel. It is necessary that they should always be nearly in equilibrium with the water in which they live. To accomplish this, when their covering is too heavy they add a piece of wood; when too light, a bit of gravel.

Mr. Smellie, from whose work on the 'Philosophy of Natural History' our examples have been drawn, distinguishes two classes of instincts: those which, independent of all instruction or experience, instantaneously produce certain actions when particular objects are presented, or under the influence of peculiar feelings; and those which can accommodate themselves to peculiar circumstances and situations. Of the latter he gives as an instance the adaptive instinct of the ostrich, which, in Senegal, neglects her eggs during the day, but sits upon them in the night; whereas at the Cape of Good Hope, where the heat is less, the ostrich, like other birds, sits upon her eggs both day and night. The distinction however seems unnecessary. By the uniformity of instinctive operations nothing more is meant than that the actions of all the individuals of the species are similar when the circumstances are the same. Under different circumstances the same species may act differently, but the correspondence of individual operations will still continue.

While some writers have gone the length of reducing all the faculties of the human mind to certain instinctive principles of action, others have elevated the animal instincts to a level with rational deliberation. Instinct however differs from intellect by the unerring certainty of the means it employs, the uniformity of its results, and the perfection of its works prior to and independent of all instruction or experience; and lastly, by the pursuit of nothing beyond what conduces directly either to the continuation of the individual or the propagation of the kind. But the arts of rational creatures proceed slowly through diversified and oft-repeated experiments, while the means they employ are always various, and seldom the best and most appropriate; and in their works, though falling far short of perfection in many respects, the difficulty is increased by a voluntary combination of the beautiful with the merely useful.

INSTITU'T NATIONA'L. The various academies of learning in France having been dispersed during the first storms of the Revolution, a decree of the Republic, dated 3rd Brumaire of the year IV., established a national academy, called the Institut, consisting of three classes, namely, 1, physical and mathematical sciences; 2, moral and political sciences; 3, literature and the fine arts. The object was to promote the progress of learning, to publish memoirs, to make the nation acquainted with the new discoveries, and to correspond with the learned of other countries. Each class consisted of a certain number of members residing at Paris, and a number of associates in different parts of France, with a small number of foreign honorary members. (*Compte rendu et presenté au Corps Législatif le 1er jour complémentaire de l'an IV., par l'Institut National des Sciences et Arts*, 8vo., Paris, an V. (1797). Bonaparte, after he was made first consul, gave a new organization to the National Institute, by a decree dated St. Cloud, January, 1803, and made it consist of four classes: 1, physical and mathematical sciences, divided into eleven sections, namely, geometry, mechanics, astronomy, geography and navigation, general physics, chemistry, mineralogy, botany, rural economy and the veterinary art, anatomy and zoology, and lastly, medicine and surgery. This class consisted of 62 resident members, who could appoint 100 correspondents, including foreigners; 2nd class, French language and literature, consisting of 40 members, like the old Académie Française; 3rd class, antient history and literature, which corresponded to the old Académie des Inscriptions et Belles Lettres. This class consisted of 40 members and 8 foreign associates, besides 60 correspondents, native and foreign; 4th class, fine arts, divided into five sections, namely, painting, sculpture, architecture, engraving, and music. This class consisted of 28 members and 8 foreign associates, and 36 correspondents, native and foreign. The class of moral and political sciences was suppressed: Bonaparte was never partial to those studies. (Thibaudeau, *Histoire du Consulat*.) The vacancies in the respective classes were filled up by the members of each class, but the choice was subject to the approbation of the first consul. An annual allowance of 1500 francs was fixed for each resident member, and a salary of 6000 francs to each of the five perpetual secretaries, of whom there were two for the first class, and one for each of the other three. Annual prizes were also awarded. Bonaparte was named member for the section of mechanics. When he became emperor the Institut took the name of Imperial.

After the Restoration, Louis XVIII., by an ordonnance, 21st March, 1816, without changing the arrangement of the departments of each class, restored the old names of Académie de Sciences, Académie Française, Académie des Inscriptions et Belles Lettres, and Académie des Beaux Arts, giving to each a more independent organization, but still keeping them united in one academical body called the Institut. Louis Philippe, by a royal ordonnance, October 26, 1832, has added a fifth class, or 'Academy of Moral and Political Sciences,' divided into five sections, and consisting of thirty resident members and five foreign associates, besides about thirty correspondents. (*Almanach Royal et National* for 1837.) These various classes or academies have published many memoirs and reports; those of the Académie des Inscriptions, styled 'Mémoires de l'Institut par la classe d'Histoire et de Littérature ancienne,' 4 vols. 4to., Paris, 1818, contain many valuable papers. See also the annual 'Compte Rendu,' on the state of science in France, and the 'Discours,' or orations pronounced at the reception of every new member.

INSTITUTION. [BENEFICE, p. 219.]

INSTRUMENTS, ASTRONOMICAL, are described under several heads.

For *Meridian* and *Vertical* circles see CIRCLE.

For the *repeating* circle (Borda's and Reichenbach's) see REPEATING CIRCLE.

For the *sextant* and other *reflecting* instruments see SEXTANT. The TRANSIT, EQUATORIAL, ZENITH SECTOR, and COLLIMATOR, are described under their respective titles.

For the apparatus used in measuring small quantities and subdivisions, see MICROMETER; VERNIER.

The machines for *measuring time* are described under CHRONOMETER; HOROLOGY; PENDULUM.

See also GRADUATION; TELESCOPE; OBSERVATORY.

INSTRUMENTS, MUSICAL, are, 1. *Keyed*, as the Organ, Piano-Forte, &c.; 2. *Stringed*, as the Violin, Violoncello, &c.; 3. *Wind*, as the Flute, Horn, &c.; and 4, of *Percussion*, as the Drum, Cymbals, &c. See the various instruments under their respective names.

INSURANCE, FIRE. Associations for securing individuals from the ruinous consequences of accidents beyond their own control now form almost a necessary part of our social institutions. Among such combinations for the security of individuals, companies for assuring the owners of property from loss arising from fire are among those of most obvious utility, and have long been successfully established in this country. It might have been expected that the great advantage to society of individuals providing against their ruin by means of trifling annual contributions would have been felt and acknowledged on the part of the government, so far at least as to prevent the imposing of a tax upon the prudence of the people. Such however is not the fact, and a duty is levied at the rate of 3*s.* per cent. per annum upon the amount of property insured against destruction by fire, which rate is, in most cases, equal to 200 per cent. upon the premium demanded by the insurance offices, and which is found sufficient to cover all losses, as well as to defray the expenses of management, and to afford an adequate return to capitalists who embark their property in the undertaking. How far the imposition of this tax prevents insurances being effected it is not possible to determine. That many persons neglect to insure against the risk of fire from being compelled to pay 4*s.* 6*d.* for each 100*l.* value of their property, who would not neglect such precaution if they could attain security by payment of 1*s.* 6*d.* for a like amount, will be readily acknowledged; and the propriety of repealing this tax has been frequently urged. But this tax produced to the revenue in 1837 the sum of 863,196*l.* 12*s.* 3*d.*, and as the amount is raised without trouble and at little cost, the tax offers to the minister of the day an inducement for its continuance which it will be difficult to overcome. There is besides no individual who can complain of special injury or grievance from the tax, and the insurance offices, by which it is collected and paid over to the government, have a special advantage in its continuance, in respect of the discount or allowance which is made to them on the amount. During a period of distress experienced by the agriculturists, the landowners and farmers of Great Britain, acting through their representatives in parliament, recently obtained an advantage over other classes of the community by the repeal of the duty upon insurance of farm produce.

The value of property insured against fire in Great Britain may be ascertained from the gross amount of the duty collected: such value amounted, in 1837, to 575,464,400*l.*, exclusive of farm produce.

INSURANCE, LIFE. [LIFE INSURANCE.]

INSURANCE, MARINE. [SHIP.]

INTA'GLIO, an Italian word composed of *in* and *tagliare*, to cut. It is a term of art applied to small works of the gem class, in which the design is indented, or engraved, to distinguish them from those in which the subject or device is raised, called Cameos, and under which head will be found a few particulars of the history of gem engraving. The French call such sunken works 'en creux.'

The earliest reference to works in *intaglio* is in the sacred writings, where they are spoken of as being employed for stamps or seals for giving authority to decrees, contracts, and similar purposes. In the Old Testament frequent notices of them occur, as, among others, when Tamar desired a pledge from Judah he gave her his signet (*Genesis*, xxxviii. 18). Another instance is in the description of the sacerdotal breastplate, where we are told the stones that were set in it were to be 'like the engravings of a signet, every one with his name' (*Exod.*, xxxix.); showing by this general reference that such engraving, or working in intaglio, must have been well known at that time.

The Greeks carried this branch of the fine arts to the same perfection which their genius and feeling for the beautiful enabled them to reach in all others to which they devoted their attention; but we do not trace its existence among them to a very remote date. It has been supposed that as Homer does not allude to seals they were not used in his time. It is to be lamented that we have no information respecting the process by which the antient intagliatori (scalptores and cœlatores—though the latter term seems to apply more properly to metal-chasers—as they are called by Pliny and others) executed works which are now justly referred to as the best examples of the art. It has been a question with antiquaries whether the lathe was known; but though it is not described by any antient writer, the works themselves seem to afford evidence of its employment, and Pliny refers to the invention of an instrument which he calls 'tornum' (*Nat. Hist.*, lib. vii.), which may fairly be supposed to mean a turning machine or tool. It is certain they were acquainted with the use of diamond-powder.

The modern practice of cutting stones in *intaglio* is by an apparatus similar in principle to the turning lathe, which gives the cutting tool, placed horizontally, a quick rotatory motion, and the stone on which the design is to be engraved being brought in contact with it, the surface is ground away or indented, till the effect required is produced. Instruments of various sizes are used, which can easily be removed and replaced, and it is usual, during the process of engraving, to supply the points of the tools with diamond-dust mixed with a little sweet oil. As the work proceeds proofs are occasionally taken in wax.

Engraving dies is an important branch of the art of *intaglio*, and requires great care and skill for its perfection. The die is made of finely prepared and tempered steel. When the first intaglio, or original die, is executed, it forms a *matrix* (or mould), into which a conically formed block of softer steel is compressed; the matrix first undergoing a process by which it is hardened. An impression taken in this way is called a *puncheon*. When this is completed (and frequent annealing and re-striking are necessary before it is perfected) the engraver retouches the work, now in relief, and gives it all the delicacy of the original model; the metal is then hardened, and by pressing this puncheon into other steel which is soft (by almost a repetition indeed of the before-mentioned process), it serves for the purpose of making the dies for coining. Owing to the different qualities of steel and the casualties to which dies are liable (in the hardening, in the operation of receiving the impression from the puncheon, and afterwards while being worked in the presses in striking the coins), many are destroyed, but Mr. Wyon, the chief engraver at the Royal Mint, has stated 'that the number of pieces that may be struck by one pair of dies not unfrequently amounts to above three and four hundred thousand;' though, he adds, the average amount is much less.

INTEGER, a whole number, as distinguished from a fraction. The more common name for a multiple of unity is 'whole number,' meaning a number of units without any broken unit or fraction of a unit. But if the student find any difficulty in separating the word 'whole' for this purpose from its common meaning, he may accustom himself to the word integer. We are led to this remark by finding in a work of celebrity an attempt to connect the word 'whole,' as used in 'whole number,' with its general meaning, as when we say the whole is greater than its part, as follows: 'Integers may be considered as numbers which refer to unity, as a whole to a part.'

INTEGRATION, INTEGRAL CALCULUS. The integral calculus is the inverse of the DIFFERENTIAL CALCULUS; that is to say, if, A being given, it be a question of the differential calculus to find B; then, B being given, it is a question of the integral calculus to find A.

The question of finding a differential coefficient requires the attainment of the limit of the ratio of two simultaneously diminishing increments of y and x, y being a function of x: and therefore the fundamental question of the integral calculus is as follows: knowing the limit of the ratio of the increment of y to the increment of x, required the function of x which y is. Or, having given a function of x, required that function of which the given function is the differential coefficient.

But though this view of the fundamental question is sufficient in pure mathematics, it is not calculated to connect the process of integration with those conceptions which the mind employs in application to geometry or mechanics. We are here accustomed to a rough species of integral calculus, with which the preceding seems at first to have no connection. Thus a number of small straight lines joined together appear to compose a curve with sufficient exactness [ARC]: we arrive at the calculation of a body's variable motion by supposing it uniform during small intervals, and accelerated at the end of each interval [ACCELERATION]: and we obtain the area of a curve with any degree of exactness by subdividing it into a large number of small curvilinear areas, for each of which we substitute a rectangle [AREA]. It should seem then that when, making the proper use of the terms [INFINITE], we say that every magnitude is made up of an infinite number of infinitely small parts, we might add that every one of the parts is of a more simple kind than the whole. Thus we appear to have a right to say that a *curve* is made of infinitely small *straight lines;* that *gradual* variable motion is made up of infinitely small separate *impulses;* that the area of a *curve* is made up of infinitely small *rectangles.* A correct understanding of this connexion is the key to that of the integral calculus, and most completely so to that of its ready application.

The student who has read the three articles above cited may now endeavour to connect the results, and others of the same kind, by the following generalization. Let a whole be divided into parts, and let each part be capable of subdivision into two parts, one of which can be simply explained and found, and the other of which would be as difficult to find as the whole itself. Let $A + a$ be the first part, of which A is of the former species, and a of the latter. Let $B + b$, $C + c$, &c. be the other parts, of which B, C, &c. are of the former, and b, c, &c. of the latter species. Then the whole in question is

$$A + B + C + \ldots\ldots + a + b + c + \ldots\ldots;$$

by which nothing is gained as yet, for a, b, c, &c. are of as much difficulty as the whole which is to be found. But suppose that when the number of parts is considerable, a is very small compared with A, even though A should be small; and the same of b compared with B, and c compared with C, &c. Then the whole in question is nearly found by adding A, B, C, &c.: for say that a were less than the thousandth part of A, b less than the thousandth part of B, and so on; then $a + b + c + \ldots\ldots$ is also less than the thousandth part of $A + B + C \ldots\ldots$, or the latter may be taken for the whole with an error of less than one in a thousand. Further, suppose that by taking a number of parts sufficiently great, we can make a, b, c, &c. as small as we please in comparison of A, B, C, &c., then $a + b + c + \ldots$ may be as small a part as we please of $A + B + C +$ &c. Consequently, by continuing this process without limit, the limit of the summation of $A + B + C + \ldots$ is the whole required, without the necessity of paying any attention to the remaining portions.

Now let ϕx be a function of x, of which the differential coefficient $\phi' x$ does not become infinite when x has any value between a and $a + b$. Then [TAYLOR'S THEOREM] it may be shown that, whenever x and $x + h$ lie between those values,

$$\phi(x + h) - \phi x = \phi' x \,.\, h + Ph^2,$$

where P is not such a function of x and h as would hinder Ph and h diminishing without limit together. Let a become $a + b$ by the steps $a + \theta$, $a + 2\theta$, ... $a + n\theta$, $n\theta$ being $= b$. We have then

$$\begin{array}{lcl}
\phi(a+\theta) - \phi a & = & \phi' a \quad \theta + A\theta^2 \\
\phi(a+2\theta) - \phi(a+\theta) & = & \phi'(a+\theta)\, \theta + B\theta^2 \\
\phi(a+3\theta) - \phi(a+2\theta) & = & \phi'(a+2\theta)\, \theta + C\theta^2 \\
\cdots & & \cdots \\
\cdots & & \cdots \\
\phi(a+n\theta) - \phi(a+\overline{n-1}\theta) & = & \phi'(a+\overline{n-1}\,\theta) + Z\theta^2
\end{array}$$

A, B, C, ... Z, being functions of the same species as P. Sum these, remembering that $n\theta = b$, and we find that

$$\phi(a + b) - \phi a$$

is made up of the following series:—

$$\{\phi' a + \phi'(a+\theta) + \phi'(a+2\theta) + \ldots\ldots + \phi'(a+\overline{n-1}\theta)\}\,\theta$$
$$\{A\theta + B\theta + C\theta + \ldots\ldots + Z\theta\}\,\theta$$

If then we diminish θ without limit, or increase without limit the number of steps by which we pass from a to $a + b$, we have before us such a case as has been already described. Let p be the least value of $\phi' x$ corresponding to values of x between a and $a + b$: then the ratio of any term in the first series to the corresponding term in the second cannot exceed that of $p\theta$ to $A\theta^2$, or $B\theta^2$, &c., or the ratio of p to $A\theta$ or $B\theta$, &c. But by diminishing θ without limit, all the preceding ratios are increased without limit; that is, the ratio of the first series to the second series is increased without limit. We have then the following equation:—

$\phi(a + b) - \phi a =$ limit of $\Sigma(\phi' x \,.\, \Delta x)$ beginning at $x = a$ and ending when $x = a + b$: or, if the interval from a to $a + b$ be divided into n parts, each of the value Δx (called θ in the preceding), and if x be made successively equal to a, $a + \Delta x$, ... $a + b - \Delta x$, then the sum of all the values of $\phi' x$, each multiplied by Δx, approaches without limit to $\phi(a + b) - \phi a$, when n is increased, or Δx diminished, without limit. Now the same sort of convention by which [DIFFERENTIAL CALCULUS] the limit of $\frac{\Delta y}{\Delta x}$ is expressed by $\frac{dy}{dx}$ is here extended, and the limit of $\Sigma(\phi' x \,.\, \Delta x)$ is written $\int \phi' x \,.\, dx$. The beginning and final values of x are placed above and below the integral sign $\int$: thus the preceding equation is written

$$\phi(a + b) - \phi a = \int_a^{a+b} \phi' x \, dx.$$

It is common to represent the terminal value of x by x itself, as follows:—

$$\phi x - \phi a = \int_a^x \phi' x \, dx,$$

and when the initial value of x is left indefinite, then a simple constant is written for ϕa, and the symbols of the limits are omitted, as follows:—

$$\phi x = \int \phi' x \, dx + C.$$

Let us now suppose a given function fx, upon which we wish to perform the preceding summation, from $x = a$ to $x = a + b$; namely, making $n\,\Delta x = b$, we desire to find the limit of

$$\{ fa + f(a + \Delta x) + \ldots\ldots + f(a + b - \Delta x) \}\, \Delta x$$

on the supposition that n is increased, or Δx diminished, without limit. This process can be performed immediately, if we can find the function which has fx for its differential coefficient. Let $f_1 x$ have the diff. co. fx; then, by the preceding theorem, the required limit of the summation is

$$f_1(a + b) - f_1 a.$$

For instance, as soon as we know that $\frac{1}{x}$ is the differential coefficient of $\log x$, we know that $\log(a + b) - \log a$ is the limit of the following series,

$$\frac{\Delta x}{a} + \frac{\Delta x}{a + \Delta x} + \frac{\Delta x}{a + 2\Delta x} + \ldots\ldots + \frac{\Delta x}{a + b - \Delta x}$$

the number of terms being n, Δx being the nth part of b, and n being increased without limit.

The process in the article AREA will now easily show that, y being the ordinate of a curve to the abscissa x, the area contained between the ordinates whose abscissæ are a and $a + b$, the part of the abscissa b, and the curve, is $\int y dx$ taken from $x = a$ to $x = a + b$. Thus if the curve be a part of a rectangular hyperbola, whose equation is $xy = c$, or $y = \frac{c}{x}$, the area included between the ordinates, whose abscissæ are 1 and $1 + k$, is $\int \frac{c}{x} dx$ from $x = 1$ to $x = 1 + k$. But $c \log x$ is the function whose differential coefficient is $\frac{c}{x}$; whence it follows that the preceding area is $c \log(1 + k) - c \log 1$ or $c \log(1 + k)$ square units. This is the property of the hyperbola from which the logarithms of Napier were called *hyperbolic.* [LOGARITHMS.]

An integral is said to be definite, when its limits are given: and indefinite when they are not given.

INTEGRATION, FINITE. By this term is meant the summation of any number of terms of a series which follows a regular law; and just as integration was reduced in the last article to the determination of a function from its differential coefficient, so finite integration or summation may be reduced to the determination of a function from its difference. [DIFFERENCE.]

Firstly, let there be a function of x, ϕx, and let x successively become $x + \Delta x$, $x + 2\Delta x$ .... up to $x + (n-1)\Delta x$, so that n different values are given to x. It is required to sum the series

$$\phi x + \phi(x + \Delta x) + \phi(x + 2\Delta x) + \ldots + \phi(x + \overline{n-1}\,\Delta x)$$

Let $x = v\Delta x$, and let $\phi(vx)$ be called ψv. Then the series becomes

$$\psi v + \psi(v+1) + \psi(v+2) + \ldots\ldots + \psi(v+n-1)$$

This sum is a function of n, and such that if n be changed into $n+1$, one more term $\psi(v+n)$ will be added: consequently it must be the function which has $\psi(v+n)$ for its difference. If then we denote the preceding sum by $\Sigma\,\psi(v+n)$, we find

$$\Delta\,(\Sigma\psi\,(v+n)) = \psi\,(v+n)$$

or Δ and Σ express operations which are inverse to one another. Remark that the symbol Σa does not denote the sum of a number of terms up to a inclusive, but up to a exclusive: thus

$$1 + 2 + 3 + \ldots\ldots + (n-1) \text{ is } \Sigma n$$
$$1 + 2 + 3 + \ldots\ldots + (n-1) + n \text{ is } \Sigma\,(n+1)$$

All that precedes has no reference to the term with which we begin: thus $4 + 5 + \ldots. + n$ and $1 + 2 + 3 + 4 + 5 + \ldots.. + n$, are equally denoted by $\Sigma\,(n+1)$. This symbol is therefore indefinite, but it will be found that the process by which it is to be determined gives an indefinite result.

Suppose, for instance, we have ascertained that $\frac{1}{2}(n^2+n)$ is the function whose difference is $(n+1)$, which will be found to be the case; or

$$\tfrac{1}{2}\left\{(n+1)^2 + (n+1)\right\} - \tfrac{1}{2}\left\{n^2+n\right\} = n+1.$$

It is equally true that $\frac{1}{2}(n^2+n) + C$ has $n+1$ for its difference, where C may be anything whatever, provided that it do not change when n changes. Hence

$$\Sigma\,(n+1) = \tfrac{1}{2}(n^2+n) + C;$$

but a being any whole number less than x, $\Sigma\,(n+1)$ may stand for $a + (a+1) + \ldots.. + x$. Consequently C in the one must be taken in a manner corresponding to a in the other. If n were equal to a, the series would be reduced to one term a, and $\frac{1}{2}(n^2+n) + C$ would become $\frac{1}{2}(a^2+a) + C$. Determine C so that these shall be equal: we have then to make

$$a = \tfrac{1}{2}(a^2+a) + C,\quad C = -\tfrac{1}{2}(a^2-a)$$
$$a + (a+1) + \ldots. + n = \tfrac{1}{2}(n^2+n) - \tfrac{1}{2}(a^2-a).$$

The inverse method of differences, or that of finite integration, is founded upon the preceding principles and notation: but so far as the mere summation of simple series is concerned, the following rules will be sufficient:—

1. Let a be the first term of a series of n terms, a, b, c, &c. Form the successive differences of a [DIFFERENCE], which will all vanish after a certain point in every instance to which this rule applies. Then the sum of the n terms is

$$na + n\frac{n-1}{2}\Delta a + n\frac{n-1}{2}\frac{n-2}{3}\Delta^2 a + \ldots\ldots$$

EXAMPLE:	1 +	8 +	27 +	64 +	125 +	.... +	n^3
First diff.	7	19	37	61		....	
Second diff.	12	18	24			...	
Third diff.	6	6				....	
Fourth diff.	0	0				....	

Here $a = 1$, $\Delta a = 7$, $\Delta^2 a = 12$, $\Delta^3 a = 6$, $\Delta^4 a = 0$, $\Delta^5 a = 0$, &c.

and the sum required is

$$n + 7n\frac{n-1}{2} + 12n\frac{n-1}{2}\frac{n-2}{3} + 6n\frac{n-1}{2}\frac{n-2}{3}\frac{n-3}{4}$$

It may be convenient to give the reduction of the preceding formula in the cases where all after the second differences vanish, and the same for the third. Let a', a'', a''', &c., be the differences of a; when $a''' = 0$, $a^{iv} = 0$, &c., the sum is one-sixth of

$$a''n^3 + (a' - a'')\,3n^2 + (6a - 3a' + 2a'')\,n.$$

When $a^{iv} = 0$, $a^{v} = 0$, &c., the sum is one twenty-fourth of

$$a'''n^4 + Pn^3 + Qn^2 + Rn$$

where
$$P = 4a'' - 6a'''$$
$$Q = 12a' - 12a'' + 11a'''$$
$$R = 24a - 12a' + 8a'' - 6a'''$$

2. Let there be a number of terms in uniformly increasing progression, such as 4, $4\frac{1}{2}$, 5, $5\frac{1}{2}$, &c.; and let a series be formed by multiplying a number of terms from the beginning, then the same number from the second, and so on; as in

$$3.4.5 + 4.5.6 + 5.6.7 + \ldots.. + 12.13.14$$

To find the sum of this series, put an additional factor at the end of the last term and at the beginning of the first term; subtract the latter from the former, and divide by the common difference of the successive factors taken one more time than there are factors in each term. Thus the sum of the preceding is 12.13.14.15 − 2.3.4.5 divided by 1 taken 4 times. Again

$$1.2 + 2.3 + 3.4 + 4.5 + 5.6$$

is 5.6.7 − 0.1.2 divided by 1 taken 3 times; or 70; as may easily be verified. Also

$$1.3 + 3.5 + 5.7 + 7.9$$

is 7.9.11 − (−1) 1.3 divided by 2 taken 3 times; or 116.

3. Let the series consist of reciprocals of terms like the preceding: as

$$\frac{1}{3.4.5} + \frac{1}{4.5.6} + \ldots.. + \frac{1}{12.13.14}$$

To sum this series, strike off a factor from the end of the first term and the beginning of the last term; subtract the second from the first, and divide by the common difference of the successive factors taken one time less than there are factors in each denominator. Thus the sum of the preceding terms is

$$\frac{1}{3.4} - \frac{1}{13.14} \text{ divided by 1 taken twice.}$$

Similarly $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7}$ is $\frac{1}{1} - \frac{1}{7}$ divided by 2 taken once; or $\frac{3}{7}$, as may easily be verified.

INTELLECT (*intellectus*), that which perceives or understands, comprehending all the cognitive powers of the mind, in contradistinction to the active powers or the will. 'The internal and immanent acts of the reasonable soul (besides those of common sense, phantasy, memory, passion, and appetite, common to man and inferior animals) are intellect and will, and the proper acts of these are intellection, deliberation, and determination, or decision.' (Hale's 'Origin of Mankind.') In the Aristotelian philosophy the intellect (νοῦς) first works on the phantasms, and discerns by a spontaneous energy what in many is one, what in things dissimilar is similar and the same (τὸ δὲ ἓν ποιοῦν τοῦτο ὁ νοῦς ἕκαστον). By this means it attains to a new kind of perceptions (εἴδη), more comprehensive than those of sense; and each of these general ideas subsists entire in each individual of an infinite multitude without losing its own unity and permanence. On the other hand it is the source of those primary principles on which all science rests, as conversant about universal and demonstrable truth.

For intellect Mr. Stewart prefers the vernacular term understanding, which he employs in the same extensive signification. But the critical philosophy of Kant distinguishes the intellect into two faculties, understanding and reason. The understanding acting on experience merely compares, judges, and measures its representations, and is conversant solely with their mutual limits and relations, classifying them according to certain schemes of its own which are called categories. While however the understanding is thus limited, the activity of the reason is unbounded, and, as the principle of principles, it is the base and the verification of every special principle and reasoning.

Intellectualism, or intellectual philosophy, as opposed to sensualism, is a particular theory in philosophy, according to which the intellect or thought is the only source of true knowledge, whereas the evidence of sense is but a cheat and delusion. The Eleatæ were the most distinguished adherents of this doctrine. The phrase intellectual knowledge denotes whatever principle or proposition had its origin in the understanding or reason, as opposed to sensuous or empirical knowledge, whose source was sensation. As contra-distinguished from sensibles, the objects of this cognition are denominated intelligibles (αἰσθητά, νοητά).

INTERCALARY. [Kalendar.]

INTERDICT (Interdictum in the Roman law). The general distinction between the Roman Interdictum and Actio seems clearly pointed out by Savigny in a few remarks on the passage in Gaius (iv. 139), where that writer treats of the interdict. The words of Gaius, which form the groundwork of the following remarks of Savigny, are: 'Certis ex caussis Prætor aut Proconsul *principaliter* auctoritatem suam finiendis controversiis proponit' (or *præponit*, as Haubold reads, after Maffei); and his remarks have reference to the supposed difficulty of the word *principaliter*, and to a certain proposed emendation supported by very indifferent reasons.

The general distinction between the actio and the interdictum is this: in the actio the prætor does nothing, but only allows a *judex*, whose duty it is to inquire and decide. When the *judex* has decided, the matter may in general be considered as at an end, and if the prætor is again called on to act in the cause, such must be viewed as an accidental thing. This appears from the terms of the prætor's order in matters which belong to the actio: he does not command or forbid a thing to be done, but he says 'judicium dabo.' With the interdictum it is just the reverse. Here also *judices* or *recuperatores* may be required when the facts are in dispute; but as a general rule in matters to which the interdict applies, the case is such that the prætor's order can immediately terminate the question. The prætor accordingly does not say 'judicium dabo,' but he uses the ordering words 'restituas, exhibeas, vim fieri veto,' &c.; and this could not be better expressed, as Savigny remarks, than by the words 'principaliter,' &c.; the meaning of which, as Haubold observes, can hardly be anything else than this: 'the prætor or the proconsul at once gives a definitive judgment, by which the dispute, at least for the present, is terminated.'

According to Gaius, the general description of the interdictum is this—it ordered something to be done, or forbade something to be done. The forms of the orders used on such occasions were called by the general name of interdicta. When the order was to produce something (exhibere), or restore a thing (restituere), the interdicta were called Decreta. The term Interdictum was used when the order forbade a certain thing to be done—as to disturb a man who was in possession, *sine vitio;* to prevent any trespass on sacred ground, &c.

The general process seems to have been by a kind of bill or petition addressed to the prætor, in which the plaintiff stated his grievance and prayed for redress, that is, for the interdictum. The defendant also stated his case, probably by way of reply to that of the plaintiff. If the case was clear on the part of the plaintiff, he obtained the interdict. Or if the defendant admitted the plaintiff's statement of his case, or if after the interdict was obtained he submitted to its terms, the matter was at an end. If the defendant denied the plaintiff's case, that is, denied that there was any ground for the interdict, or maintained that he had given the plaintiff full satisfaction, and had complied with the terms of the interdict, the plaintiff made his application to the prætor to refer the matter to *judices* or *recuperatores*, or to an *arbiter*. The parties complainant and defendant went before the *judex* or *arbiter* whom the prætor named, and the process then became the usual process of the actio. The parties produced their witnesses and proofs, and the judex or arbiter decided upon them. The terms of the interdict, in case it was prohibitory, were the formal words of the edict which determined in what cases such relief could be given (certis ex caussis), only so far varied as to apply to the parties who were in dispute. In the restitutory and exhibitory interdict, the terms of the order would necessarily vary according to circumstances. If the matter came before a *judex*, the only question as to the prohibitory interdict which he had to settle was, whether the defendant had, by his acts, brought himself within the prætor's interdict. If he had, the interdict must be enforced against him; if not, it must be dissolved. In the case of the restitutory and exhibitory interdict coming before the *judex* or *arbiter*, the matters for inquiry would be—whether the defendant had, by his acts, given good ground for the interdict; whether he had satisfied the terms of the interdict; what damages the defendant should pay to the plaintiff, in case he had not satisfied the terms of the interdict, or had only satisfied them imperfectly. If no *sponsio* (deposit of money by the parties abiding by the result of the inquiry) had been entered into, and consequently the matter had come before an *arbiter*, all these three points had to be determined, and the damages were at the discretion of the *arbiter;* in case there was a sponsio (which in the prohibitory interdict was necessary, but in the other interdicts not absolutely necessary), the *judices* or recuperatores had to determine only the first two points. (Cicero, *Pro Cæcina*, 8.) In fact, when the matter came before a *judex* or *arbiter* the interdict process did not differ from that of the ordinary actio, as appears from Cicero's oration *Pro Cæcina*, in which the plaintiff Cæcina had obtained the prætor's interdict 'Unde Tu,' &c., against the defendant Æbutius, and the matter had been referred to recuperatores. The defence of Æbutius before the recuperatores was, that he had obeyed the interdict and had restored the plaintiff to the same place from which he had ejected him. The defendant had not in fact done this; but it appears to have been sometimes the formal way of raising the question, whether the act complained of had been committed. If it was not committed, the defendant had in substance obeyed the interdict, that is, had not acted contrary to it.

The authorities for what is above stated are: Haubold, *Ueber die Stelle von den Interdicten in den Veronesischen Handschriften;* and Savigny, C., *Nachträgliche Bemerkungen*, in the *Zeitschrift für geschichtliche Rechtswissenschaft*, 3er band. For the application of the interdict to the case of possession, Savigny, *Das Recht des Besitzes*, 4r *Abschnitt*, should be consulted, and his remarks on the case of Cæcina. The valuable work of Brissonius, *De Formulis*, lib. v., c. 154, contains a collection of passages which refer to the functions of the judex in the interdict process. [Injunction.]

INTERDICT, ECCLESIASTICAL, a mode of censure employed at times by the Roman Catholic church, by which, in consequence of some offence alleged to have been committed by the people or rulers of a town or country, the pope forbade by a bull the performance of any kind of church rites within the same; the church-service was suspended, the sacraments were not administered, and the funeral service was not read. The use of interdicts appears to have originated with the bishops in the ninth century. Hincmar, bishop of Laon in France, laid a parish of his diocese under an interdict in the year 870. (Moreri's *Dictionary*, art. 'Interdict.') In the middle ages this measure was often resorted to by the popes in consequence of some serious dispute with the sovereigns of particular countries, and it had the effect of throwing whole kingdoms into consternation, and even into a state of rebellion, by which the refractory sovereigns were obliged to sue for pardon from the pontiff. Gregory VII. and Innocent III. made free use of the interdict. Adrian IV. laid Rome itself under an interdict for the purpose of driving away Arnaldo da Brescia and his followers. Some popes mitigated the rigour of the interdict out of regard to the spiritual wants of the people, who could not be justly punished for the guilt of their rulers. Gregory IX., during the interdict against Frederic II., allowed mass to be said on Sundays. On some occasions the sacrament to the dying and baptism to infants were allowed to be administered. (See Lyndwood.)

The frequent abuse of the interdict has been censured even by Catholic writers. In course of time the measure was found no longer to answer its object, and it became of rare occurrence. Paul V., in April, 1606, laid the republic of Venice under an interdict, because the senate had decreed that no more convents should be founded, and no more property should be bequeathed to monastic orders without permission from the government. The senate forbade the bull of interdict to be published in the territories of the republic, and ordered the parochial clergy to continue the exercise of their sacred ministry as usual. The Jesuits, Franciscans, and other monks pleaded their duty of obedience to the see of Rome, and the senate told them that they might depart, which they did. At last, in 1607, through the mediation of Henry IV. of France, the pope removed the interdict, which had produced little or no effect on the minds of the Venetian people.

INTEREST, money which is paid for the use of other money, the lender stipulating for a fixed sum to be paid yearly, half-yearly, or quarterly, for each 100*l*. lent, until the money is returned. When this is not the case, and when the money paid for the loan depends upon the success of an undertaking, or any casualty not connected with the duration of life, it is called a *dividend:* when the money and its interest are to be returned by yearly instalments, and paid off in a certain fixed number of years, it is called an *annuity certain:* but when the payment is to depend upon the life of any person or persons, it is called a *life-annuity*. [ANNUITY.] But by whatever name the proceeds of money may be called, the rules of calculation are the same in every case hut that of a life-contingency.

A simple rule for converting shillings, pence, and farthings into the decimal of a pound, alluded to in the article ANNUITIES, might be made of such frequent use in calculations connected with interest, that we begin with it. The rule is founded upon the circumstance of one farthing being very little more than the thousandth part of a pound.

To convert any number of shillings, pence, and farthings to the decimal of 1*l.*, as far as three places.

RULE.—Allow 100 for every two shillings, and 50 for the odd shilling, if there be one, and a unit for every farthing in the pence and farthings, adding 1 if the pence and farthings be sixpence or upwards. Then make three decimal places of the result. Thus 1*s.* 7¾*d.* give 50 and 31 and 1, or 82, which, converted into a decimal of three places, is ·082, or 1*s.* 7¾*d.* is ·082*l.*: the truth lies between ·0822 and ·0823. Again, 17*s.* 4½*d.* give 800 and 50 and 18, or 868, so that 17*s.* 4½*d.* is ·868*l.* very nearly.

To convert any decimal of a pound of three places into shillings, pence, and farthings. RULE.—Take away the decimal point, and make a whole number of the three places: for every hundred of this whole number allow two shillings, and another shilling to the remaining 50, if so much remain: let every unit of the remainder be one farthing, but strike off one if the remaining number exceed 24. Thus ·973*l.* gives 18*s.* and 1*s.* and 23 farthings, or 19*s.* 5¾*d.*; but ·147*l.* gives 2*s.* and 46 farthings, or 2*s.* 11½*d.* The following are examples of hoth rules:—

6¾*d.* is ·028*l.*	16*s.* 0½*d.* is ·802*l.*
3*s.* 2*d.* is ·158*l.*	17*s.* 11*d.* is ·895*l.*
4*s.* 9¼*d.* is ·238*l.*	19*s.* 10½*d.* is ·993*l.*

The preceding rule is sufficiently accurate for common purposes: hut by allowing 1·04 instead of 1 for every farthing, and neglecting the contingent addition, the result may he made nearly true to five places. And hy allowing 10,000 for every 2 shillings, 5000 for 1 shilling, 2500 for sixpence, and 104⅙ for every farthing, any number of shillings, pence, and farthings is accurately multiplied by a hundred thousand. Thus to multiply 15*s.* 9¾*d.* by 100,000—

14*s.*	gives	70000
1*s.*	„	5000
6*d.*	„	2500
3*d.*	„	1250
¾*d.*	„	312½
15*s.* 9¾*d.*	„	£79062½

from which we immediately find that 15*s.* 9¾*d.* is exactly £·790625.

Interest is usually reckoned by the sum paid yearly for each 100*l.*; thus 4 *per centum*, ahhreviated into 4 *per cent.*, means that 4 pounds is paid yearly for 100*l.*, or that one-twenty-fifth of the whole sum is paid yearly for its use. In some cases, as in the dividend of a bankrupt's estate, a part is compared with the whole hy stating how much of each pound is paid. The preceding rule gives the means of reducing one to the other instantaneously; thus since 4*s.* 9¼*d.* is ·238*l.*, a bankrupt who pays the former sum per pound, or ·238*l.* for 1*l.*, pays 23·8*l.* for each 100*l.*, or 23⅘ per cent. Similarly 37$\frac{2}{10}$ per cent., or 37·2*l.* for 100*l.*, is ·372*l.* for 1*l.*, or 7*s.* 5½*d.* in the pound.

Interest is called *simple* when it is paid as soon as due, or when, if deferred, interest is not charged upon interest. But when the latter charge is made, the interest is called *compound*. In simple interest it makes no difference whether it be payahle yearly or at shorter terms; but this is not the case in compound interest. The sum lent is called the *principal;* and the principal, together with the interest, the *amount:* also the principal is called the *present value* of the amount.

A common question of simple interest requires merely the process of taking a given fractional part of a sum of money, and need not be explained at length in a work of reference. One example however will serve to show the facilities which the preceding rule affords.

What is the interest upon 697*l.* 13*s.* 4½*d.* at 4½ per cent. for 7¾ years?

To find this we must take the hundredth part of the sum 4½ times for one year's interest, which we must then repeat 7¾ times.

£697 13*s.* 4½*d.*	is	£697·668	
		4½	
		2790·672	
		348·834	
		100)2139·506	
		21·39506	or 21·39506
		7¾	8
		149·76542	171·16048
		10·69753	534877
		5·34876	165·81171
		165·81171	

Answer £165·812 or £165 16*s.* 3*d.*

When interest is to be taken for a number of days, a person who is often required to perform the operation will provide himself with a set of tahles, several of which are published. Those who do not often meet with the operation must take such a fraction of a year's interest as the number of days in the question is of a year. The following rule will facilitate the introduction of the arithmetical rule of practice. RULE.—Whenever the portion of an amount per annum is to be taken corresponding to a number of days, calculate as if the year had only 360 days, and from the result subtract its 72nd part, or one farthing in eighteenpence, or 3½*d.* on each guinea. This falls short of the truth by about one penny in 20*l.* Thus suppose the yearly interest is 283*l.* 17*s.* 4*d.*, and that for 254 days is required—

			283·866
180	.. ½	...	141·933
60	.. ⅓	...	47·311
12	.. ⅕	...	9·462
2	.. ⅙	...	1·577
			8)200·283
			9) 25·035
			2·782
			200·283
			197·501

Answer, 197*l.* 10*s.*; or, adding 1*d.* for each 20*l.*, about 197*l.* 10*s.* 10*d.*, which is within one halfpenny of the truth.

It is sometimes necessary to express the interest by the day, in which the following rules will be convenient.

To turn a given amount per day into the corresponding amount per year, to the nnmber of pence per day add its half, and take as many pounds as there are now pence: this is the amount in 360 days, and five days' allowance added gives the result.

To find out how much a sum per annum yields per day, suhtract one-third from the pounds, and take as many pence as there are in the result. The answer is the preceding result diminished hy one farthing in eighteenpence, or its 72nd part.

Thus 3¾*d.* per day, or 3·75 pence, gives 3·75 + 1·875, or 5·625 per 360 days, which is 5*l.* 12*s.* 6*d.* To this add five times 3¾*d.* or 1*s.* 6¾*d.*, which gives 5*l.* 14*s.* 0¾*d.* per annum.

Again 26*l.* 14*s.* 7*d.* per annum, or (nearly enough) 26·7*l.*, gives 26·7 − 8·9 pence per day nearly; that is, 17⅘*d.* Diminish this hy one farthing, and 17½*d.* is the answer within a farthing.

All persons who attempt for the first time to use decimal fractions in money computations imagine that they gain nothing, but a little practice soon convinces them of the contrary.

We now proceed to the subject of compound interest, which cannot be satisfactorily treated without algebra. Let r be the interest of 1*l.* for one year, or $100r$ the rate per cent. As follows:—

At 2½ per cent. $r = {\cdot}025$	At 4 per cent. $r = {\cdot}04$
At 3½ per cent. $r = {\cdot}035$	At 5⅛ per cent. $r = {\cdot}05125$.

It is not usual in treating of compound interest to separate that part of the amount which is interest from the whole. We shall therefore speak only of principal and amount, or, when the latter is the given sum, of present value and deferred principal. Hence $1 + r$ is the amount of one pound in one year, $2 + 2r$ that of two pounds in one year, and, generally, a sum which is a pounds at the beginning of any one year hecomes $a(1+r)$ pounds at the end.

Consequently the amounts of £1, at the end of one, two, three, &c., years are $1+r$, $(1+r)^2$, $(1+r)^3$, &c., pounds; and £1 at the end of n years becomes $(1+r)^n$ pounds. I then £a become £A in n years, at r per pound, we have

$$A = a\,(1+r)^n \qquad a = \frac{A}{(1+r)^n}$$

$$r = \sqrt[n]{\frac{A}{a}} - 1 \qquad n = \frac{\log A - \log a}{\log(1+r)}$$

from one of which forms of the equation, either of the four, $A, a, r,$ or n, can be found, when the other three are known.

From the second form it appears that the fraction of £1, which will in a year amount to a pound, is 1 divided by $1+r$. Let this be called v; we have then

$$v = \frac{1}{1+r} \qquad r = \frac{1-v}{v}$$

Hence it is easily seen, that according as a pound is to be the amount at the end of one, two, three, &c., years, the principal now necessary to produce that amount is v, v^2, v^3, &c., or v^n expresses 'the present value of £1 to be received at the end of n years.' Here are no less than *fifteen* words necessary to express a fundamental result; and when we speak of $(1+r)^n$ it must be as 'the amount of £1 in n years.' To shorten these phrases, the former might be advantageously called the nth present value, and the latter the nth amount.

The sum which yields £1 every year is called the value of a perpetuity of one pound, or simply the *perpetuity* of £1. If it be P, we have

$$Pr = 1,\ P = \frac{1}{r},\ r = \frac{1}{P},\ P = \frac{v}{1-v},\ v = \frac{P}{1+P}.$$

The reader will find an arithmetical account of ANNUITIES under that word; we now proceed to the algebraical formulæ connected with them. An annuity, and also a perpetuity, is always said to be created a year before any payment is made: thus an immediate grant of an annuity payable yearly implies that the first payment is made a year hence; and similarly of a perpetuity. But in cases where we have to speak of an annuity or perpetuity, of which one payment is to be made now, we propose to call them an annuity due, and a perpetuity due. Again, an annuity or perpetuity deferred for, say 10 years, makes its first payment in 11 years: but a perpetuity due in 10 years, makes the first payment at the end of 10 years. An annuity of 20 years makes 20 payments; an annuity due of 20 years makes 21 payments. Let all annuities mentioned be of £1, unless otherwise specified.

The present value of an annuity for n years is evidently

$$v + v^2 + v^3 + \ \ldots\ldots\ + v^{n-1} + v^n$$

for v in one year becomes £1, and provides for the first payment; v^2 for the second, and so on. The preceding is equivalent to

$$\frac{v - v^{n+1}}{1-v} \quad \text{or} \quad \frac{1-v^n}{r} \quad \text{or} \quad \frac{(1+r)^n - 1}{r(1+r)^n}$$

Similarly the present value of an annuity due for n years is £1 more than the preceding, or

$$\frac{1-v^{n+1}}{1-v} \quad \text{or} \quad \frac{1+r-v^n}{r} \quad \text{or} \quad \frac{(1+r)^{n+1}-1}{r(1+r)^n}$$

An annuity of n years deferred for k years is now worth

$$v^{k+1} + v^{k+2} + \ \ldots\ + v^{k+n}$$

$$\text{or} \quad v^k\,\frac{v-v^{n+1}}{1-v} \quad \text{or} \quad \frac{v^k - v^{n+k}}{r} \quad \text{or} \quad \frac{(1+r)^n - 1}{r(1+r)^{n+k}}$$

A perpetuity deferred for k years is worth $\frac{v^k}{r}$ or v^kP; but a perpetuity due in k years is the same as a perpetuity deferred for $k-1$ years, and $k-1$ must be written for k in the preceding: giving v^{k-1} P.

If the proceeds of an annuity of n years be put out to interest as fast as they become due, then at the instant after the last payment is made the first payment will have improved for $n-1$ years, the second for $n-2$ years, &c., and the last payment will have made nothing: whence the whole amount of the annuity at the moment of expiration is

$$(1+r)^{n-1} + (1+r)^{n-2} + \ \ldots\ + (1+r) + 1$$

$$\text{which is} \quad \frac{(1+r)^n - 1}{r} \quad \text{or} \quad \frac{1-v^n}{rv^n}$$

The annuity of n years, which £1 will buy, makes at each payment $r \div (1-v^n)$; and so on: that is, the following are methods of restoring £1 now lent:

1. By annuity for n years . . . . . . of $\dfrac{r}{1-v^n}$
2. By annuity for n years, deferred k years, of $\dfrac{r}{v^k - v^{n+k}}$
3. By perpetuity . . . . of r
4. By perpetuity deferred for k years . of $\dfrac{r}{v^k}$

And £1, due at the end of n years, may be paid by an n years annuity of $rv^n \div (1-v^n)$, or by an annuity due of $rv^n \div (1+r-v^n)$.

It is hardly necessary to say, that an annuity, &c., of £s is to be found by multiplying the annuity, &c., of £1 by s.

An annuity of n years, which gives £1 at the first payment, £2 at the second payment, &c., and £n at the nth and last payment, is worth

$$\frac{v + nv^{n+2} - (n+1)\,v^{n+1}}{(1-v)^2}$$

and when the numerator and denominator change places, we have the fraction of £1, which must be paid at the end of the first year, in order to repay £1 now lent, by uniformly increasing instalments in n years.

For a short and easy method of deducing the preceding formula from the common tables, see the fifth appendix to the 'Essay on Probabilities' in Dr. Lardner's 'Cabinet Cyclopædia.'

An annuity of n years, which gives £n at the first payment, £$(n-1)$ at the second payment, &c., and £1 at the nth and last payment, is worth

$$\frac{nv + v^{n+2} - (n+1)\,v^2}{(1-v)^2}$$

and, reversing numerator and denominator, we have the fraction of £1, which must be paid at the end of the first year, in order to repay £1 now lent, by uniformly decreasing instalments in n years.

All the preceding formulæ are easy to compute by aid of logarithms, and the result of any one being given, and the rate of interest, it is easy to determine (except in the two last formulæ) the number of years necessary. But if the number of years be given, and the result, and it is the rate of interest which is unknown, an equation must be solved, the degree of which is at least as high as the number of years.

When the interest is to be paid at the expiration of a fraction of a year, it is the same thing as if a less rate of interest were paid for a greater number of years. In the preceding investigations $1+r$ may be considered as the amount of 1*l.* at the end of a term, and n as the number of terms. If then quarterly interest be paid during n years, r per pound per annum gives $\frac{1}{4}r$ per pound per quarter, which continued for $4n$ quarters gives $(1+\frac{1}{4}r)^{4n}$ for the amount.

The tables appended to this article are intended to save the trouble of calculation in ordinary cases. They extend from $2\frac{1}{2}$ to 6 per cent. Higher rates are occasionally useful, but it is to be remembered that when the rate of interest is high, and the number of years not small, tables of yearly interest become sensibly incorrect when the money is really improved half-yearly or quarterly. Thus the tables at 5 per cent., with double the number of terms, will better represent the actual progress of money at 10 per cent. than the common yearly tables. The calculator who wishes to meet every case with readiness, must make himself independent of particular tables. This can be done with the common seven-decimal tables of logarithms, up to five places of decimals and 100 years: and if the logarithm of $1+r$ be given to ten places of decimals, up to seven places and 1000 years. The following subsidiary table is therefore given, which contains the logarithms of $1+r$, for every quarter per cent. up to 6 per cent., and to ten places of decimals. (See INTERPOLATION for a simple method of finding intermediate logarithms.)

$1+r$	Log. $(1+r)$	$1+r$	Log. $(1+r)$
1·0025	·00108 43813	1·0325	·01389 00603
1·0050	·00216 60618	1·0350	·01494 03498
1·0075	·00324 50548	1·0375	·01598 81054
1·0100	·00432 13738	1·0400	·01703 33393
1·0125	·00539 50319	1·0425	·01807 60636
1·0150	·00646 60422	1·0450	·01911 62904
1·0175	·00753 44179	1·0475	·02015 40316
1·0200	·00860 01718	1·0500	·02118 92991
1·0225	·00966 33167	1·0525	·02222 21045
1·0250	·01072 38654	1·0550	·02325 24596
1·0275	·01178 18305	1·0575	·02428 03760
1·0300	·01283 72247	1·0600	·02530 58653

By taking the first nine multiples of any one of these logarithms, a table of seven places might be formed, which should be correct in every figure. The following, for instance, is the table for 1 per cent. per quarter, or 4 per cent. per annum, payable quarterly:—

1	·0043214	10	·0432137	100	0·4321374
2	·0086427	20	·0864275	200	0·8642748
3	·0129641	30	·1296412	300	1·2964121
4	·0172855	40	·1728550	400	1·7285495
5	·0216069	50	·2160687	500	2·1606869
6	·0259282	60	·2592824	600	2·5928243
7	·0302496	70	·3024962	700	3·0249617
8	·0345710	80	·3457099	800	3·4570990
9	·0388924	90	·3889236	900	3·8892364

For instance, suppose it required to find out in how many years money will increase tenfold at 4 per cent. payable quarterly: or to solve the equation $(1\cdot01)^{4n} = 10$.

```
Log. 10 = 1·0000000
           ·8642748 .. 200
          ---------
           ·1357252
           ·1296412 ..  30
          ---------
           ·0060840
           ·0043214 ..   1
          ---------
           ·0017626
```

Answer.—The amount of 1*l.* in 232 quarters, or 58 years, will be a little more than 10*l.*

We now describe the tables which follow:—

Table I. gives the present value of 1*l.* to be received at the end of the several years marked. Thus, in the column of 4 per cent. opposite to 15 years, we find ·55526, which is the sum that will in fifteen years, at 4 per cent., amount to 1*l.* The present value of 100*l.*, similarly circumstanced, is 55·526*l.* or 55*l.* 10*s.* 6½*d.*

Table II. gives the present value of an annuity of 1*l.* Thus opposite to 20 years in the column of 5 per cent. is 12·46221, meaning that 1*l.*, to be paid at the end of every year from this time for 20 years, is now worth 12·46221*l.*, if money will make 5 per cent.

Table III. shows the annuity which 1*l.* will buy for any number of years. Thus in the column of 4 per cent., opposite to 7 years, we find ·16661. If then 100*l.*, now lent, were to be repaid by instalments in seven years, the first instalment a year hence, so as to allow compound interest at 4 per cent., then each instalment should be 16·661*l.*

Table IV. gives the amount of 1*l.* improved at compound interest during a number of years. Thus opposite to 11 years in the column of 3 per cent. is found 1·38423, meaning that 1*l.* in 11 years, at 3 per cent., amounts to 1·38423, and 100*l.* to 138·423*l.*

Table V. gives the amount of an annuity of 1*l.*, as it will be the moment after the last payment has been made, if the preceding payments have been allowed to accumulate. Thus in the column of 3½ per cent., under 27 years, we find 43·75906, so that the proceeds of an annuity of 100*l.* for 27 years, allowed to accumulate at 3½ per cent., will at the last payment have realized 4375·906*l.*

Table I.

The Present Value of £1, due at the end of any number of Years.

Years.	2½ pr. Ct.	3 pr. Ct.	3½ pr. Ct.	4 pr. Ct.	4½ pr. Ct.	5 pr. Ct	6 pr. Ct.
1	·97561	·97087	·96618	·96154	·95694	·95238	·94340
2	·95181	·94260	·93351	·92456	·91573	·90703	·89000
3	·92860	·91514	·90194	·88900	·87630	·86384	·83962
4	·90595	·88849	·87144	·85480	·83856	·82270	·79209
5	·88385	·86261	·84197	·82193	·80245	·78353	·74726
6	·86230	·83748	·81350	·79031	·76790	·74622	·70496
7	·84127	·81309	·78599	·75992	·73483	·71068	·66506
8	·82075	·78941	·75941	·73069	·70319	·67684	·62741
9	·80073	·76642	·73373	·70259	·67290	·64461	·59190
10	·78120	·74409	·70892	·67556	·64393	·61391	·55839
11	·76214	·72242	·68495	·64958	·61620	·58468	·52679
12	·74356	·70138	·66178	·62460	·58966	·55684	·49697
13	·72542	·68095	·63940	·60057	·56427	·53032	·46884
14	·70773	·66112	·61778	·57748	·53997	·50507	·44230
15	·69047	·64186	·59689	·55526	·51672	·48102	·41727
16	·67362	·62317	·57671	·53391	·49447	·45811	·39365
17	·65720	·60502	·55720	·51337	·47318	·43630	·37136
18	·64117	·58739	·53836	·49363	·45280	·41552	·35034
19	·62553	·57029	·52016	·47464	·43330	·39573	·33051
20	·61027	·55368	·50257	·45639	·41464	·37689	·31180
21	·59539	·53755	·48557	·43883	·39679	·35894	·29416
22	·58086	·52189	·46915	·42196	·37970	·34185	·27751
23	·56670	·50669	·45329	·40573	·36335	·32557	·26180
24	·55288	·49193	·43796	·39012	·34770	·31007	·24698
25	·53939	·47761	·42315	·37512	·33273	·29530	·23300
26	·52623	·46369	·40884	·36069	·31840	·28124	·21981
27	·51340	·45019	·39501	·34682	·30469	·26785	·20737
28	·50088	·43708	·38165	·33348	·29157	·25509	·19563
29	·48866	·42435	·36875	·32065	·27902	·24295	·18456
30	·47674	·41199	·35628	·30832	·26700	·23138	·17411
31	·46511	·39999	·34423	·29646	·25550	·22036	·16425
32	·45377	·38834	·33259	·28506	·24450	·20987	·15496
33	·44270	·37703	·32134	·27409	·23397	·19987	·14619
34	·43191	·36604	·31048	·26355	·22390	·19035	·13791
35	·42137	·35538	·29998	·25342	·21425	·18129	·13011
36	·41109	·34503	·28983	·24367	·20503	·17266	·12274
37	·40107	·33498	·28003	·23430	·19620	·16444	·11580
38	·39128	·32523	·27056	·22529	·18775	·15661	·10924
39	·38174	·31575	·26141	·21662	·17967	·14915	·10306
40	·37243	·30656	·25257	·20829	·17193	·14205	·09722
41	·36335	·29763	·24403	·20028	·16453	·13528	·09172
42	·35448	·28896	·23578	·19257	·15744	·12884	·08653
43	·34584	·28054	·22781	·18517	·15066	·12270	·08163
44	·33740	·27237	·22010	·17805	·14417	·11686	·07701
45	·32917	·26444	·21266	·17120	·13796	·11130	·07265
46	·32115	·25674	·20547	·16461	·13202	·10600	·06854
47	·31331	·24926	·19852	·15828	·12634	·10095	·06466
48	·30567	·24200	·19181	·15219	·12090	·09614	·06100
49	·29822	·23495	·18532	·14634	·11569	·09156	·05755
50	·29094	·22811	·17905	·14071	·11071	·08720	·05429
55	·25715	·19677	·15076	·11566	·08884	·06833	·04057
60	·22728	·16973	·12693	·09506	·07129	·05354	·03031
65	·20089	·14641	·10688	·07813	·05721	·04195	·02265
70	·17755	·12630	·08999	·06422	·04590	·03287	·01693
75	·15693	·10895	·07577	·05278	·03684	·02575	·01265
80	·13870	·09398	·06379	·04338	·02956	·02018	·00945
85	·12259	·08107	·05371	·03566	·02372	·01581	·00706
90	·10836	·06993	·04522	·02931	·01903	·01239	·00528
95	·09577	·06032	·03808	·02409	·01527	·00971	·00394
100	·08465	·05203	·03206	·01980	·01226	·00760	·00295

Table II.

The Present Value of £1 per annum for any number of Years.

Years	2½ pr. Ct	3 pr. Ct.	3½ pr. Ct.	4 pr. Ct.	4½ pr. Ct.	5 pr. Ct.	6 pr. Ct.
1	·97561	·97087	·96618	·96154	·95694	·95238	·94340
2	1·92742	1·91347	1·89969	1·88609	1·87267	1·85941	1·83339
3	2·85602	2·82861	2·80164	2·77509	2·74896	2·72325	2·67301
4	3·76197	3·71710	3·67308	3·62990	3·58753	3·54595	3·46511
5	4·64583	4·57971	4·51505	4·45182	4·38998	4·32948	4·21236
6	5·50813	5·41719	5·32855	5·24214	5·15787	5·07569	4·91732
7	6·34939	6·23028	6·11454	6·00205	5·89270	5·78637	5·58238
8	7·17014	7·01969	6·87396	6·73274	6·59589	6·46321	6·20979
9	7·97087	7·78611	7·60769	7·43533	7·26879	7·10782	6·80169
10	8·75206	8·53020	8·31661	8·11090	7·91272	7·72173	7·36009
11	9·51421	9·25262	9·00155	8·76048	8·52892	8·30641	7·88687
12	10·25776	9·95400	9·66333	9·38507	9·11858	8·86325	8·38384
13	10·98318	10·63496	10·30274	9·98565	9·68285	9·39357	8·85268
14	11·69091	11·29607	10·92052	10·56312	10·22283	9·89864	9·29498
15	12·38138	11·93794	11·51741	11·11839	10·73955	10·37966	9·71225
16	13·05500	12·56110	12·09412	11·65230	11·23402	10·83777	10·10590
17	13·71220	13·16612	12·65132	12·16567	11·70719	11·27407	10·47726
18	14·35336	13·75351	13·18968	12·65930	12·15999	11·68959	10·82760
19	14·97889	14·32380	13·70984	13·13394	12·59329	12·08532	11·15812
20	15·58916	14·87747	14·21240	13·59033	13·00794	12·46221	11·46992
21	16·18455	15·41502	14·69797	14·02916	13·40472	12·82115	11·76408
22	16·76541	15·93692	15·16712	14·45112	13·78442	13·16300	12·04158
23	17·33211	16·44361	15·62041	14·85684	14·14777	13·48857	12·30338
24	17·88499	16·93554	16·05837	15·24696	14·49548	13·79864	12·55036
25	18·42438	17·41315	16·48151	15·62208	14·82821	14·09394	12·78336
26	18·95061	17·87684	16·89035	15·98277	15·14661	14·37519	13·00317
27	19·46401	18·32703	17·28536	16·32959	15·45130	14·64303	13·21053
28	19·96489	18·76411	17·66702	16·66306	15·74287	14·89813	13·40616
29	20·45355	19·18845	18·03577	16·98371	16·02189	15·14107	13·59072
30	20·93029	19·60044	18·39205	17·29203	16·28889	15·37245	13·76483
31	21·39541	20·00043	18·73628	17·58849	16·54439	15·59281	13·92909
32	21·84918	20·38877	19·06887	17·87355	16·78889	15·80268	14·08404
33	22·29188	20·76579	19·39021	18·14765	17·02286	16·00255	14·23023
34	22·72379	21·13184	19·70068	18·41120	17·24676	16·19290	14·36814
35	23·14516	21·48722	20·00066	18·66461	17·46101	16·37419	14·49825
36	23·55625	21·83225	20·29049	18·90828	17·66604	16·54685	14·62099
37	23·95732	22·16724	20·57053	19·14258	17·86224	16·71129	14·73678
38	24·34860	22·49246	20·84109	19·36786	18·04999	16·86789	14·84602
39	24·73034	22·80822	21·10250	19·58448	18·22966	17·01704	14·94907
40	25·10278	23·11477	21·35507	19·79277	18·40158	17·15909	15·04630
41	25·46612	23·41240	21·59910	19·99305	18·56611	17·29437	15·13802
42	25·82061	23·70136	21·83488	20·18563	18·72355	17·42321	15·22454
43	26·16645	23·98190	22·06269	20·37079	18·87421	17·54591	15·30617
44	26·50385	24·25427	22·28279	20·54884	19·01838	17·66277	15·38318
45	26·83302	24·51871	22·49545	20·72004	19·15635	17·77407	15·45583
46	27·15417	24·77545	22·70092	20·88465	19·28837	17·88007	15·52437
47	27·46748	25·02471	22·89944	21·04294	19·41471	17·98102	15·58903
48	27·77315	25·26671	23·09124	21·19513	19·53561	18·07716	15·65003
49	28·07137	25·50166	23·27656	21·34147	19·65130	18·16872	15·70757
50	28·36231	25·72976	23·45562	21·48218	19·76201	18·25593	15·76186
55	29·71398	26·77443	24·26405	22·10861	20·24802	18·63347	15·99054
60	30·90866	27·67556	24·94473	22·62349	20·63802	18·92929	16·16143
65	31·96458	28·45289	25·51785	23·04668	20·95098	19·16107	16·28912
70	32·89786	29·12342	26·00040	23·39451	21·20211	19·34269	16·38454
75	33·72274	29·70183	26·40669	23·68041	21·40363	19·48497	16·45585
80	34·45182	30·20076	26·74878	23·91539	21·56534	19·59646	16·50913
85	35·09621	30·63115	27·03680	24·10853	21·69511	19·68382	16·54896
90	35·66577	31·00241	27·27922	24·26728	21·79924	19·75226	16·57870
95	36·16917	31·32266	27·48350	24·39776	21·88280	19·80599	16·60093
100	36·61411	31·59891	27·65543	24·50500	21·94985	19·84791	16·61755

Table III.

The Annuity which £1 will purchase for any number of Years.

Years	2½ pr. Ct.	3 pr. Ct.	3½ pr. Ct.	4 pr. Ct.	4½ pr. Ct.	5 pr. Ct.	6 pr. Ct.
1	1·02500	1·03000	1·03500	1·04000	1·04500	1·05000	1·06000
2	·51883	·52261	·52640	·53020	·53400	·53780	·54544
3	·35014	·35353	·35693	·36035	·36377	·36721	·37411
4	·26582	·26903	·27225	·27549	·27874	·28201	·28859
5	·21525	·21835	·22148	·22463	·22779	·23097	·23740
6	·18155	·18460	·18767	·19076	·19388	·19702	·20336
7	·15750	·16051	·16354	·16661	·16970	·17282	·17914
8	·13947	·14246	·14548	·14853	·15161	·15472	·16104
9	·12546	·12843	·13145	·13449	·13757	·14069	·14702
10	·11426	·11723	·12024	·12329	·12638	·12950	·13587
11	·10511	·10808	·11109	·11415	·11725	·12039	·12679
12	·09749	·10046	·10348	·10655	·10967	·11283	·11928
13	·09105	·09403	·09706	·10014	·10328	·10646	·11296
14	·08554	·08853	·09157	·09467	·09782	·10102	·10758
15	·08077	·08377	·08683	·08994	·09311	·09634	·10296
16	·07660	·07961	·08268	·08582	·08902	·09227	·09895
17	·07293	·07595	·07904	·08220	·08542	·08870	·09544
18	·06967	·07271	·07582	·07899	·08224	·08555	·09236
19	·06676	·06981	·07294	·07614	·07941	·08275	·08962
20	·06415	·06722	·07036	·07358	·07688	·08024	·08718
21	·06179	·06487	·06804	·07128	·07460	·07800	·08500
22	·05965	·06275	·06593	·06920	·07255	·07597	·08305
23	·05770	·06081	·06402	·06731	·07068	·07414	·08128
24	·05591	·05905	·06227	·06559	·06899	·07247	·07968
25	·05428	·05743	·06067	·06401	·06744	·07095	·07823
26	·05277	·05594	·05921	·06257	·06602	·06956	·07690
27	·05138	·05456	·05785	·06124	·06472	·06829	·07570
28	·05009	·05329	·05660	·06001	·06352	·06712	·07459
29	·04889	·05211	·05545	·05888	·06241	·06605	·07358
30	·04778	·05102	·05437	·05783	·06139	·06505	·07265
31	·04674	·05000	·05337	·05686	·06044	·06413	·07179
32	·04577	·04905	·05244	·05595	·05956	·06328	·07100
33	·04486	·04816	·05157	·05510	·05874	·06249	·07027
34	·04401	·04732	·05076	·05431	·05798	·06176	·06960
35	·04321	·04654	·05000	·05358	·05727	·06107	·06897
36	·04245	·04580	·04928	·05289	·05661	·06043	·06839
37	·04174	·04511	·04861	·05224	·05598	·05984	·06786
38	·04107	·04446	·04798	·05163	·05540	·05928	·06736
39	·04044	·04384	·04739	·05106	·05486	·05876	·06689
40	·03984	·04326	·94683	·05052	·05434	·05828	·06646
41	·03927	·04271	·04630	·05002	·05386	·05782	·06606
42	·03873	·04219	·04580	·04954	·05341	·05739	·06568
43	·03822	·04170	·04533	·04909	·05298	·05699	·06533
44	·03773	·04123	·04488	·04866	·05258	·05662	·06501
45	·03727	·04079	·04445	·04826	·05220	·05626	·06470
46	·03683	·04036	·04405	·04788	·05184	·05593	·06441
47	·03641	·03996	·04367	·04752	·05151	·05561	·06415
48	·03601	·03958	·04331	·04718	·05119	·05532	·06390
49	·03562	·03921	·04296	·04686	·05089	·05504	·06366
50	·03526	·03887	·04263	·04655	·05060	·05478	·06344
55	·03365	·03735	·04121	·04523	·04939	·05367	·06254
60	·03235	·03613	·04009	·04420	·04845	·05283	·06183
65	·03128	·03515	·03919	·04339	·04773	·05219	·06139
70	·03040	·03434	·03846	·04275	·04717	·05170	·06103
75	·02965	·03367	·03787	·04223	·04672	·05132	·06077
80	·02903	·03311	·03738	·04181	·04637	·05103	·06057
85	·02849	·03265	·03699	·04148	·04609	·05080	·06043
90	·02804	·03226	·03666	·04121	·04587	·05063	·06032
93	·02765	·03193	·03639	·04099	·04570	·05049	·06024
100	·02731	·03165	·03616	·04081	·04556	·05038	·06018

Table IV.

The Amount of £1 in any number of Years.

Years.	2½ pr. Ct.	3 pr. Ct.	3½ pr. Ct.	4 pr. Ct.	4½ pr. Ct.	5 pr. Ct	6 pr. Ct.
1	1·02500	1·03000	1·03500	1·04000	1·04500	1·05000	1·06000
2	1·05063	1·06090	1·07123	1·08160	1·09203	1·10250	1·12360
3	1·07689	1·09273	1·10872	1·12486	1·14117	1·15763	1·19102
4	1·10381	1·12551	1·14752	1·16986	1·19252	1·21551	1·26248
5	1·13141	1·15927	1·18769	1·21665	1·24618	1·27628	1·33823
6	1·15969	1·19405	1·22926	1·26532	1·30226	1·34010	1·41852
7	1·18869	1·22987	1·27228	1·31593	1·36086	1·40710	1·50363
8	1·21840	1·26677	1·31681	1·36857	1·42210	1·47746	1·59385
9	1·24886	1·30477	1·36290	1·42331	1·48610	1·55133	1·68948
10	1·28008	1·34392	1·41060	1·48024	1·55297	1·62889	1·79085
11	1·31209	1·38423	1·45997	1·53945	1·62285	1·71034	1·89830
12	1·34489	1·42576	1·51107	1·60103	1·69588	1·79586	2·01220
13	1·37851	1·46853	1·56396	1·66507	1·77220	1·88565	2·13293
14	1·41297	1·51259	1·61869	1·73168	1·85194	1·97993	2·26090
15	1·44830	1·55797	1·67535	1·80094	1·93528	2·07893	2·39656
16	1·48451	1·60471	1·73399	1·87298	2·02237	2·18287	2·54035
17	1·52162	1·65285	1·79468	1·94790	2·11338	2·29202	2·69277
18	1·55966	1·70243	1·85749	2·02582	2·20848	2·40662	2·85434
19	1·59865	1·75351	1·92250	2·10685	2·30786	2·52695	3·02560
20	1·63862	1·80611	1·98979	2·19112	2·41171	2·65330	3·20714
21	1·67958	1·86029	2·05943	2·27877	2·52024	2·78596	3·39956
22	1·72157	1·91610	2·13151	2·36992	2·63365	2·92526	3·60354
23	1·76461	1·97359	2·20611	2·46472	2·75217	3·07152	3·81975
24	1·80873	2·03279	2·28333	2·56330	2·87601	3·22510	4·04893
25	1·85394	2·09378	2·36324	2·66584	3·00543	3·38635	4·29187
26	1·90029	2·15659	2·44596	2·77247	3·14068	3·55567	4·54938
27	1·94780	2·22129	2·53157	2·88337	3·28201	3·73346	4·82235
28	1·99650	2·28793	2·62017	2·99870	3·42970	3·92013	5·11169
29	2·04641	2·35657	2·71189	3·11865	3·58404	4·11614	5·41839
30	2·09757	2·42726	2·80679	3·24340	3·74532	4·32194	5·74349
31	2·15001	2·50008	2·90503	3·37313	3·91386	4·53804	6·08810
32	2·20376	2·57508	3·00671	3·50806	4·08998	4·76494	6·45339
33	2·25885	2·65234	3·11194	3·64838	4·27403	5·00319	6·84059
34	2·31532	2·73191	3·22086	3·79432	4·46636	5·25335	7·25103
35	2·37321	2·81386	3·33359	3·94609	4·66735	5·51602	7·68609
36	2·43254	2·89828	3·45027	4·10393	4·87738	5·79182	8·14725
37	2·49335	2·98523	3·57103	4·26809	5·09686	6·08141	8·63609
38	2·55568	3·07478	3·69601	4·43881	5·32622	6·38548	9·15425
39	2·61957	3·16703	3·82537	4·61637	5·56590	6·70475	9·70351
40	2·68506	3·26204	3·95926	4·80102	5·81636	7·03999	10·28572
41	2·75219	3·35990	4·09783	4·99306	6·07810	7·39199	10·90286
42	2·82100	3·46070	4·24126	5·19278	6·35162	7·76159	11·55703
43	2·89152	3·56452	4·38970	5·40050	6·63744	8·14967	12·25045
44	2·96381	3·67145	4·54334	5·61652	6·93612	8·55715	12·98548
45	3·03790	3·78160	4·70236	5·84118	7·24825	8·98501	13·76461
46	3·11385	3·89504	4·86694	6·07482	7·57442	9·43426	14·59049
47	3·19170	4·01190	5·03728	6·31782	7·91527	9·90597	15·46592
48	3·27149	4·13225	5·21359	6·57053	8·27146	10·40127	16·39387
49	3·35328	4·25622	5·39606	6·83335	8·64367	10·92133	17·37750
50	3·43711	4·38391	5·58493	7·10668	9·03264	11·46740	18·42015
55	3·88877	5·08215	6·63314	8·64637	11·25631	14·63568	24·65032
60	4·39979	5·89160	7·87809	10·51963	14·02741	18·67919	32·98769
65	4·97796	6·82998	9·35670	12·79874	17·48070	23·83990	44·14497
70	5·63210	7·91782	11·11283	15·57162	21·78414	30·42643	59·07593
75	6·37221	9·17893	13·19855	18·94525	27·14700	38·83269	79·05692
80	7·20957	10·64089	15·67574	23·04980	33·83010	49·56144	105·7960
85	8·15696	12·33571	18·61786	28·04360	42·15846	63·25435	141·5789
90	9·22896	14·30047	22·11218	34·11933	52·53711	80·73037	189·4645
95	10·44160	16·57816	26·26233	41·51139	65·47079	103·0347	253·5463
100	11·81372	19·21863	31·19141	50·50495	81·58852	131·5013	339·3021

Table V.

The Amount of £1 per annum in any number of Years.

Years.	2½ per Cent.	3 per Cent.	3½ per Cent.	4 per Cent.	4½ per Cent.	5 per Cent.	6 per Cent.
1	1·00000	1·00000	1·00000	1·00000	1·00000	1·00000	1·00000
2	2·02500	2·03000	2·03500	2·04000	2·04500	2·05000	2·06000
3	3·07563	3·09090	3·10623	3·12160	3·13703	3·15250	3·18360
4	4·15252	4·18363	4·21494	4·24646	4·27819	4·31013	4·37462
5	5·25633	5·30914	5·36247	5·41632	5·47071	5·52563	5·63709
6	6·38774	6·46841	6·55015	6·63298	6·71689	6·80191	6·97532
7	7·54743	7·66246	7·77941	7·89829	8·01915	8·14201	8·39384
8	8·73612	8·89234	9·05169	9·21423	9·38001	9·54911	9·89747
9	9·95452	10·15911	10·36850	10·58280	10·80211	11·02656	11·49132
10	11·20338	11·46388	11·73139	12·00611	12·28821	12·57789	13·18079
11	12·48347	12·80780	13·14199	13·48635	13·84118	14·20679	14·97164
12	13·79555	14·19203	14·60196	15·02581	15·46403	15·91713	16·86994
13	15·14044	15·61779	16·11303	16·62684	17·15991	17·71298	18·88214
14	16·51895	17·08632	17·67699	18·29191	18·93211	19·59863	21·01507
15	17·93193	18·59891	19,29568	20·02359	20·78405	21·57856	23·27597
16	19·38022	20·15688	20·97103	21·82453	22·71934	23·65749	25·67253
17	20·86473	21·76159	22·70502	23·69751	24·74171	25·84037	28·21288
18	22·38635	23·41444	24·49969	25·64541	26·85508	28·13238	30·90565
19	23·94601	25·11687	26·35718	27·67123	29·06356	30·53900	33·75999
20	25·54466	26·87037	28·27968	29·77808	31·37142	33·06595	36·78559
21	27·18327	28·67649	30·26947	31·96920	33·78314	35·71925	39·99273
22	28·86286	30·53678	32·32890	34·24797	36·30328	38·50521	43·39229
23	30·58443	32·45288	34·46041	36·61789	38·93703	41·43048	46·99583
24	32·34904	34·42647	36·66653	39·08260	41·68920	44·50200	50·81558
25	34·15776	36·45926	38·94986	41·64591	44·56521	47·72710	54·86451
26	36·01171	38·55304	41·31310	44·31174	47·57064	51·11345	59·15638
27	37·91200	40·70963	43·75906	47·08421	50·71132	54·66913	63·70577
28	39·85980	42·93092	46·29063	49·96758	53·99333	58·40258	68·52811
29	41·85630	45·21885	48·91080	52·96629	57·42303	62·32271	73·63980
30	43·90270	47·57542	51·62268	56·08494	61·00707	66·43885	79·05819
31	46·00027	50·00268	54·42947	59·32834	64·75239	70·76079	84·80168
32	48·15028	52·50276	57·33450	62·70147	68·66625	75·29883	90·88978
33	50·35403	55·07784	60·34121	66·20953	72·75623	80·06377	97·34316
34	52·61289	57·73018	63·45315	69·85791	77·03026	85·06696	104·18375
35	54·92821	60·46208	66·67491	73·65222	81·49662	90·32031	111·43478
36	57·30141	63·27594	70·00760	77·59831	86·16397	95·83632	119·12087
37	59·73395	66·17422	73·45787	81·70225	91·04134	101·62814	127·26812
38	62·22730	69·15945	77·02889	85·97031	96·13820	107·70955	135·90421

Table V.—*continued.*

The Amount of £1 per annum in any number of Years:

Years.	2½ per Cent.	3 per Cent.	3½ per Cent.	4 per Cent.	4½ per Cent.	5 per Cent.	6 per Cent.
39	64·78298	72·23423	80·72491	90·40915	101·46442	110·49502	145·05846
40	67·40255	75·40126	84·55028	95·02552	107·03032	120·79977	154·76197
41	70·08762	78·66330	88·50954	99·82654	112·84669	127·83976	165·04768
42	72·83981	82·02320	92·60737	104·81960	118·92479	135·23175	175·95054
43	75·66080	85·48389	96·84563	110·01238	125·27640	142·99334	187·50758
44	78·55232	89·04841	101·23833	115·41288	131·91384	151·14301	199·75803
45	81·51613	92·71986	105·78167	121·02939	138·84997	159·70016	212·74351
46	84·55403	96·50146	110·48403	126·87057	146·09821	168·68516	226·50812
47	87·66789	100·39650	115·35097	132·94539	153·67263	178·11942	241·09861
48	90·85958	104·40840	120·38826	139·26321	161·58790	188·02539	256·56453
49	94·13107	108·54065	125·60185	145·83373	169·85936	198·42666	272·95840
50	97·48435	112·79687	130·99791	152·66703	178·50303	209·34800	290·33590
55	115·55092	136·07162	160·94689	191·15917	227·91796	272·71262	394·17203
60	135·99159	163·05344	196·51688	237·99069	289·49795	353·58372	533·12818
65	159·11833	194·33276	238·76288	294·96838	366·23783	456·79801	719·08286
70	185·28411	230·59406	288·93786	364·29046	461·86968	588·52851	967·93217
75	214·88830	272·63086	348·53001	448·63137	581·04436	756·65372	1300·94868
80	248·38271	321·36302	419·30679	551·24498	729·55770	971·22882	1746·59989
85	286·27857	377·85695	503·36739	676·09012	914·63234	1245·08707	2342·98174
90	329·15425	443·34890	603·20503	827·98333	1145·26901	1594·60730	3141·07519
95	377·66415	519·27203	721·78082	1012·78465	1432·68426	2040·69353	4209·10425
100	432·54865	607·28773	862·61166	1237·62370	1790·85596	2610·02516	5638·36806

The amount of money which persons are willing to pay for the temporary use of money depends upon a variety of circumstances. When profits are high the rate of interest will also be high. When, on the contrary, money capital is abundant in proportion to the calls for its employment, the competition of those persons who possess money, and who derive an income from it, will cause them to underbid each other in the money-market. They will lend money at a low rate of interest to traders, who again will meet each other in competition in their various occupations, and must be content with such a rate of profit as will repay the low rate of interest for which they have bargained, together with such a compensation for their risk, skill, and trouble in its management as the degree of competition at the time will allow. If some new channel for the employment of money should be opened holding out the promise of higher profits, a competition among borrowers will ensue, the effect of which will be to raise the rate of interest until it assumes its due proportion to the rate of profits; and as there never can, generally speaking, be two rates of profits at the same time (at least for any long period), in the same market, the effect of the additional call for capital to supply the partial demand that has been supposed, will be to raise profits and interest generally. An increase of money capital, either absolutely, or relatively to the means for its employment, will obviously have the contrary effect of lowering its value in use, that is, reducing the rate of interest and profits.

It would be difficult to imagine any circumstances bearing upon this subject which must not resolve themselves into the conditions here proposed, and it is therefore difficult to see wherein consists the wisdom on the part of governments of limiting the rate of interest; and yet the fact of such limitation has usually been the rule, and the absence of restriction as to the rate of interest the exception. The circumstance of the laws which regulate and limit the rate of interest in this country having been made by those who were among the class of borrowers rather than that of lenders, may perhaps afford some explanation of the views of the legislature in putting restrictions on the trade in money. That these restrictions however were, and so far as they exist still are, unfavourable both to lenders and borrowers, and more unfavourable to the borrowers than the lenders, may easily be demonstrated. In the year 1787 Mr. Bentham wrote his 'Defence of Usury,' and showed, in a manner which one would have thought adapted to produce general conviction, the mischief of such restrictions so far as the law was operative, and the inefficacy of the law to prevent altogether what are denominated usurious transactions. But the minds of those who in this country have the functions of legislation to discharge are slow in surrendering a prejudice or a false judgment to the attacks of true principles, and for many years the efforts of Mr. Bentham and others remained fruitless. The system of restriction has however of late been modified in some important particulars, so that within certain limits, as regards time, the rate of interest among the mercantile classes may now be said to depend upon what may be considered the market value of money, which is thus allowed to bear its due proportion to the current and usual rate of profits. A statute passed in 1545 limited the rate of interest to 10 per cent. per annum; in 1624 the rate was lowered to 8 per cent., in 1660 to 6 per cent., and by the statute 12 Anne, c. 16 (1713), it was further reduced to 5 per cent., beyond which rate, with the recent exception above referred to, it has been illegal to charge since that time, under the penalty of forfeiting for every offence three times the amount of the money lent.

During the late war, when the rate of profit was high and when the government was an habitual borrower of enormous sums, the system of restriction was not adhered to in the negotiation of its loans, the interest upon which was necessarily regulated by the market value of money; and at all times necessitous borrowers and those who have a doubtful or insufficient security to offer to lenders have always found means to evade the statute by granting annuities [ANNUITIES] and by other means. Except for one or two almost momentary occasions of commercial difficulty or panic the market rate of interest in this country has not been higher, since the peace in 1815, than the legal rate.

The law does not recognise the charge of interest upon interest, or, as it is called, compound interest, and yet it is only equitable that where money which is due for interest is not settled, it should be considered a fresh loan, for the use of which interest should be paid. This however is a rule so easily evaded by the borrower granting a further acknowledgement of the interest as though it were principal, that it does not amount to a practical hardship: such new contract, in fact, changes the interest already due into a principal sum. The law also recognises *rests* in mercantile and banking accounts, in which *interest is* charged upon a former ascertained balance. Such balance may, and in fact often does, include interest already due; and thus the creditor really receives interest upon interest, or compound interest.

Debts do not as an invariable rule carry even simple interest from the time when the money becomes due to the creditor: in such case payment of interest is rather the exception than the rule. Unless the debt be such a debt as carries interest by the custom of merchants or traders, or unless there is an express agreement to such effect between the parties, or unless such agreement can be inferred from their course of dealing, or unless there are some very *special* circumstances, debts do not necessarily carry interest from the time when due. But now, by 3 and 4 Will. IV., c. 42, a jury may, if they think fit, upon all debts or sums certain, allow interest to the creditor, at a rate not exceeding the current rate of interest, from the time when such debts or sums were payable, if payable by virtue of a written instrument at a certain time; or if payable otherwise, then from the time of a demand of payment in writing, so as such demand give notice that interest will be claimed from the date of such demand. This statute also empowers juries to give damages, in the nature of interest, in respect of the detention or appropriation of goods. By 1 and 2 Vict., c. 110, all judgment-debts are to carry interest at the rate of 4 per cent. per ann. from the time of entering up the judgment. Legacies are payable at the end of one year after a testator's death, and from the end of that year carry interest at the rate of four per cent. per annum; unless the testator has made special provisions in his will as to the time of payment and the rate of interest. As to interest of money lent on ships or their cargo see BOTTOMRY.

The relaxation above mentioned as having been made as to the rate of interest formed part of the arrangement made in 1833, at the last renewal of the charter of the Bank of England. It consisted in excepting from the operation of the statute all bills of exchange and promissory notes not having more than three months to run previous to their maturity; these might be discounted at any rate of interest agreed upon with the holder. More recently, by the act 1 Victoria, c. 70 (July, 1837), this relaxation was extended to all such mercantile instruments not having more than twelve months to run before they are due.

INTERJECTIONS have been defined to be 'words used to express some passion or emotion of the mind,' as exclamations of joy, grief, astonishment, &c. Interjections however can hardly be considered as a distinct part of speech, but are more properly natural sounds common to all men when laughing, in pain, &c. Many words, such as *malum, macte, profecto*, &c., in Latin, and *adieu, welcome*, &c., in English, which have been considered as interjections by grammarians, ought to be regarded as verbs, substantives, adjectives, or adverbs.

INTERLOCUTORY (*inter*, between, and *loquor*, to speak), a term applied to those judgments, decrees, and orders of courts of law and equity which are made in the progress of a suit before final judgment. Thus, orders for the production of papers, for taking an account of the dealings out of which the dispute arises, are interlocutory orders or decrees; and those judgments which, though they establish the right of the plaintiff, leave the amount of damages to be ascertained by a jury, are interlocutory judgments.

INTERLUDE, a brief piece of church music for the organ, seldom exceeding a few bars, generally produced *ex tempore*, and played after each stanza, except the last, of the metrical psalm. This, being merely for the purpose of giving breathing time to the singers, should always be short and grave, and in keeping with the psalm tune.

INTERLUDE. [ENGLISH DRAMA.]

INTERMENT, the burial of a dead body in the earth. All nations have felt the necessity of disposing, in some manner, of their dead, both to avoid the disagreeable sensation which the sight of a dead body occasions, to prevent it from being devoured by wild beasts, and to guard against the noxious effects which arise from the putrefaction of dead animal matter when exposed to the atmosphere. Among some of the nations of antiquity we find that a superstitious veneration for the dead, the necessity of funeral rites in order to secure the future happiness of the deceased, and the crime attached to the violation of the tomb, formed a part both of their civil and religious code. The manner of disposing of the bodies of the dead has varied in different nations; but the most general modes have been interment in the earth and burning on a funeral pile. The practice of burying is probably the oldest as it is the simplest mode, and with most nations has always been the ordinary mode of sepulture; but the custom of burning the body, and afterwards collecting the ashes and depositing them in a tomb or urn, became very general, and was the common practice of the Greeks and Romans, so far as we know their history. The Egyptians do not seem to have ever adopted the practice of burning the dead; and though, as we have observed, burning was common among the antient Greeks and Romans, it seems likely that interment was always practised by the lower orders. At Rome bodies were sometimes buried in pits (puticuli), or thrown to decay in certain unfrequented places. (Varro, *De Ling. Lat.* 4.) The practice of burning seems to have gradually ceased at Rome under the emperors. Tacitus (xvi. c. 6) speaks of the embalming and interment of Poppæa as a deviation from the general practice. For further particulars the reader is referred to the *Townley Gallery*, 'Library of Entertaining Knowledge,' and the article COLUMBARIUM in this work.

At the present day all European nations deposit their dead in the earth, and the ceremony of burning is extinct in Europe. It was proposed indeed to revive it during the French revolution, but the idea was never adopted. In the early ages of the world, the dead were probably only deposited in holes in the ground, which were filled up with earth; but this would scarcely be found a sufficient protection against wild beasts, and heaps of stones or mounds of earth were accordingly added. Respect for the memory of the dead, the fear of their being forgotten or confounded with the vulgar, have given rise in all ages to the erection of sepulchres, tombs, and monuments of all kinds, to perpetuate the remembrance of those whom the survivors loved or honoured.

The places set apart for the burial of the dead are generally called cemeteries, which is a Greek term signifying 'a place of rest or sleep,' and was applied to common places of interment by the early Christians. It is a matter of great importance to determine what are the best situations for cemeteries. Among the Greeks we find that they were usually without the cities. Among the Romans the tombs were generally placed by the sides of the public roads.

The early Christians followed the custom of the Romans, but they afterwards transferred their burial-places to the vicinity of the churches and within towns, where they have continued to be generally situated up to the present time, the churchyard being the usual place of interment, though, when the church is surrounded by houses, it is by no means a fit situation; for the putrid exhalations arising during the decomposition of animal bodies are highly injurious to health, and capable of giving rise to, or at least of encouraging, the progress of various pestilential diseases, of which the most common in this country are low nervous or typhus fevers. Thus the situation of cemeteries becomes an important consideration, in connexion with public hygiène, or medical police. The advantage, in point of salubrity, of having burial-places removed to some distance from large towns, is now beginning to be seen, and it is to be hoped that in a few years the practice of burying the dead in the midst of crowded cities and in churches will entirely cease. Cemeteries should be placed on high ground, and to the north of habitations, so that southerly winds should not blow over the houses charged with the putrid exhalations; low wet places should be avoided, and care should be taken that bodies are not interred near wells or rivers from which people are supplied with water.

The subject of interment possesses considerable interest in a medico-legal point of view, for it is often of great importance to determine how long a body has lain in the ground; and by observing the changes which naturally take place in bodies at different stages of decomposition, it is possible in some cases to determine whether certain marks are the result of decomposition or the remains of injuries inflicted before death.

The chemical constitution of the soil seems to have little influence either in hastening or retarding decomposition: the two most active agents in accelerating this process are air and moisture. Accordingly we find that the greater the depth from the surface at which a body is interred, the longer it resists putrefaction, and it will remain unchanged for a considerable period if enclosed in a leaden coffin so as altogether to exclude the air. The action of the earth depends, in a great measure, on its power of absorbing and retaining moisture; thus in sandy soils through which the water drains quickly, decomposition goes on slowly, and is sometimes altogether prevented, as in cases where people have perished in deserts, and have been overwhelmed by the drifting sands, in which their bodies have been found long after, dry and shrivelled, but without any sign of having undergone putrefaction. In clayey soils, which retain water, putrefaction readily takes place, and quickly proceeds to the destruction of all the soft parts, unless transformation into adipocire is effected, which stops decomposition. [ADIPOCIRE.] Bodies may change in three ways, as the result of decomposition: first, the putrefactive process may go on uninterruptedly till the soft parts are entirely destroyed, and only the skeleton remains; secondly, the flesh may be converted into adipocire; thirdly, the body may become dried, and preserve its form, and be converted into a sort of natural mummy. This last change sometimes takes place in the ground in very dry and elevated situations, but more frequently in dry vaults and caves. With respect to the successive changes which the body undergoes in its progress to complete decomposition, it has been found that every portion of the face is generally destroyed between the third and fourth months; the thorax rarely undergoes any change for the first three months; nor the abdomen, except in the colour of its integuments, but after that period it collapses and its parietes become very thin. For an accurate knowledge of this subject we are principally indebted to the labours of Orfila, to whose 'Exhumations Juridiques' we refer for further information.

INTERMITTENT. [FEVER.]

INTERNAL and EXTERNAL, geometrical terms applied to the angles made by the sides of a bounded figure. The angle made by two sides is an internal angle; that made by a side and a side produced is an external angle.

INTERPLEADER, or ENTER PLEADER, the name of a suit or action at law, or in equity. When a person holding goods, or owing a debt or duty, is sued by two or more claimants, the court will order them to interplead upon the application of the party sued, and upon his delivering up or offering to deliver up the matter in dispute, and disclaiming all interest therein. Antiently this doctrine formed a great title in the law, but from the number of exceptions and technical niceties admitted by courts of law, parties sued or liable to be sued by two or more persons in respect of one matter were able to obtain relief in courts of equity only, which disregarded mere formal objections, and interfered upon the filing of what is called a Bill of Interpleader. The legislature, upon the recommendation of the late Common Law Commissioners, by the statute 1 and 2 Wm. IV., c. 58, has rendered this mode of relief more easy of attainment in the courts of law.

INTERPOLATION. Every mathematical table consists of a series of values of some algebraical expression corresponding to equidistant values of the letter on which it depends. Thus, the most extensive table of logarithms in common use is a succession of values of log. x, answering to $x = 10{,}000$, $x = 10{,}001$, $x = 10{,}002$, and so on up to $x = 99{,}999$. The process of interpolation is that of inserting in a table values of the tabulated function intermediate to those given in the table. For example, suppose that p, q, r, s, &c., are written in a table opposite to a, $a + b$, $a + 2b$, $a + 3b$, &c., and it is demanded what is the value of the function corresponding to $a + 2\frac{1}{2}b$: this is a question of interpolation.

Such a question can only be solved approximately, but, generally speaking, the values in the table are themselves but approximations, and the interpolated values are as correct as the tabular ones. Strictly speaking, the question itself is indeterminate, for no function can be determined by means of any finite number of values, however great. The question is precisely analogous to that of drawing a curve through a given number of points, which may be done in an infinite number of ways, how many points soever there may be. But if the points be gradually increasing in distance from a given line, and if it be a condition that the intermediate points must do the same, then if the points be near together, any two curves which satisfy the conditions must very nearly coincide. If equidistant abscissæ of such a curve be tabulated with their ordinates, then the ordinates corresponding to intermediate abscissæ will be very nearly the same for any curve which can pass through the points which belong to the tabulated ordinates.

The method of interpolation consists entirely in the application of the following theorem. [DIFFERENCE.] Let p, q, r, s, t, &c., be terms of a series corresponding to a, $a + b$, $a + 2b$, &c., and let the successive differences be formed, as in the following table:

$$\begin{array}{c|ccccc}
\vdots & \vdots & \vdots & \vdots & \vdots \\
a & p & & & \\
 & & \Delta p & & \\
a + b & q & & \Delta^2 p & \\
 & & \Delta q & & \Delta^3 p \\
a + 2b & r & & \Delta^2 q & \\
 & & \Delta r & & \Delta^3 q \\
a + 3b & s & & \Delta^2 r & \\
 & & \Delta s & & \vdots \\
a + 4b & t & & \vdots & \\
\vdots & \vdots & \vdots & &
\end{array}$$

where Δp is $q - p$, &c., $\Delta^2 p$ is $\Delta q - \Delta p$, &c. Then the nth term reckoned from p exclusive is

$$p + n\,\Delta p + n\,\frac{n-1}{2}\,\Delta^2 p + n\,\frac{n-1}{2}\,\frac{n-2}{3}\,\Delta^3 p + \text{\&c.} \quad \text{(A).}$$

Thus q is $p + \Delta p$, r is $p + 2\Delta p + \Delta^2 p$, and so on. This series, which gives the rest of the table accurately, will give the intermediate values approximately, if p, Δp, $\Delta^2 p$, &c., diminish rapidly. Thus, by making $n = \frac{1}{2}$, we find the term which should stand opposite to $a + \frac{1}{2}b$, if the table were made twice as minute as it now is, or, as we may say, *bisected*: if $n = 2\frac{1}{2}$, we find the term answering to $a + 2\frac{1}{2}b$, and so on. The following is an instance:—

Given the present value of 1,000,000*l.* 20 years hence, at 2, 4, 6, 8, and 10 per cent.: to deduce from thence an approximation at the rate of $4\frac{1}{2}$ per cent. Let it be observed, that from 2 to $4\frac{1}{2}$ is one interval and a quarter of the tables, or $n = 1\frac{1}{4}$.

$$\begin{array}{r|lllll}
2 & 672971 & & & & \\
 & & -216584 & & & \\
4 & 456387 & & +72002 & & \\
 & & -144582 & & -24677 & \\
6 & 311805 & & +47325 & & +8705 \\
 & & -\ \ 97257 & & -15972 & \\
8 & 214548 & & +31353 & & \\
 & & -\ \ 65904 & & & \\
10 & 148644 & & & &
\end{array}$$

We have taken this example to show, when the intervals of the tables are considerable, how slowly the differences may diminish. The consequence is that only four places of the result will be correct. We have now

$$p = 672971 \qquad \Delta^3 p = -24677$$
$$\Delta p = -216584 \qquad \Delta^4 p = +8705$$
$$\Delta^2 p = +72002$$

$$n = \frac{5}{4},\quad \frac{n-1}{2} = \frac{1}{8},\quad \frac{n-2}{3} = -\frac{1}{4},\quad \frac{n-3}{4} = -\frac{7}{16},$$
$$n\,\frac{n-1}{2} = \frac{5}{32},\quad n\,\frac{n-1}{2}\,\frac{n-2}{3} = -\frac{5}{128},$$
$$n\,\frac{n-1}{2}\,\frac{n-2}{3}\,\frac{n-3}{4} = \frac{35}{2048}.$$

$$\begin{array}{rrr}
 & & 672971 \\
\frac{5}{4} & \times -216584 = & -270730 \\
\frac{5}{32} & \times 72002 = & +\ \ 11250 \\
-\frac{5}{128} & \times -\ \ 24677 = & +\ \ \ \ 964 \\
\frac{35}{2048} & \times \ \ 8705 = & +\ \ \ \ 149 \\
\hline
 & \text{Answer} & 414604 \\
 & \text{Correct Answer} & 414643
\end{array}$$

The smaller the tabular interval, the more correctly will a given number of differences serve to make the interpolation. Let us take the preceding question on the supposition that the rates are 2, 3, 4, 5, and 6 per cent., in which from 2 to $4\frac{1}{2}$ is $2\frac{1}{2}$ intervals, or $n = 2\frac{1}{2}$.

$$\begin{array}{r|lllll}
2 & 672971 & & & & \\
 & & -119295 & & & \\
3 & 553676 & & +22006 & & \\
 & & -\ \ 97289 & & -4215 & \\
4 & 456387 & & +17791 & & +838 \\
 & & -\ \ 79498 & & -3377 & \\
5 & 376889 & & +14414 & & \\
 & & -\ \ 65084 & & & \\
6 & 311805 & & & &
\end{array}$$

$$n = \frac{5}{2},\quad n\,\frac{n-1}{2} = \frac{15}{8},\quad n\,\frac{n-1}{2}\,\frac{n-2}{3} = \frac{5}{16},$$
$$n\,\frac{n-1}{1}\,\frac{n-2}{3}\,\frac{n-3}{4} = -\frac{5}{128}.$$

$$\begin{array}{rrr}
 & & 672971 \\
\frac{5}{2} & \times -119295 = & -29823 \\
\frac{15}{8} & \times +\ \ 22006 = & +\ 41261 \\
\frac{5}{16} & \times -\ \ \ \ 4215 = & -\ \ \ 1317 \\
-\frac{5}{128} & \times +\ \ \ \ \ 838 = & -\ \ \ \ \ 33 \\
\hline
 & \text{Answer} & 414644 \\
 & \text{Correct Answer} & 414643
\end{array}$$

The most simple interpolation is that which takes first differences only into account, and is perfectly well known to every one who can use a table of logarithms, or interpose arithmetical means.

We now give some instances in which the intermediate terms are expressed by means, not of the differences of given terms, but of the terms themselves. The case which most often occurs is that in which it is required to bisect the interval of the tables, and in this case a rule may be given which amounts to using the *third* differences, and is extremely simple. Let p, q, r, and s be successive terms of a table, and let it be required to find the term intermediate between q and r, that is, if q and r stand opposite to x and $x+y$, required the term answering to $x+\frac{1}{2}y$. The following formula shows the process:—

$$\frac{q+r}{2}+\frac{(q+r)-(p+s)}{16}\quad \ldots \text{(B)}.$$

Thus in the preceding instance—

$$\begin{array}{ll} p = 553676 & q+r = 833276 \\ q = 456387 & p+s = \underline{865481} \\ r = 376889 & \quad 4)-\ 32205 \\ s = 311805 & \quad 4)-\ \ 8051 \\ & \qquad -\ \ \underline{2013} \\ & \tfrac{1}{2}(q+r) = \underline{416638} \\ & \text{Answer}\ \ 414625 \end{array}$$

This more simple rule is equivalent to the use of the preceding method with p and its first three differences. It requires that two terms should lie on each side of the term sought; but if it were required to bisect the interval between p and q by means of p, q, r, and s, the formula is as follows:

$$q-\frac{5(r-p)-(s-q)}{16}\quad \ldots \text{(C)}$$

Thus, to find the value at $3\frac{1}{2}$ per cent. from the preceding data, we have

$$\begin{array}{rr} r-p = & -\ 176787 \\ & \underline{5} \\ & -\ \underline{883935} \\ s-q = & -\ \underline{144582} \\ 5(r-p)-(s-q) = & 4)-\ 739353 \\ & 4)-\ 184838 \\ & -\ \ \underline{46210} \\ q = & \underline{456387} \\ \text{Answer} & 502597 \\ \text{Correct Answer} & 502566 \end{array}$$

The formula for the bisection of the interval of r and s by means of p, q, r, and s, is

$$r+\frac{5(s-q)-(r-p)}{16}\quad \ldots \text{(D)}.$$

Where extreme accuracy of bisection is required, the following rule will be equivalent to going as far as fifth differences, and taking from the table three terms on each side of the intermediate term required. Let the terms of the table be p, q, r, s, t, and u, the intermediate term of r and s being required.

$$\begin{array}{lll} p & q & r \\ \underline{u} & \underline{t} & \underline{s} \\ u+p=x & t+q=y & s+r=z \end{array}$$

$$\text{Intermed. term} = \frac{z}{2}+\frac{25(z-y)+3(x-z)}{256}\quad \ldots \text{(E)}.$$

As an instance, take from the article INTEREST (p. 503) the logarithms to ten places of 1·01, 1·02, 1·03, 1·04, 1·05, and 1·06, for p, q, r, s, t, and u, neglecting decimal points and preliminary ciphers.

$$\begin{array}{rrr} 43213738 & 86001718 & 128372247 \\ \underline{253058653} & \underline{211892991} & \underline{170333393} \\ x = 296272391 & y = 297894709 & z = 298705640 \\ \underline{298705640} & & \underline{297894709} \\ -\ 2433249 = x-z & & z-y = 4)81093100 \\ \underline{3} & & \underline{20273275} \\ -\ 7299747 & & -\ \underline{7299747} \\ & & 8)\underline{12973528} \\ \tfrac{1}{2}z = 149352820 & & 8)\ \underline{1621691} \\ \underline{50678} & & 4)\ \underline{202711{\cdot}4} \\ \text{Ans.}\ \ {\cdot}0149403498 = \text{log. } 1{\cdot}035 & & 50677{\cdot}9 \end{array}$$

The formula (B) is sufficient to bisect the intervals given in the article cited.

The following is the method by which the formula (A) may be expressed in terms, not of p, Δp, &c., but of p, q, r, &c. Suppose this is to be done as far as the third difference, or in terms of p, q, r, and s. Assume for the function in question

$$A(n-1)(n-2)(n-3)+Bn(n-2)(n-3)+Cn(n-1)(n-3)+Dn(n-1)(n-2).$$

When $n=0$, this should be p; but it then becomes $-6A$, whence $A=-\frac{1}{6}p$. When $n=1$, this should be q; but it then becomes $2B$, whence $B=\frac{1}{2}q$. Similarly $C=-\frac{1}{2}r$, and $D=\frac{1}{6}s$: or the function tabulated, within the given limit, is, so far as third differences can determine it,

$$n(n-1)\left\{\frac{n-2}{6}s-\frac{n-3}{2}r\right\}$$

$$+(n-2)(n-3)\left\{\frac{n}{2}q-\frac{n-1}{6}p\right\}$$

This method may be extended to the interpolation of intermediate values, when the given values are not equally distant. Suppose that according as n is a, b, or c, a function is p, q, or r. Assume for the function

$$A(n-b)(n-c)+B(n-a)(n-c)+C(n-a)(n-b).$$

Then when $n=a$, we must have $A(a-b)(a-c)=p$, or

$$A=\frac{p}{(a-b)(a-c)};\ B=\frac{q}{(b-a)(b-c)};\ C=\frac{r}{(c-a)(c-b)}$$

The following results will serve as an instance of the application of the last method but one. Suppose it required to interpose four equidistant values between q and r in the series p, q, r, s, using third differences inclusive. First interpose four arithmetical means between q and r, and let them be A, B, C, D: then interpose four arithmetical means between $3q-2p-s$, and $3r-2s-p$, and let these be A′, B′, C′, and D′. Then the four terms intermediate between q and r must be

$$A+\tfrac{8}{300}A',\quad B+\tfrac{4}{100}B',\quad C+\tfrac{4}{100}C',\quad D+\tfrac{8}{300}D'.$$

If it be required to interpose three equidistant values between q and r, using third differences, take p, q, r, s, and between q and r interpose three arithmetical means, A, B, and C; also between $3q-2p-s$ and $3r-2s-p$ interpose three means, A′, B′, and C′. Then the three terms required are

$$A+\tfrac{1}{32}A',\ B+\tfrac{1}{24}B',\ C+\tfrac{1}{32}C'.$$

To interpose two terms, still with third differences, find two arithmetical means between $30q-2p-s$ and $30r-2s-p$; the twenty-seventh parts of these means are the intermediate terms required. The interpolation of one term has already been given (B).

When second differences only are used, no material simplification of the fundamental rule can be given. To place k intermediate terms between q and r by means of q, r, and s, interpose k arithmetical means, and correct them as follows. Calculate $(q+s-2r)\div 2(k+1)^2$, and call this A; then subtract from the several means

$$kA,\ 2(k-1)A,\ 3(k-2)A,\ \ldots\ (k-1)2A,\ kA.$$

It would be a little more correct to let A be $(p+r-q-s)\div 4(k+1)^2$, which in the case of a single intermediate term would amount to using third differences.

INTERPRETATION. (Mathematics.) This word is coming into use as descriptive of a process which it has long been customary to employ, though without any express name. When an algebraical definition is laid down, there is frequently some restriction implied in the manner of making the definition, so that the process to which it leads presents more cases than can be explained by it, or were contemplated when it was made. For example, the abbreviation of a, aa, aaa, &c. [EXPONENT] into a, a^2, a^3, and the rules which spring from it, soon lead to such results as—

$$a^{-3},\quad a^{0},\quad a^{\frac{1}{2}},\quad a^{-\frac{1}{2}};$$

which, though they follow from algebraical processes, yet, when they first arrive, are without algebraical meaning. In such a case, the process of interpretation enters: the question is, what should such symbols mean? have they a necessary meaning? if not, is there any meaning which will be more convenient than another? A definition has been laid down, leading to results which cannot be explained by it: required the extension of the definition which will enable it to explain its own results.

Examples are found in all works which explain the principles of algebra. The rule always is, let the interpreted meaning of the new symbols be such as will make the whole of the process true by which they were obtained. Now as they must have been obtained by the application of those formulæ which are true of the intelligible results of the definition, the rule just mentioned leads to the following: let the meaning of the intelligible results be such as will make the formulæ of the intelligible ones true of them. Thus, in the preceding instance, the fundamental formula which connects the terms of the series a, a^2, a^3, a^4, &c., is—

$$a^m \times a^n = a^{m+n}$$

which is intelligible when m and n are positive whole numbers. Suppose it now required to interpret a^0: that is, to give it a meaning which shall make the preceding formula true of it. Write 0 instead of m and we have $a^0 \times a^n = a^{0+n} = a^n$, or a^0 must stand for 1. Again, suppose it required to interpret $a^{\frac{1}{2}}$. In order that the preceding formula may be true of the meaning of $a^{\frac{1}{2}}$, we must have

$$a^{\frac{1}{2}} \times a^{\frac{1}{2}} = a^{\frac{1}{2}+\frac{1}{2}} = a^1 \text{ or } a,$$

whence $a^{\frac{1}{2}}$ must stand for $\sqrt{a}$. And similarly for other cases.

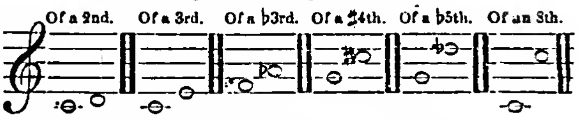
It is interpretation which creates the distinction between algebra, as now known, and arithmetic with general symbols of number, or universal arithmetic. This we shall see in the article NEGATIVE AND IMPOSSIBLE QUANTITIES.

INTERVAL. [SCALE.]

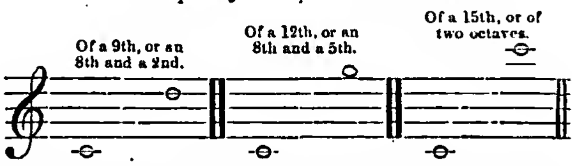
INTERVAL, in Music, is described by Dr. Robert Smith, in his *Harmonics*, as 'a quantity of a certain kind, terminated by a graver and an acuter sound.' Brossard had said the same thing in other words:—*C'est la différence, ou distance, qu'il y a d'un son grave à un son aigu.* Agreeing in this definition, from C to D is an interval of a 2nd; from C to G an interval of a 5th; from C to B♭ an interval of a flat 7th, &c.

Intervals are *Simple* when confined within the octave, *Compound* when they exceed it, and are named according to the distance of the two boundary notes. Thus the interval of a whole tone (C D) is called a 2nd; of a whole tone and a semitone (C E♭), a minor 3rd, &c. Intervals therefore are considered as sounds, and hence are either consonant or dissonant; *i.e.* concords or discords. [CONCORD; DISCORD.]

Examples of Simple Intervals.



Examples of Compound Intervals.



INTESTACY is either the dying without a will, or after having made a will which does not dispose of the whole of the real or personal estate to which the deceased was entitled, and therefore there may be either general or partial intestacy. Real estate, in all cases where it is not disposed of by will, descends to the heir. [HEIR; DESCENT.] Personal estate which is not disposed of by will goes to the administrator, to be by him applied in payment of the debts of the deceased, and to be distributed among his next of kin. [EXECUTOR; ADMINISTRATOR.]

INTESTI'NA (Intestinaux), the second class of the Radiata, or fourth division of the animal kingdom, according to the classification of Cuvier. In the 'Règne Animal' this class is divided into two orders, *Cavitaria* and *Parenchymata*, which include all the Entozoa of Rudolphi; but the term Intestina, if retained at all, should be applied only to the true intestinal worms, or those parasites which live in the intestines of other animals, and should exclude the Entozoa which are found in the cellular tissue and substance of the different viscera of the body.

The order Cavitaria ('vers intestinaux cavitaires') of Cuvier corresponds to the fifth order Nematoïdea of Rudolphi, and the group Cœlelmintha of Owen. The Parenchymata ('vers intestinaux parenchymateux') includes the other four orders of Rudolphi, Acanthocephala, Trematoda, Cestoidea, and Cystica, and corresponds to Mr. Owen's group of Sterelmintha.

The principal species of worms infesting the stomach and intestines of man are enumerated under ANTHELMINTICS; and for further details see ENTOZOA.

END OF VOLUME THE TWELFTH.

Printed by WILLIAM CLOWES and SONS, Stamford-street.