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THE ENCYCLOPÆDIA BRITANNICA

A DICTIONARY OF ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION

ELEVENTH EDITION

VOLUME XI SLICE V

Gassendi, Pierre to Geocentric

Articles in This Slice

GASSENDI[1] [Gassend], **PIERRE** (1592-1655), French philosopher, scientist and mathematician, was born of poor parents at Champtercier, near Digne, in Provence, on the 22nd of January 1592. At a very early age he gave indications of remarkable mental powers and was sent to the college at Digne. He showed particular aptitude for languages and mathematics, and it is said that at the age of sixteen he was invited to lecture on rhetoric at the college. Soon afterwards he entered the university of Aix, to study philosophy under P. Fesaye. In 1612 he was called to the college of Digne to lecture on theology. Four years later he received the degree of doctor of theology at Avignon, and in 1617 he took holy orders. In the same year he was called to the chair of philosophy at Aix, and

seems gradually to have withdrawn from theology. He lectured principally on the Aristotelian philosophy, conforming as far as possible to the orthodox methods. At the same time, however, he followed with interest the discoveries of Galileo and Kepler, and became more and more dissatisfied with the Peripatetic system. It was the period of revolt against the Aristotelianism of the schools, and Gassendi shared to the full the empirical tendencies of the age. He, too, began to draw up objections to the Aristotelian philosophy, but did not at first venture to publish them. In 1624, however, after he had left Aix for a canonry at Grenoble, he printed the first part of his *Exercitationes paradoxicae adversus Aristoteleos*. A fragment of the second book was published later at La Haye (1659), but the remaining five were never composed, Gassendi apparently thinking that after the *Discussiones Peripateticae* of Francesco Patrizzi little field was left for his labours.

After 1628 Gassendi travelled in Flanders and Holland. During this time he wrote, at the instance of Mersenne, his examination of the mystical philosophy of Robert Fludd (*Epistolica dissertatio in qua praecipua principia philosophiae Ro. Fluddi deteguntur*, 1631), an essay on parhelia (*Epistola de parheliis*), and some valuable observations on the transit of Mercury which had been foretold by Kepler. He returned to France in 1631, and two years later became provost of the cathedral church at Digne. Some years were then spent in travelling through Provence with the duke of Angoulême, governor of the department. The only literary work of this period is the *Life of Peiresc*, which has been frequently reprinted, and was translated into English. In 1642 he was engaged by Mersenne in controversy with Descartes. His objections to the fundamental propositions of Descartes were published in 1642; they appear as the fifth in the series contained in the works of Descartes. In these objections Gassendi's tendency towards the empirical school of speculation appears more pronounced than in any of his other writings. In 1645 he accepted the chair of mathematics in the Collège Royal at Paris, and lectured for many years with great success. In addition to controversial writings on physical questions, there appeared during this period the first of the works by which he is known in the history of philosophy. In 1647 he published the treatise *De vita, moribus, et doctrina Epicuri libri octo*. The work was well received, and two years later appeared his commentary on the tenth book of Diogenes Laërtius, *De vita, moribus, et placitis Epicuri, seu Animadversiones in X. librum Diog. Laër*. (Lyons, 1649; last edition, 1675). In the same year the more important *Syntagma philosophiae Epicuri* (Lyons, 1649; Amsterdam, 1684) was published.

In 1648 ill-health compelled him to give up his lectures at the Collège Royal. He travelled in the south of France, spending nearly two years at Toulon, the climate of which suited him. In 1653 he returned to Paris and resumed his literary work, publishing in that year lives of Copernicus and Tycho Brahe. The disease from which he suffered, lung complaint, had, however, established a firm hold on him. His strength gradually failed, and he died at Paris on the 24th of October 1655. A bronze statue of him was erected by subscription at Digne in 1852.

His collected works, of which the most important is the *Syntagma philosophicum* (*Opera*, i. and ii.), were published in 1658 by Montmort (6 vols., Lyons). Another edition, also in 6 folio volumes, was published by N. Averanius in 1727. The first two are occupied entirely with his *Syntagma philosophicum*; the third contains his critical writings on Epicurus, Aristotle, Descartes, Fludd and Lord Herbert, with some occasional pieces on certain problems of physics; the fourth, his *Institutio astronomica*, and his *Commentarii de rebus celestibus*; the fifth, his commentary on the tenth book of Diogenes Laërtius, the biographies of Epicurus, N.C.F. de Peiresc, Tycho Brahe, Copernicus, Georg von Peuerbach, and Regiomontanus, with some tracts on the value of ancient money, on the Roman calendar, and on the theory of music, to all which is appended a large and prolix piece entitled *Notitia ecclesiae Diniensis*; the sixth volume contains his correspondence. The *Lives*, especially those of Copernicus, Tycho and Peiresc, have been justly admired. That of Peiresc has been repeatedly printed; it has also been translated into English. Gassendi was one of the first after the revival of letters who treated the *literature* of philosophy in a lively way. His writings of this kind, though too laudatory and somewhat diffuse, have great merit; they abound in those anecdotal details, natural yet not obvious reflections, and vivacious turns of thought, which made Gibbon style him, with some extravagance certainly, though it was true enough up to Gassendi's time—"le meilleur philosophe des littérateurs, et le meilleur littérateur des philosophes."

Gassendi holds an honourable place in the history of physical science. He certainly added little to the stock of human knowledge, but the clearness of his exposition and the manner in which he, like Bacon, urged the importance of experimental research, were of inestimable service to the cause of science. To what extent any place can be assigned him in the history of philosophy is more doubtful. The *Exercitationes* on the whole seem to have excited more attention than they deserved. They contain little or nothing beyond what had been already advanced against Aristotle. The first book expounds clearly, and with much vigour, the evil effects of the blind acceptance of the Aristotelian dicta on physical and philosophical study; but, as is the case with so many of the anti-Aristotelian works of this period, the objections show the usual ignorance of Aristotle's own writings. The second book, which contains the review of Aristotle's dialectic or logic, is throughout Ramist in tone and method. The objections to Descartes—one of which at least, through Descartes's statement of it in the appendix of objections in the *Meditationes* has become famous—have no speculative value, and in general are the outcome of the crudest empiricism. His labours on Epicurus have a certain historical value, but the want of consistency inherent in the philosophical system raised on Epicureanism is such as to deprive it of genuine worth. Along with strong expressions of empiricism we find him holding doctrines absolutely irreconcilable with empiricism in any form. For while he maintains constantly his favourite maxim "that there is nothing in the intellect which has not been in the senses" (*nihil in intellectu quod non prius fuerit in sensu*), while he contends that the imaginative faculty (*phantasia*) is the counterpart of sense—that, as it has to do with material images, it is itself, like sense, material, and essentially the same both in men and brutes; he at the same time admits that the intellect, which he affirms to be immaterial and immortal—the most characteristic distinction of humanity—attains notions and truths of which no effort of sensation or imagination can give us the slightest apprehension (*Op.* ii. 383). He instances the capacity of forming "general notions"; the very conception of universality itself (*ib.* 384), to which he says brutes, who partake as truly as men in the faculty called *phantasia*, never attain; the notion of God, whom he says we may imagine to be corporeal, but understand to be incorporeal; and lastly, the reflex action by which the mind makes its own phenomena and operations the objects of attention.

The *Syntagma philosophicum*, in fact, is one of those eclectic systems which unite, or rather place in juxtaposition, irreconcilable dogmas from various schools of thought. It is divided, according to the usual fashion of the Epicureans, into logic (which, with Gassendi as with Epicurus, is truly *canonic*), physics and ethics. The logic, which contains at least one praiseworthy portion, a sketch of the history of the science, is divided into theory of right apprehension (*bene imaginari*), theory of right judgment (*bene proponere*), theory of right inference (*bene colligere*), theory of right method (*bene ordinare*). The first part contains the specially empirical positions which Gassendi afterwards neglects or leaves out of account. The senses, the sole source of knowledge, are supposed to yield us immediately cognition of individual things; phantasy (which Gassendi takes to be material in nature) reproduces these ideas; understanding compares these ideas, which are particular, and frames general ideas.

Nevertheless, he at the same time admits that the senses yield knowledge—not of things—but of qualities only, and holds that we arrive at the idea of thing or substance by induction. He holds that the true method of research is the analytic, rising from lower to higher notions; yet he sees clearly, and admits, that inductive reasoning, as conceived by Bacon, rests on a general proposition not itself proved by induction. He ought to hold, and in disputing with Descartes he did apparently hold, that the evidence of the senses is the only convincing evidence; yet he maintains, and from his special mathematical training it was natural he should maintain, that the evidence of reason is absolutely satisfactory. The whole doctrine of judgment, syllogism and method is a mixture of Aristotelian and Ramist notions.

In the second part of the *Syntagma*, the physics, there is more that deserves attention; but here, too, appears in the most glaring manner the inner contradiction between Gassendi's fundamental principles. While approving of the Epicurean physics, he rejects altogether the Epicurean negation of God and particular providence. He states the various proofs for the existence of an immaterial, infinite, supreme Being, asserts that this Being is the author of the visible universe, and strongly defends the doctrine of the foreknowledge and particular providence of God. At the same time he holds, in opposition to Epicureanism, the doctrine of an immaterial rational soul, endowed with immortality and capable of free determination. It is altogether impossible to assent to the supposition of Lange (*Gesch. des Materialismus*, 3rd ed., i. 233), that all this portion of Gassendi's system contains nothing of his own opinions, but is introduced solely from motives of self-defence. The positive exposition of atomism has much that is attractive, but the hypothesis of the *calor vitalis* (vital heat), a species of *anima mundi* (world-soul) which is introduced as physical explanation of physical phenomena, does not seem to throw much light on the special problems which it is invoked to solve. Nor is his theory of the weight essential to atoms as being due to an inner force impelling them to motion in any way reconcilable with his general doctrine of mechanical causes.

In the third part, the ethics, over and above the discussion on freedom, which on the whole is indefinite, there is little beyond a milder statement of the Epicurean moral code. The final end of life is happiness, and happiness is harmony of soul and body (*tranquillitas animi et indolentia corporis*). Probably, Gassendi thinks, perfect happiness is not attainable in this life, but it may be in the life to come.

The *Syntagma* is thus an essentially unsystematic work, and clearly exhibits the main characteristics of Gassendi's genius. He was critical rather than constructive, widely read and trained thoroughly both in languages and in science, but deficient in speculative power and original force. Even in the department of natural science he shows the same inability steadfastly to retain principles and to work from them; he wavers between the systems of Brahe and Copernicus. That his revival of Epicureanism had an important influence on the general thinking of the 17th century may be admitted; that it has any real importance in the history of philosophy cannot be granted.

Authorities.—Gassendi's life is given by Sorbière in the first collected edition of the works, by Bugerel, *Vie de Gassendi* (1737; 2nd ed., 1770), and by Damiron, *Mémoire sur Gassendi* (1839). An abridgment of his philosophy was given by his friend, the celebrated traveller, Bernier (*Abrégé de la philosophie de Gassendi*, 8 vols., 1678; 2nd ed., 7 vols., 1684). The most complete surveys of his work are those of G.S. Brett (*Philosophy of Gassendi*, London, 1908), Buhle (*Geschichte der neuern Philosophie*, iii. 1, 87-222), Damiron (*Mémoires pour servir à l'histoire de philosophie au XVII^e siècle*), and P.F. Thomas (*La Philosophie de Gassendi*, Paris, 1889). See also Ritter, *Geschichte der Philosophie*, x. 543-571; Feuerbach, *Gesch. d. neu. Phil. von Bacon bis Spinoza*, 127-150; F.X. Kiefl, *P. Gassendis Erkenntnistheorie und seine Stellung zum Materialismus* (1893) and "Gassendi's Skepticismus" in *Philos. Jahrb.* vi. (1893); C. Güttler, "Gassend oder Gassendi?" in *Archiv f. Gesch. d. Philos.* x. (1897), pp. 238-242.

(R. Ad.; X.)

1 It was formerly thought that *Gassendi* was really the genitive of the Latin form *Gassendus*. C. Güttler, however, holds that it is a modernized form of the O. Fr. *Gassendy* (see paper quoted in bibliography).

GASTEIN, in the duchy of Salzburg, Austria, a side valley of the Pongau or Upper Salzach, about 25 m. long and 1¼ m. broad, renowned for its mineral springs. It has an elevation of between 3000 and 3500 ft. Behind it, to the S., tower the mountains Mallnitz or Nassfeld-Tauern (7907 ft.) and Ankogel (10,673 ft.), and from the right and left of these mountains two smaller ranges run northwards forming its two side walls. The river Ache traverses the valley, and near Wildbad-Gastein forms two magnificent waterfalls, the upper, the Kesselfall (196 ft.), and the lower, the Bärenfall (296 ft.). Near these falls is the Schleierfall (250 ft.), formed by the stream which drains the Bockhart-see. The valley is also traversed by the so-called Tauern railway (opened up to Wildbad-Gastein in September 1905), which goes to Mallnitz, piercing the Tauern range by a tunnel 9260 yds. in length. The principal villages of the valley are Hof-Gastein, Wildbad-Gastein and Böckstein.

Hof-Gastein, pop. (1900) 840, the capital of the valley, is also a watering-place, the thermal waters being conveyed here from Wildbad-Gastein by a conduit 5 m. long, constructed in 1828 by the emperor Francis I. of Austria. Hof-Gastein was, after Salzburg, the richest place in the duchy, owing to its gold and silver mines, which were already worked during the Roman period. During the 16th century these mines were yielding annually 1180 ℔ of gold and 9500 ℔ of silver, but since the 17th century they have been much neglected and many of them are now covered by glaciers.

Wildbad-Gastein, commonly called *Bad-Gastein*, one of the most celebrated watering-places in Europe, is picturesquely situated in the narrow valley of the Gasteiner Ache, at an altitude of 3480 ft. The thermal springs, which issue from the granite mountains, have a temperature of 77°-120° F., and yield about 880,000 gallons of water daily. The water contains only 0.35 to 1000 of mineral ingredients and is used for bathing purposes. The springs are resorted to in cases of nervous affections, senile and general debility, skin diseases, gout and rheumatism. Wildbad-Gastein is annually visited by over 8500 guests. The springs were known as early as the 7th century, but first came into fame by a successful visit paid to them by Duke Frederick of Austria in 1436. Gastein was a favourite resort of William I. of Prussia and of the Austrian imperial family, and it was here that, on the 14th of August 1865, was signed the agreement known as the Gastein Convention, which by dividing the administration of the conquered provinces of Schleswig and Holstein between Austria and Prussia postponed for a while the outbreak of war between the two powers. It was also here (August-September 1879) that Prince Bismarck negotiated with Count Julius Andrássy the Austro-German treaty, which resulted in the formation of the Triple Alliance.

See Pröll, *Gastein, Its Springs and Climate* (Vienna, 5th ed., 1893).

GASTRIC ULCER (ulcer of the stomach), a disease of much gravity, commonest in females, and especially in anaemic domestic servants. It is connected in many instances with impairment of the circulation in the stomach and the formation of a clot in a small blood-vessel (thrombosis). It may be due to an impoverished state of the blood (anaemia), but it may also arise from disease of the blood-vessels, the result of long-continued indigestion and gastric catarrh.

When clotting takes place in a blood-vessel the nutrition of that limited area of the stomach is cut off, and the patch undergoes digestion by the unresisted action of the gastric juices, an ulcer being formed. The ulcer is usually of the size of a silver threepence or sixpence, round or oval, and, eating deeply, is apt to make a hole right through the coats of the stomach. Its usual site is upon the posterior wall of the upper curvature, near to the pyloric orifice. It may undergo a healing process at any stage, in which case it may leave but little trace of its existence; while, on the other hand, it may in the course of cicatrizing produce such an amount of contraction as to lead to stricture of the pylorus, or to a peculiar hour-glass deformity of the stomach. Perforation is in most cases quickly fatal, unless previously the stomach has become adherent to some neighbouring organ, by which the dangerous effects of this occurrence may be averted, or unless the condition has been promptly recognized and an operation has been quickly done. Usually there is but one ulcer, but sometimes there are several ulcers.

The symptoms of ulcer of the stomach are often indefinite and obscure, and in some cases the diagnosis has been first made on the occurrence of a fatal perforation. First among the symptoms is pain, which is present at all times, but is markedly increased after food. The pain is situated either at the lower end of the breast-bone or about the middle of the back. Sometimes it is felt in the sides. It is often extremely severe, and is usually accompanied with localized tenderness and also with a sense of oppression, and by an inability to wear tight clothing. The pain is due to the movements of the stomach set up by the presence of the food, as well as to the irritation of the inflamed nerve filaments in the floor of the ulcer. Vomiting is a usual symptom. It occurs either soon after the food is swallowed or at a later period, and generally relieves the pain and discomfort. Vomiting of blood (haematemesis) is a frequent and important symptom. The blood may show itself in the form of a brown or coffee-like mixture, or as pure blood of dark colour and containing clots. It comes from some vessel or vessels which the ulcerative process has ruptured. Blood is also found mixed with the discharges from the bowels, rendering them dark or tarry-looking. The general condition of the patient with gastric ulcer is, as a rule, that of extreme ill-health, with pallor, emaciation and debility. The tongue is red, and there is usually constipation. In most of the cases the disease is chronic, lasting for months or years; and in those cases where the ulcers are large or multiple, incomplete healing may take place, relapses occurring from time to time. But the ulcers may give rise to no marked symptoms, and there have been instances where fatal perforation suddenly took place, and where post-mortem examination revealed the existence of long-standing ulcers which had given rise to no suggestive symptoms. While gastric ulcer is to be regarded as dangerous, its termination, in the great majority of cases, is in recovery. It frequently, however, leaves the stomach in a delicate condition, necessitating the utmost care as regards diet. Occasionally the disease proves fatal by sudden haemorrhage, but a fatal result is more frequently due to perforation and the escape of the contents of the stomach into the peritoneal cavity, in which case death usually occurs in from twelve to forty-eight hours, either from shock or from peritonitis. Should the stomach become adherent to another organ, and fatal perforation be thus prevented, chronic “indigestion” may persist, owing to interference with the natural movements of the stomach. Stricture of the pylorus and consequent dilatation of the stomach may be caused by the cicatrization of an ulcer.

The patient should at once be sent to bed and kept there, and allowed for a while nothing stronger than milk and water or milk and lime water. But if bleeding has recently taken place no food whatever should be allowed by the stomach, and the feeding should be by nutrient enemata. As the symptoms quiet down, eggs may be given beaten up with milk, and later, bread and milk and home-made broths and soups. Thus the diet advances to chicken and vegetables rubbed through a sieve, to custard pudding and bread and butter. As regards medicines, iron is the most useful, but no pills of any sort should be given. Under the influence of rest and diet most gastric ulcers get well. The presence of healthy-looking scars upon the surface of the stomach, which are constantly found in operating upon the interior of the abdomen, or as revealed in post-mortem examinations, are evidence of the truth of this statement. It is unlikely that under the treatment just described perforation of the stomach will take place, and if the surgeon is called in to assist he will probably advise that operation is inadvisable. Moreover, he knows that if he should open the abdomen to search for an ulcer of the stomach he might fail to find it; more than that, his search might also be in vain if he opened the stomach itself and examined the interior. Serious haemorrhages, however, may make it necessary that a prompt and thorough search should be made in order that the surgeon may endeavour to locate the ulcer, and, having found it, secure the damaged vessel and save the patient from death by bleeding.

Perforation of a gastric ulcer having taken place, the septic germs, which were harmless whilst in the stomach, escape with the rest of the contents of the stomach into the general peritoneal cavity. The immediate effects of this leakage are sudden and severe pain in the upper part of the abdomen and a great shock to the system (collapse). The muscles of the abdominal wall become hard and resisting, and as peritonitis appears and the intestines are distended with gas, the abdomen is distended and becomes greatly increased in size and ceases to move, the respiratory movements being short and quick. At first, most likely, the temperature drops below normal, and the pulse quickens. Later, the temperature rises. If nothing is done, death from the septic poisoning of peritonitis is almost certain.

The treatment of ruptured gastric ulcer demands immediate operation. An incision should be made in the upper part of the middle line of the abdomen, and the perforation should be looked for. There is not, as a rule, much difficulty in finding it, as there are generally deposits of lymph near the spot, and other signs of local inflammation; moreover, the contents of the stomach may be seen escaping from the opening. The ulcer is to be closed by running a “purse-string” suture in the healthy tissue around it, and the place is then buried in the stomach by picking up small folds of the stomach-wall above and below it and fixing them together by suturing. This being done, the surface of the stomach, and the neighbouring viscera which have been soiled by the leakage, are wiped clean and the abdominal wound is closed, provision being made for efficient drainage. A large proportion of cases of perforated gastric ulcer thus treated recover.

(E. O.*)

GASTRITIS (Gr. γαστήρ, stomach), an inflammatory affection of the stomach, of which the condition of catarrh, or irritation of its mucous membrane, is the most frequent and most readily recognized. This may exist in an acute or a chronic form, and depends upon some condition, either local or general, which produces a congested state of the circulation in the walls of the stomach (see Digestive Organs: *Pathology*).

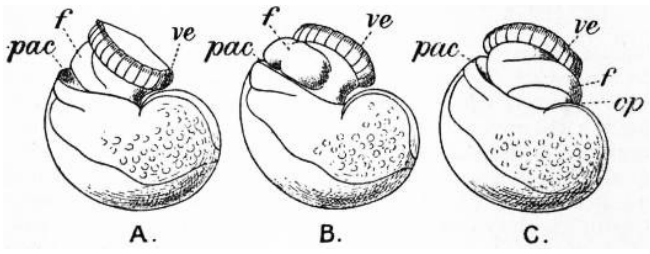
Acute Gastritis may arise from various causes. The most intense forms of inflammation of the stomach are the toxic conditions which follow the swallowing of corrosive poisons, such as strong mineral acids of alkalis which may extensively destroy the mucous membrane. Other non-corrosive poisons cause acute degeneration of the stomach wall (see Poisons). Acute inflammatory conditions may be secondary to zymotic diseases such as diphtheria, pyaemia, typhus fever and others. Gastritis is also caused by the ingestion of food which has begun to decompose, or may result from eating unsuitable articles which themselves remain undigested and so excite acute catarrhal conditions. These give rise to the symptoms well known as characterizing an acute "bilious attack," consisting in loss of appetite, sickness or nausea, and headache, frontal or occipital, often accompanied with giddiness. The tongue is furred, the breath foetid, and there is pain or discomfort in the region of the stomach, with sour eructations, and frequently vomiting, first of food and then of bilious matter. An attack of this kind tends to subside in a few days, especially if the exciting cause be removed. Sometimes, however, the symptoms recur with such frequency as to lead to the more serious chronic form of the disease.

The treatment bears reference, in the first place, to any known source of irritation, which, if it exist, may be expelled by an emetic or purgative (except in cases due to poisoning). This, however, is seldom necessary, since vomiting is usually present. For the relief of sickness and pain the sucking of ice and counter-irritation over the region of the stomach are of service. Further, remedies which exercise a soothing effect upon an irritable mucous membrane, such as bismuth or weak alkaline fluids, and along with these the use of a light milk diet, are usually sufficient to remove the symptoms.

Chronic Gastric Catarrh may result from the acute or may arise independently. It is not infrequently connected with antecedent disease in other organs, such as the lungs, heart, liver or kidneys, and it is especially common in persons addicted to alcoholic excess. In this form the texture of the stomach is more altered than in the acute form, except in the toxic and febrile forms above referred to. It is permanently in a state of congestion, and its mucous membrane and muscular coat undergo thickening and other changes, which markedly affect the function of digestion. The symptoms are those of dyspepsia in an aggravated form (see Dyspepsia), of which discomfort and pain after food, with distension and frequently vomiting, are the chief; and the treatment must be conducted in reference to the causes giving rise to it. The careful regulation of the diet, alike as to the amount, the quality, and the intervals between meals, demands special attention. Feeding on artificially soured milk may in many cases be useful. Lavage or washing out of the stomach with weak alkaline solutions has been used with marked success in the treatment of chronic gastritis. Of medicinal agents, bismuth, arsenic, nux vomica, and the mineral acids are all of acknowledged efficacy, as are also preparations of pepsin.

GASTROPODA, the second of the five classes of animals constituting the phylum Mollusca. For a discussion of the relationship of the Gastropoda to the remaining classes of the phylum, see Mollusca.

The Gastropoda are mainly characterized by a loss of symmetry, produced by torsion of the visceral sac. This torsion may be resolved into two successive movements. The first is a ventral flexure in the antero-posterior or sagittal plane; the result of this is to approximate the two ends of the alimentary canal. In development, the openings of the mantle-cavity and the anus are always originally posterior; later they are brought forward ventrally. During this first movement flexure is also produced by the coiling of the visceral sac and shell; primitively the latter was bowl-shaped; but the ventral flexure, which brings together the two extremities of the digestive tube, gives the visceral sac the outline of a more or less acute cone. The shell necessarily takes this form also, and then becomes coiled in a dorsal or anterior plane—that is to say, it becomes exogastric. This condition may be seen in embryonic *Patellidae*, *Fissurellidae* and *Trochidae* (fig. 1, A), and agrees with the method of coiling of a mollusc without lateral torsion, such as *Nautilus*. But ultimately the coil becomes ventral or endogastric, in consequence of the second torsion movement then apparent.



From Lankester's *Treatise on Zoology*.

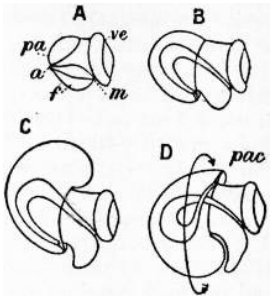
Fig. 1.—Three stages in the development of Trochus, during the process of torsion. (After Robert.)

A, Nearly symmetrical larva (veliger).
B, A stage 1½ hours later than A.
C, A stage 3½ hours later than B.
f, Foot.
op, Operculum.
pac, Pallial cavity.
ve, Velum.

The shell is represented as fixed, while the head and foot rotate from left to right. In reality the head and foot are fixed and the shell rotates from right to left.

The second movement is a lateral torsion of the visceral mass, the foot remaining a fixed point; this torsion occurs in a plane approximately at right angles to that of the first movement, and carries the pallial aperture and the anus from behind forwards. If, at this moment, the animal were placed with mouth and ventral surface turned towards the observer, this torsion carries the circumanal complex in a clockwise direction (along the right side in dextral forms) through 180° as compared with its primitive condition. The (primitively) right-hand organs of the complex thus become left-hand, and vice versa. The visceral commissure, while still surrounding the digestive tract, becomes looped; its right half, with its proper ganglion, passes to the left side over the dorsal face of the alimentary canal (whence the name supra-intestinal), while the left half passes below towards the right side, thus originating the name infra-intestinal given to this half and to its ganglion. Next, the shell, the coil of which was at first exogastric, being also included in this rotation through 180°, exhibits an endogastric coiling (fig. 1, B, C). This, however, is not generally retained in one plane, and the spire projects, little by little, on the side which was originally left, but finally becomes right (in dextral forms, with a clockwise direction, if viewed from the side of the spire; but counter-clockwise in sinistral forms). Finally, the original symmetry of the circumanal complex vanishes; the anus leaves the centre of the pallial cavity and passes towards the right side (left side in sinistral forms); the organs of this side become atrophied and disappear. The essential feature of the asymmetry of Gastropoda is the atrophy or disappearance of the primitively left half of the circumanal complex (the right half in sinistral forms), including the gill, the auricle, the osphradium, the hypobranchial gland and the kidney.

In dextral Gastropods the only structure found on the topographically right side of the rectum is the genital duct. But this is not part of the primitive complex. It is absent in the most primitive and symmetrical forms, such as *Haliotis* and *Pleurotomaria*. Originally the gonads opened into the kidneys. In the most primitive existing Gastropods the gonad opens into the right kidney (*Patellidae*, *Trochidae*, *Fissurellidae*). The gonaduct, therefore, is derived from the topographically right kidney. The transformation has been actually shown to take place in the development of Paludina. In a dextral Gastropod the shell is coiled in a right-handed spiral from apex to mouth, and the spiral also projects to the right of the median plane of the animal.



From Lankester's *Treatise on Zoology*.

FIG. 2.—Four stages in the development of a Gastropod showing the process of body torsion. (After Robert.)

A, Embryo without flexure.
B, Embryo with ventral flexure of the intestine.
C, Embryo with ventral flexure and exogastric shell.
D, Embryo with lateral torsion and an endogastric shell.
a, Anus.
f, Foot.
m, Mouth.
pa, Mantle.
pac, Pallial cavity.
ve, Velum.

When the shell is sinistral the asymmetry of the organs is usually reversed, and there is a complete situs *inversus viscerum*, the direction of the spiral of the shell corresponding to the position of the organs of the body. *Triforis*, *Physa*, *Clausilia* are examples of sinistral Gastropods, but reversal also occurs as an individual variation among forms normally dextral. But there are forms in which the involution is "hyperstrophic," that is to say, the turns of the spire projecting but slightly, the spire, after flattening out gradually, finally becomes re-entrant and transformed into a false umbilicus; at the same time that part which corresponds to the umbilicus of forms with a normal coil projects and constitutes a false spire; the coil thus appears to be sinistral, although the asymmetry remains dextral, and the coil of the operculum (always the opposite to that of the shell) sinistral (*e.g. Lanistes* among Streptoneura, *Limacinidae* among Opisthobranchia). The same, *mutatis mutandis*, may occur in sinistral shells.

The problem of the causes of the torsion of the Gastropod body has been much discussed. E.R. Lankester in the ninth edition of this work attributed it to the pressure of the shell and visceral hump towards the right side. He referred also to the nautiloid shell of the larva falling to one side. But these are two distinct processes. In the larva a nautiloid shell is developed which is coiled exogastrically, that is, dorsally, and the pallial cavity is posterior or ventral (fig. 2, C): the larva therefore resembles *Nautilus* in the relations of body and shell. The shell then rotates towards the left side through 180°, so that it becomes ventral or endogastric (fig. 2, D). The pallial cavity, with its organs, is by this torsion moved up the *right* side of the larva to the dorsal surface, and thus the left organs become right and vice versa. In the subsequent growth of the shell the spire comes to project on the right side, which was originally the left. Neither the rotation of the shell as a whole nor its helicoid spiral coiling is the immediate cause of the torsion of the body in the individual, for the direction of the torsion is indicated in the segmentation of the ovum, in which there is a complete reversal of the cleavage planes in sinistral as compared with dextral forms. The facts, however, strongly suggest that the original cause of the torsion was the weight of the exogastric shell and visceral hump, which in an animal creeping on its ventral surface necessarily fell over to one side. It is not certain that the projection of the spire to the originally left side of the shell has anything to do with the falling over of the shell to that side. The facts do not support such a suggestion. In the larva there is no projection at the time the torsion takes place. In some forms the coiling disappears in the adult, leaving the shell simply conical as in *Patellidae*, *Fissurellidae*, &c., and in some cases the shell is coiled in one plane, *e.g. Planorbis*. In all these cases the torsion and asymmetry of the body are unaffected.

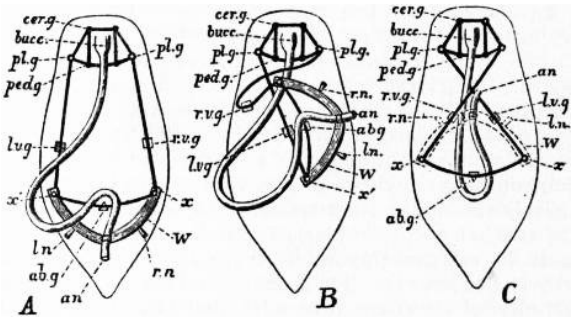


FIG 3.—Sketch of a model designed so as to show the effect of torsion or rotation of the visceral hump in Streptoneurous Gastropoda.

A, Unrotated ancestral condition.
B, Quarter-rotation.
C, Complete semi-rotation (the limit).
an, Anus.
ln, *rn*, Primarily left nephridium and primarily right nephridium.
lvg, Primarily left (subsequently the sub-intestinal) visceral ganglion.
rvg, Primarily right (subsequently the sub-intestinal) visceral ganglion.
cerg, Cerebral ganglion.
plg, Pleural ganglion.
pedg, Pedal ganglion.
abg, Abdominal ganglion.
bucc, Buccal mass.
W, Wooden arc representing the base-line of the wall of the visceral hump.
x, *x'*, Pins fastening the elastic cord (representing the visceral nerve loop) to *W*.

The characteristic torsion attains its maximum effect among the majority of the Streptoneura. It is followed in some specialized Heteropoda and in the Euthyneura by a torsion in the opposite direction, or detorsion, which brings the anus farther back and untwists the visceral commissure (see Euthyneura, below). This conclusion has shown that the Euthyneura do not represent an archaic form of Gastropoda, but are themselves derived from streptoneurous forms. The difference between the two sub-classes has been shown to be slight; certain of the more archaic Tectibranchia (*Actaeon*) and Pulmonata (*Chilina*) still have the visceral commissure long and not untwisted. The fact that all the Euthyneura are hermaphrodite is not a fundamental difference; several Streptoneura are so, likewise *Valvata*, *Oncidiopsis*, *Marsenina*, *Odostomia*, *Bathysciadium*, *Entoconcha*.

Classification.—The class Gastropoda is subdivided as follows:

Sub-class I. Streptoneura.
  Order 1. Aspidobranchia.
    Sub-order 1. Docoglossa.
    " 2. Rhipidoglossa.
  Order 2. Pectinibranchia.
    Sub-order 1. Taenioglossa.
      Tribe 1. Platypoda.
      " 2. Heteropoda.
    Sub-order 2. Stenoglossa.
      Tribe 1. Rachiglossa.
      " 2. Toxiglossa.
Sub-class II. Euthyneura.
  Order 1. Opisthobranchia.
    Sub-order 1. Tectibranchia.
      Tribe 1. Bullomorpha.
      " 2. Aplysiomorpha.
      " 3. Pleurobranchomorpha.
    Sub-order 2. Nudibranchia.
      Tribe 1. Tritoniomorpha.
      " 2. Doridomorpha.
      " 3. Eolidomorpha.
      " 4. Elysiomorpha.
  Order 2. Pulmonata.
    Sub-order 1. Basommatophora.
    " 2. Stylommatophora.
      Tribe 1. Hologna tha.
      " 2. Agnatha.
      " 3. Elasmognatha.
      " 4. Ditremata.

Sub-Class I.—Streptoneura

In this division the torsion of the visceral mass and visceral commissure is at its maximum, the latter being twisted into a figure of eight. The right half of the commissure with its ganglion is supra-intestinal, the left half with its ganglion infra-intestinal. In some cases each pleural ganglion is connected with the opposite branch of the visceral commissure by anastomosis with the pallial nerve, a condition which is called dialyneury; or there may be a direct connective from the pleural ganglion to the visceral ganglion of the opposite side, which is called zygoneury. The head bears only one pair of tentacles. The radular teeth are of several different kinds in each transverse row. The heart is usually posterior to the branchia (proso-branchiate). The sexes are usually separate.

The old division into Zygobranchia and Azygobranchia must be abandoned, for the Azygobranchiate Rhipidoglossa have much greater affinity to the Zygobranchiate *Haliotidae* and *Fissurellidae* than to the Azygobranchia in general. This is shown by the labial commissure and pedal cords of the nervous system, by the opening of the gonad into the right kidney, and by other points. Further, the *Pleurotomariidae* have been discovered to possess two branchiae. The sub-class is now divided into two orders: the Aspidobranchia in which the branchia or ctenidium is bipectinate and attached only at its base, and the Pectinibranchia in which the ctenidium is monopectinate and attached to the mantle throughout its length.

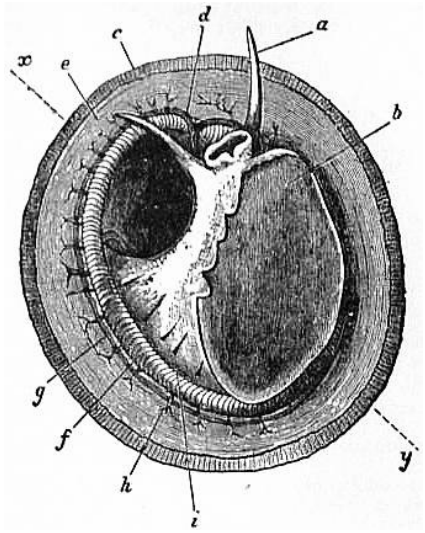


FIG. 4.—The Common Limpet (*Patella vulgata*) in its shell, seen from the pedal surface. (Lankester.)

x, *y*, The median antero-posterior axis.
a, Cephalic tentacle.
b, Plantar surface of the foot.
c, Free edge of the shell.
d, The branchial efferent vessel carrying aerated blood to the auricle, and here interrupting the circlet of gill lamellae.
e, Margin of the mantle-skirt.
f, Gill lamellae (*not* ctenidia, but special pallial growths, comparable with those of Pleurophyllidia).
g, The branchial efferent vessel.
h, Factor of the branchial advehent vessel.
i, Interspaces between the muscular bundles of the root of the foot, causing the separate areae seen in fig. 5, *c*.

Order I. ASPIDOBRANCHIA.—These are the most primitive Gastropods, retaining to a great degree the original symmetry of the organs of the pallial complex, having two kidneys, in some cases two branchiae, and two auricles. The gonad has no accessory organs and except in *Neritidae* no duct, but discharges into the right kidney.

Forms adapted to terrestrial life and to aerial respiration occur in various divisions of Gastropods, and do not constitute a single homogeneous group. Thus the *Helicinidae*, which are terrestrial, are now placed among the Aspidobranchia. In these there are neither branchia nor osphradium, and the pallial chamber which retains its large opening serves as a lung. Degeneration of the shell occurs in some members of the order. It is largely covered by the mantle in some *Fissurellidae*, is entirely internal in *Pupilia* and absent in *Titiscaniidae*.

The common limpet is a specially interesting and abundant example of the more primitive Aspidobranchia. The foot of the limpet is a nearly circular disk of muscular tissue; in front, projecting from and raised above it, are the head and neck (figs. 4, 13). The visceral hump forms a low conical dome above the sub-circular foot, and standing out all round the base of this dome so as completely to overlap the head and foot, is the circular mantle-skirt. The depth of free mantle-skirt is greatest in front, where the head and neck are covered in by it. Upon the surface of the visceral dome, and extending to the edge of the free mantle-skirt, is the conical shell. When the shell is taken away (best effected by immersion in hot water) the surface of the visceral dome is found to be covered by a black-coloured epithelium, which may be removed, enabling the observer to note the position of some organs lying below the transparent integument (fig. 5). The muscular columns (*c*) attaching the foot to the shell form a ring incomplete in front, external to which is the free mantle-skirt. The limits of the large area formed by the flap over the head and neck (*ecr*) can be traced, and we note the anal papilla showing through and opening on the right shoulder, so to speak, of the animal into the large anterior region of the sub-pallial space. Close to this the small renal organ (*i*, mediad) and the larger renal organ (*k*, to the right and posteriorly) are seen, also the pericardium (*l*) and a coil of the intestine (*int*) embedded in the compact liver.

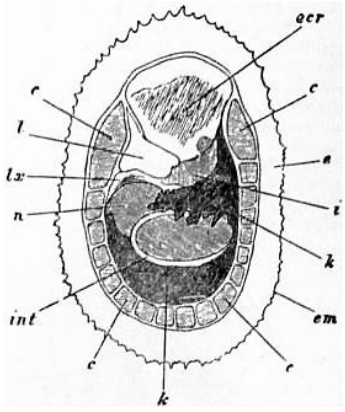


FIG. 5.—Dorsal surface of the Limpet removed from its shell and deprived of its black pigmented epithelium; the internal organs are seen through the transparent body-wall. (Lankester.)

c, Muscular bundles forming the root of the foot, and adherent to the shell.
e, Free mantle-skirt.
em, Tentaculiferous margin of the same.
i, Smaller (left) nephridium.
k, Larger (right) nephridium.
l, Pericardium.
lx, Fibrous septum, behind the pericardium.
n, Liver.
int, Intestine.
ecr, Anterior area of the mantle-skirt over-hanging the head (cephalic hood).

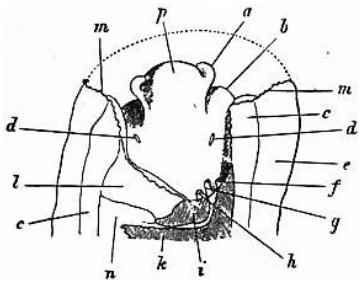


FIG. 6.—Anterior portion of the same Limpet, with the overhanging cephalic hood removed. (Lankester.)

a, Cephalic tentacle.
b, Foot.
c, Muscular substance forming the root of the foot.
d, The capito-pedal organs of Lankester (= rudimentary ctenidia).
e, Mantle-skirt.
f, Papilla of the larger nephridium.
g, Anus.
h, Papilla of the smaller nephridium.
i, Smaller nephridium.
k, Larger nephridium.
l, Pericardium.
m, Cut edge of the mantle-skirt.
n, Liver.
p, Snout.

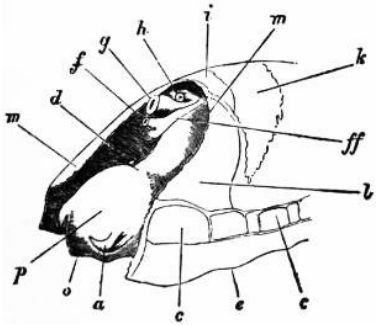


FIG. 7.—The same specimen viewed from the left front, so as to show the sub-anal tract (*ff*) of the larger nephridium, by which it communicates with the pericardium. *o*, Mouth; other letters as in fig. 6.

On cutting away the anterior part of the mantle-skirt so as to expose the sub-pallial chamber in the region of the neck, we find the right and left renal papillae (discovered by Lankester in 1867) on either side of the anal papilla (fig. 6), but no gills. If a similar examination be made of the allied genus *Fissurella* (fig. 17, *d*), we find right and left of the two renal apertures a right and left gill-plume or ctenidium, which here as in *Haliotis* and *Pleurotomaria* retain their original paired condition. In *Patella* no such plumes exist, but right and left of the neck are seen a pair of minute oblong yellow bodies (fig. 6, *d*), which were originally described by Lankester as orifices possibly connected with the evacuation of the generative products. On account of their position they were termed by him the “capito-pedal orifices,” being placed near the junction of head and foot. J.W. Spengel has, however, in a most ingenious way shown that these bodies are the representatives of the typical pair of ctenidia, here reduced to a mere rudiment. Near to each rudimentary ctenidium Spengel has discovered an olfactory patch or osphradium (consisting of modified epithelium) and an olfactory nerve-ganglion (fig. 8). It will be remembered that, according to Spengel, the osphradium of mollusca is definitely and intimately related to the gill-plume or ctenidium, being always placed near the base of that organ; further, Spengel has shown that the nerve-supply of this olfactory organ is always derived from the visceral loop. Accordingly, the nerve-supply affords a means of testing the conclusion that we have in Lankester’s capito-pedal bodies the rudimentary ctenidia. The accompanying diagrams (figs. 9, 10) of the nervous systems of *Patella* and of *Haliotis*, as determined by Spengel, show the identity in the origin of the nerves passing from the visceral loop to Spengel’s olfactory ganglion of the Limpet, and that of the nerves which pass from the visceral loop of *Haliotis* to the olfactory patch or osphradium, which lies in immediate relation on the right and on the left side to the right and left gill-plumes (ctenidia) respectively. The same diagrams serve to demonstrate the streptoneurous condition of the visceral loop in Aspidobranchia.

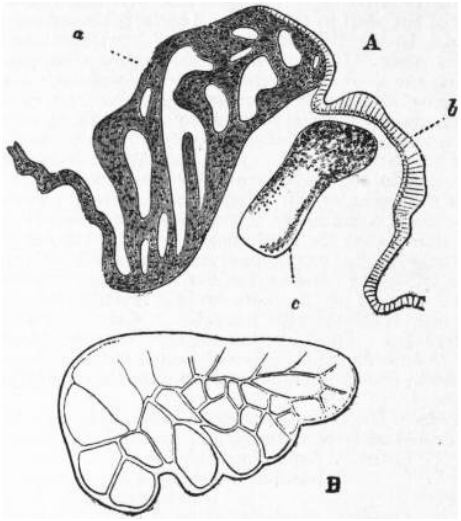


FIG. 8.—A, Section in a plane vertical to the surface of the neck of *Patella* through *a*, the rudimentary ctenidium (Lankester’s organ), and *b*, the olfactory epithelium (osphradium); *c*, the olfactory (osphradial) ganglion. (After Spengel.)

B, Surface view of a rudimentary ctenidium of *Patella* excised and viewed as a transparent object. (Lankester.)

Thus, then, we find that the limpet possesses a symmetrically disposed pair of ctenidia in a rudimentary condition, and justifies its position among Aspidobranchia. At the same time it possesses a totally distinct series of *functional* gills, which are not derived from the modification of the typical molluscan ctenidium. These gills are in the form of delicate lamellae (fig. 4, *f*), which form a series extending completely round the inner face of the depending mantle-skirt. This circlet of gill-lamellae led Cuvier to class the limpets as Cyclobranchiata, and, by erroneous identification of them with the series of metamerically repeated ctenidia of *Chiton*, to associate the latter mollusc with the former. The gill-lamellae of *Patella* are processes of the mantle comparable with the plait-like folds often observed on the roof of the branchial chamber in other Gastropoda (*e.g. Buccinum* and *Haliotis*). They are termed pallial gills. The only other molluscs in which they are exactly represented are the curious Opisthobranchs *Phyllidia* and *Pleurophyllidia* (fig. 55). In these, as in *Patella*, the typical ctenidia are aborted, and the branchial function is assumed by close-set lamelliform processes arranged in a series beneath the mantle-skirt on either side of the foot. In fig. 4, *d*, the large branchial vein of *Patella* bringing blood from the gill-series to the heart is seen; where it crosses the series of lamellae there is a short interval devoid of lamellae.

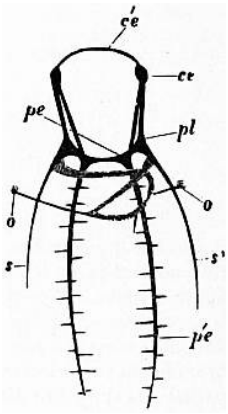


FIG. 9.—Nervous system of *Patella*; the visceral loop is lightly shaded; the buccal ganglia are omitted. (After Spengel.)

ce, Cerebral ganglia.
c'e, Cerebral commissure.
pl, Pleural ganglion.
pe, Pedal ganglion.
p'e, Pedal nerve.
s, *s'*, Nerves (right and left) to the mantle.
o, Olfactory ganglion, connected by nerve to the streptoneurous visceral loop.

The heart in *Patella* consists of a single auricle (not two as in *Haliotis* and *Fissurella*) and a ventricle; the former receives the blood from the branchial vein, the latter distributes it through a large aorta which soon leads into irregular blood-lacunae.

The existence of two renal organs in *Patella*, and their relation to the pericardium (a portion of the coelom), is important. Each renal organ is a sac lined with glandular epithelium (ciliated cell, with concretions) communicating with the exterior by its papilla, and by a narrow passage with the pericardium. The connexion with the pericardium of the smaller of the two renal organs was demonstrated by Lankester in 1867, at a time when the fact that the renal organ of the Mollusca, as a rule, opens into the pericardium, and is therefore a typical nephridium, was not known. Subsequent investigations carried on under the direction of the same naturalist have shown that the larger as well as the smaller renal sac is in communication with the pericardium. The walls of the renal sacs are deeply plaited and thrown into ridges. Below the surface these walls are excavated with blood-vessels, so that the sac is practically a series of blood-vessels covered with renal epithelium, and forming a meshwork within a space communicating with the exterior. The larger renal sac (remarkably enough, that which is aborted in other Anisopleura) extends between the liver and the integument of the visceral dome very widely. It also bends round the liver as shown in fig. 12, and forms a large sac on half of the upper surface of the muscular mass of the foot. Here it lies close upon the genital body (ovary or testis), and in such intimate relationship with it that, when ripe, the gonad bursts into the renal sac, and its products are carried to the exterior by the papilla on the right side of the anus (Robin, Dall). This fact led Cuvier erroneously to the belief that a duct existed leading from the gonad to this papilla. The position of the gonad, best seen in the diagrammatic section (fig. 13), is, as in other Aspidobranchia, devoid of a special duct communicating with the exterior. This condition, probably an archaic one, distinguishes the Aspidobranchia from other Gastropoda.

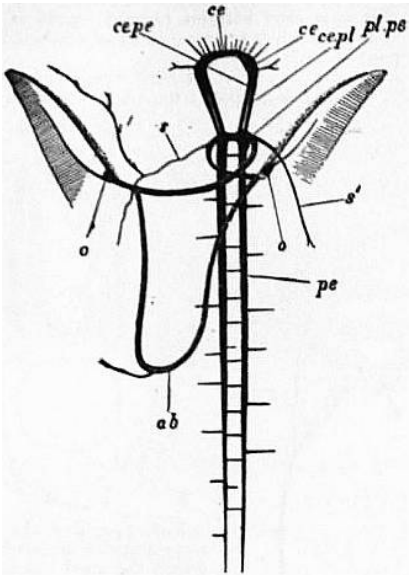


FIG. 10.—Nervous system of *Haliotis*; the visceral loop is lightly shaded; the buccal ganglia are omitted. (After Spengel.)

ce, Cerebral ganglion.
pl.pe, The fused pleural and pedal ganglia.
pe, The right pedal nerve.
ce.pl, The cerebro-pleural connective.
ce.pe, The cerebro-pedal connective.
s, *s'*, Right and left mantle nerves.
ab, Abdominal ganglion or site of same.
o, *o*, Right and left olfactory ganglia and osphardia receiving nerve from visceral loop.

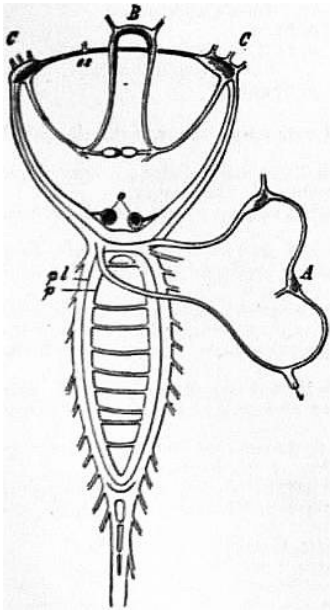


FIG. 11.—Nervous system of *Fissurella*. (From Gegenbaur, after Jhering.)

pl, Pallial nerve.
p, Pedal nerve.
A, Abdominal ganglia in the streptoneurous visceral commissure, with supra- and sub-intestine ganglion on each side.
B, Buccal ganglia.
C, *C*, Cerebral ganglia.
es, Cerebral commissure.
o, Otocysts attached to the cerebro-pedal connectives.

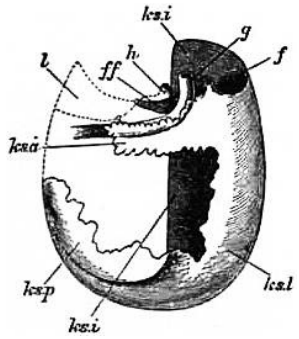


FIG. 12.—Diagram of the two renal organs (nephridia), to show their relation to the rectum and to the pericardium. (Lankester.)

f, Papilla of the larger nephridium.
g, Anal papilla with rectum leading from it.
h, Papilla of the smaller nephridium, which is only represented by dotted outlines.
l, Pericardium indicated by a dotted outline—at its right side are seen the two reno-pericardial pores.
ff, The sub-anal tract of the large nephridium given off near its papilla and seen through the unshaded smaller nephridium.
ks.a, Anterior superior lobe of the large nephridium.
ks.l, Left lobe of same.
ks.p, Posterior lobe of same.
ks.i, Inferior sub-visceral lobe of same.

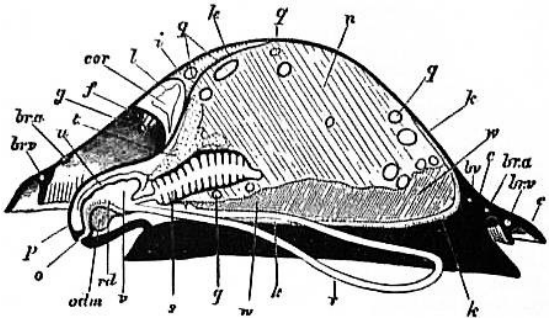


FIG. 13.—Diagram of a vertical antero-postero median section of a Limpet. Letters as in figs. 6, 7, with following additions. (Lankester.)

q, Intestine in transverse section.
r, Lingual sac (radular sac).
rd, Radula.
s, Lamellated stomach.
t, Salivary gland.
u, Duct of same.
v, Buccal cavity
w, Gonad.
br.a, Branchial advehent vessel (artery).
br.v, Branchial efferent vessel (vein).
bv, Blood-vessel.
odm, Muscles and cartilage of the odontophore.
cor, Heart within the pericardium.

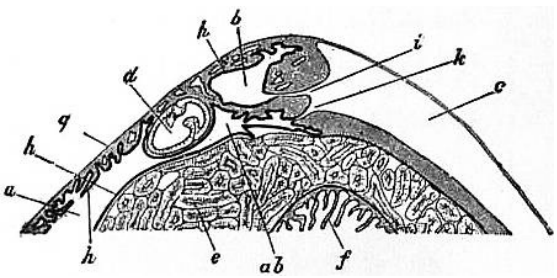


FIG. 14.—Vertical section in a plane running right and left through the anterior part of the visceral hump of *Patella* to show the two renal organs and their openings into the pericardium. (J.T. Cunningham.)

a, Large or external or right renal organ.
ab, Narrow process of the same running *below* the intestine and leading by *k* into the pericardium.
f, Manyplies.
g, Epithelium of the dorsal surface.
h, Renal epithelium lining the renal sacs.
i, Aperture connecting the

b, Small or median renal organ.
c, Pericardium.
d, Rectum.
e, Liver.
small sac with the pericardium.
k, Aperture connecting the large sac with the pericardium.

The digestive tract of *Patella* offers some interesting features. The odontophore is powerfully developed; the radular sac is extraordinarily long, lying coiled in a space between the mass of the liver and the muscular foot. The radula has 160 rows of teeth with twelve teeth in each row. Two pairs of salivary ducts, each leading from a salivary gland, open into the buccal chamber. The oesophagus leads into a remarkable stomach, plaited like the manyplies of a sheep, and after this the intestine takes a very large number of turns embedded in the yellow liver, until at last it passes between the two renal sacs to the anal papilla. A curious ridge (spiral? valve) which secretes a slimy cord is found upon the inner wall of the intestine. The general structure of the Molluscan intestine has not been sufficiently investigated to render any comparison of this structure of *Patella* with that of other Mollusca possible. The eyes of the limpet deserve mention as examples of the most primitive kind of eye in the Molluscan series. They are found one on each cephalic tentacle, and are simply minute open pits or depressions of the epidermis, the epidermic cells lining them being pigmented and connected with nerves (compare fig. 14, art. Cephalopoda). The limpet breeds upon the southern English coast in the early part of April, but its development has not been followed. It has simply been traced as far as the formation of a diblastula which acquires a ciliated band, and becomes a nearly spherical trochosphere. It is probable that the limpet takes several years to attain full growth, and during that period it frequents the same spot, which becomes gradually sunk below the surrounding surface, especially if the rock be carbonate of lime. At low tide the limpet (being a strictly intertidal organism) is exposed to the air, and (according to trustworthy observers) quits its attachment and walks away in search of food (minute encrusting algae), and then once more returns to the identical spot, not an inch in diameter, which belongs, as it were, to it. Several million limpets—twelve million in Berwickshire alone—are annually used on the east coast of Britain as bait. 510

Sub-order 1. *Docoglossa.*—Nervous system without dialyneury. Eyes are open invaginations without crystalline lens. Two osphradia present but no hypobranchial glands nor operculum. Teeth of radula beam-like, and at most three marginal teeth on each side. Heart has only a single auricle, neither heart nor pericardium traversed by rectum. Shell conical without spire.

Fam. 1.—*Acmaeidae.* A single bipectinate ctenidium on left side. Acmaea, without pallial branchiae, British. Scurria, with pallial branchiae in a circle beneath the mantle.

Fam. 2.—*Tryblidiidae.* Muscle scar divided into numerous impressions. *Tryblidium*, Silurian.

Fam. 3.—*Patellidae*. No ctenidia but pallial branchiae in a circle between mantle and foot. *Patella*, pallial branchiae forming a complete circle, no epipodial tentacles, British. *Ancistromesus*, radula with median central tooth. *Nacella*, epipodial tentacles present. *Helcion*, circlet of branchiae interrupted anteriorly, British.

Fam. 4.—*Lepetidae.* Neither ctenidia nor pallial branchiae. *Lepeta*, without eyes. *Pilidium. Propilidium.*

Fam. 5.—*Bathysciadidae.* Hermaphrodite; head with appendage on right side; radula without central tooth. *Bathysciadium*, abyssal.

Sub-order 2. Rhipidoglossa.—Aspidobranchia with a palliovisceral anastomosis (dialyneurous); eye-vesicle closed, with crystalline lens; ctenidia, osphradia and hypobranchial glands paired or single. Radula with very numerous marginal teeth arranged like the rays of a fan. Heart with two auricles; ventricle traversed by the rectum, except in the *Helicinidae*. An epipodial ridge on each side of the foot and cephalic expansions between the tentacles often present.

Fam. 1.—*Pleurotomariidae*. Shell spiral; mantle and shell with an anterior fissure; two ctenidia; a horny operculum. *Pleurotomaria*, epipodium without tentacles. Genus includes several hundred extinct species ranging from the Silurian to the Tertiary. Five living species from the Antilles, Japan and the Moluccas. Moluccan species is 19 cm. in height.

Fam. 2.—*Bellerophontidae.* 300 species, all fossil, from Cambrian to Trias.

Fam. 3.—*Euomphalidae.* Also extinct, from Cambrian to Cretaceous.

Fam. 4.—*Haliotidae.* Spire of shell much reduced; two bipectinate ctenidia, the right being the smaller; no operculum. Haliotis.

Fam. 5.—*Velainiellidae*, an extinct family from the Eocene.

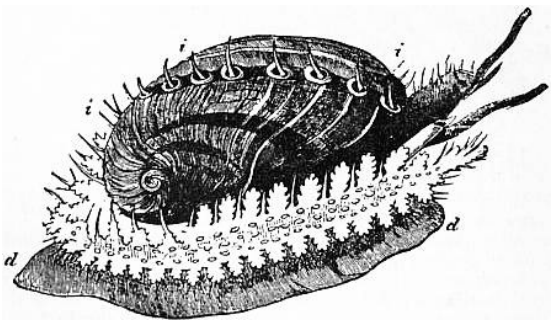


Fig. 15.—*Halio tistuberculata. d*, Foot; *i*, tentacular processes of the mantle. (From Owen, after Cuvier.)

Fam. 6.—*Fissurellidae.* Shell conical; slit or hole in anterior part of mantle; two symmetrical ctenidia; no operculum. *Emarginula*, mantle and shell with a slit, British. *Scutum*, mantle split anteriorly and reflected over shell, which has no slit. *Puncturella*, mantle and shell with a foramen in front of the apex, British. *Fissurella*, mantle and shell perforated at apex, British.

Fam. 7.—*Cocculinidae.* Shell conical, symmetrical, without slit or perforation. *Cocculina*, abyssal.

Fam. 8.—*Trochidae.* Shell spirally coiled; a single ctenidium; eyes perforated; a horny operculum; lobes between the tentacles. *Trochus*, shell umbilicated, spire pointed and prominent, British. *Monodonta*, no jaws, spire not prominent, no umbilicus, columella toothed. *Gibbula*, with jaws, three pairs of epipodial cirri without

pigment spots at their bases, British. *Margarita*, five to seven pairs of epipodial cirri with a pigment spot at base of each.

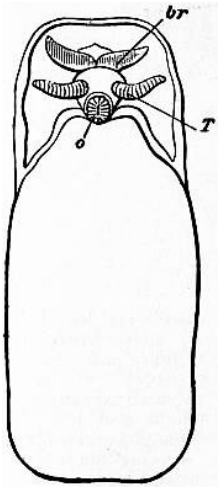


Fig. 16.—*Scutum*, seen from the pedal surface. (Lankester.)

o, Mouth.
T, Cephalic tentacle.
br, One of the two symmetrical gills placed on the neck.

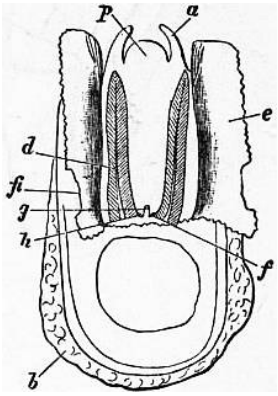


Fig. 17.—Dorsal aspect of a specimen of *Fissurella* from which the shell has been removed, whilst the anterior area of the mantle-skirt has been longitudinally slit and its sides reflected. (Lankester.)

a, Cephalic tentacle.
b, Foot.
d, Left (archaic right) gill-plume.
e, Reflected mantle-flap.
fi, The fissure or hole in the mantle-flap traversed by the longitudinal incision.
f, Right (archaic left) nephridium's aperture.
g, Anus.
h, Left (archaic right) aperture of nephridium.
p, Snout.

Fam. 9.—*Stomatellidae.* Spire of shell much reduced; a single ctenidium. *Stomatella*, foot truncated posteriorly, an operculum present, no epipodial tentacles. *Gena*, foot elongated posteriorly, no operculum.

Fam. 10.—*Delphinulidae.* Shell spirally coiled; operculum horny; intertentacular lobes absent. *Delphinula.*

Fam. 11.—*Liotiidae*, shell globular, margin of aperture thickened. *Liotia.*

Fam. 12.—*Cyclostrematidae.* Shell flattened, umbilicated; foot anteriorly truncated with angles produced into lobes. *Cyclostrema. Teinostoma.*

Fam. 13.—*Trochonematidae.* All extinct, Cambrian to Cretaceous.

Fam. 14.—*Turbinidae.* Shell spirally coiled; epipodial tentacles present; operculum thick and calcareous. *Turbo. Astralium. Molleria. Cyclonema.*

Fam. 15.—*Phasianellidae.* Shell not nacreous, without umbilicus, with prominent spire and polished surface. *Phasianella.*

Fam. 16.—*Umboniidae.* Shell flattened, not umbilicated, generally smooth; operculum horny. *Umbonium. Isanda.*

Fam. 17.—*Neritopsidae.* Shell semi-globular, with short spire; operculum calcareous, not spiral. *Neritopsis. Naticopsis*, extinct.

Fam. 18.—*Macluritidae.* Extinct, Cambrian and Silurian.

Fam. 19.—*Neritidae.* Shell with very low spire, without umbilicus, internal partitions frequently absorbed; a single ctenidium; a cephalic penis present. *Nerita*, marine. *Neritina*, freshwater, British. *Septaria*, shell boat-shaped.

Fam. 20.—*Titiscaniidae.* Without shell and operculum, but with pallial cavity and ctenidium. *Titiscania*, Pacific.

Fam. 21.—*Helicinidae.* No ctenidium, but a pulmonary cavity; heart with a single auricle, not traversed by the rectum. *Helicina. Eutrochatella. Stoastoma. Bourceria.*

Fam. 22.—*Hydrocenidae.* No ctenidium, but a pulmonary cavity; operculum with an apophysis. *Hydrocena*, Dalmatia.

Fam. 23.—*Proserpinidae.* No operculum. *Proserpina*, Central America.

Order 2. Pectinibranchia.—In this order there is no longer any trace of bilateral symmetry in the circulatory, respiratory and excretory organs, the topographically right half of the pallial complex having completely disappeared, except the right kidney, which is represented by the genital duct. There is usually a penis in the male. The ctenidium is monopectinate and attached to the mantle along its whole length, except in *Adeorbis* and *Valvata*; in the latter alone it is bipectinate. There is a single well-developed, often pectinated osphradium. The eye is always a closed vesicle, and the internal cornea is extensive. In the radula there is a single central tooth or none.

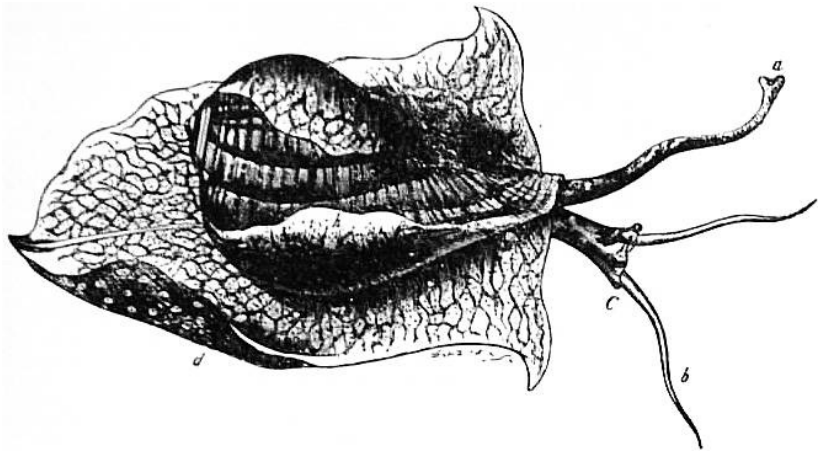


Fig. 18.—Animal and shell of *Pyrula laevigata*. (From Owen.)

a, Siphon.
b, Head-tentacles.
C, Head, the letter placed near the right eye.
d, The foot, expanded as in crawling.
h, The mantle-skirt reflected over the sides of the shell.

The former classification into Holochlamyda, Pneumochlamyda and Siphonochlamyda has been abandoned, as it was founded on adaptive characters not always indicative of true affinities. The order is now divided into two sub-orders: the Taenioglossa, in which there are three teeth on each side of the median tooth of the radula, and the Stenoglossa, in which there is only one tooth on each side of the median tooth. In the latter a pallial siphon, a well-developed proboscis and an unpaired oesophageal gland are always present, in the former they are usually absent. The siphon is an incompletely tubular outgrowth of the mantle margin on the left side, contained in a corresponding outgrowth of the edge of the shell-mouth, and serving to conduct water to the respiratory cavity.

The condition usually spoken of as a “proboscis” appears to be derived from the condition of a simple rostrum (having the mouth at its extremity) by the process of *incomplete introversion* of that simple rostrum. There is no reason in the actual significance of the word why the term “proboscis” should be applied to an alternately introversible and eversible tube connected with an animal’s body, and yet such is a very customary use of the term. The introversible tube may be completely closed, as in the “proboscis” of Nemertine worms, or it may have a passage in it leading into a non-eversible oesophagus, as in the present case, and in the case of the eversible pharynx of the predatory Chaetopod worms. The diagrams here introduced (fig. 19) are intended to show certain important distinctions which obtain amongst the various “introverts,” or intro- and e-versible tubes so frequently met with in animal bodies. Supposing the tube to be completely introverted and to commence its eversion, we then find that eversion may take place, either by a forward movement of the side of the tube near its attached base, as in the proboscis of the Nemertine worms, the pharynx of Chaetopods and the eye-tentacle of Gastropods, or by a forward movement of the inverted apex of the tube, as in the proboscis of the Rhabdocoel Planarians, and in that of Gastropods here under consideration. The former case we call “pleurecbolic” (fig. 19, A, B, C, H, I, K), the latter “acrecbolic” tubes or introverts (fig. 19, D, E, F, G). It is clear that, if we start from the condition of full eversion of the tube and watch the process of introversion, we shall find that the pleurecbolic variety is introverted by the apex of the tube sinking inwards; it may be called acrembolic, whilst conversely the acrecbolic tubes are pleurembolic. Further, it is obvious enough that the process either of introversion or of eversion of the tube may be arrested at any point, by the development of fibres connecting the wall of the introverted tube with the wall of the body, or with an axial structure such as the oesophagus; on the other hand, the range of movement of the tubular introvert may be unlimited or complete. The acrembolic proboscis or frontal introvert of the Nemertine worms has a complete range. So has the acrembolic pharynx of Chaetopods, if we consider the organ as terminating at that point where the jaws are placed and the oesophagus commences. So too the acrembolic eye-tentacle of the snail has a complete range of movement, and also the pleurembolic proboscis of the Rhabdocoel prostoma. The introverted rostrum of the Pectinibranch Gastropods presents in contrast to these a limited range of movement. The “introvert” in these Gastropods is not the pharynx as in the Chaetopod worms, but a prae-oral structure, its apical limit being formed by the true lips and jaws, whilst the apical limit of the Chaetopod’s introvert is formed by the jaws placed at the junction of pharynx and oesophagus, so that the Chaetopod’s introvert is part of the stomodaeum or fore-gut, whilst that of the Gastropod is external to the alimentary canal altogether, being in front of the mouth, not behind it, as is the Chaetopod’s. Further, the Gastropod’s introvert is pleurembolic (and therefore acrecbolic), and is limited both in eversion and in introversion; it cannot be completely everted owing to the muscular bands (fig. 19, G), nor can it be fully introverted owing to the bands (fig. 19, F) which tie the axial pharynx to the adjacent wall of the apical part of the introvert. As in all such intro- and e-versible organs, eversion of the Gastropod proboscis is effected by pressure communicated by the muscular body-wall to the liquid contents (blood) of the body-space, accompanied by the relaxation of the muscles which directly pull upon either the sides or the apex of the tubular organ. The inversion of the proboscis is effected directly by the contraction of these muscles. In various members of the Pectinibranchia the mouth-bearing cylinder is introversible (*i.e.* is a *proboscis*)—with rare exceptions these forms have a siphonate mantle-skirt. On the other hand, many which have a siphonate mantle-skirt are not provided with an introversible mouth-bearing cylinder, but have a simple non-introversible rostrum, as it has been termed, which is also the condition presented by the mouth-bearing region in nearly all other Gastropoda. One of the best examples of the introversible mouth-cylinder or proboscis which can be found is that of the common whelk (*Buccinum undatum*) and its immediate allies. In fig. 23 the proboscis is seen in an everted state; it is only so carried when feeding, being withdrawn when the animal is at rest. Probably its use is to enable the animal to introduce its rasping and licking apparatus into very narrow apertures for the purposes of feeding, *e.g.* into a small hole bored in the shell of another mollusc.

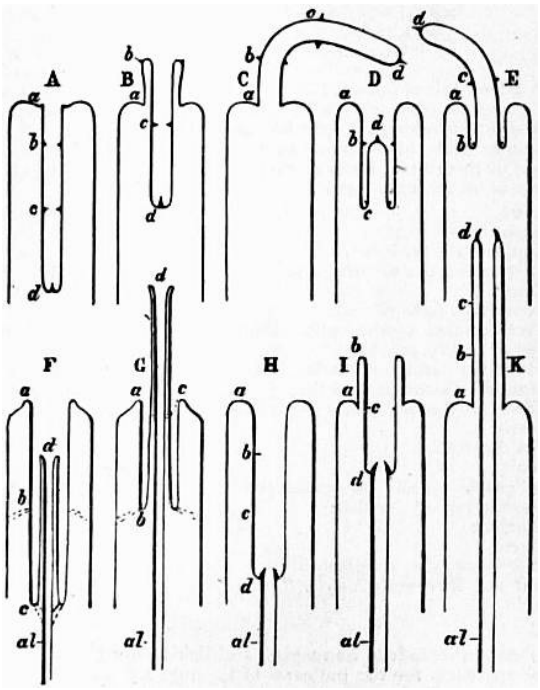


FIG. 19.—Diagrams explanatory of the nature of so-called proboscides or "introverts." (Lankester.)

A, Simple introvert completely introverted.

B, The same, partially everted by eversion of the sides, as in the Nemertine proboscis and Gastropod eye-tentacle = pleurecbolic.

C, The same, fully everted.

D, E, A similar simple introvert in course of eversion by the forward movement, not of its sides, but of its apex, as in the proboscidean Rhabdocoels = acrecbolic.

F, Acrecbolic (= pleurembolic) introvert, formed by the snout of the proboscidiferous Gastropod. *al*, alimentary canal; *d*, the true mouth. The introvert is not a simple one with complete range both in eversion and introversion, but is arrested in introversion by the fibrous bands at *c*, and similarly in eversion by the fibrous bands at *b*.

G, The acrecbolic snout of a proboscidiferous Gastropod, arrested short of complete eversion by the fibrous band *b*.

H, The acrembolic (= pleurecbolic) pharynx of a Chaetopod fully introverted. *al*, alimentary canal; at *d*, the jaws; at a, the mouth; therefore *a* to *d* is stomodaeum, whereas in the Gastropod (F) *a* to *d* is inverted body-surface.

I, Partial eversion of H.

K, Complete eversion of H.

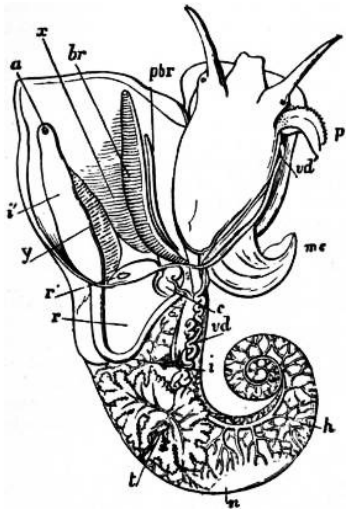


FIG. 20.—Male of *Littorina littoralis*, Lin., removed from its shell; the mantle-skirt cut along its right line of attachment and thrown over to the left side of the animal so as to expose the organs on its inner face.

a, Anus.
i, Intestine.
r, Nephridium (kidney).
r', Aperture of the nephridium.
c, Heart.
br, Ctenidium (gill-plume).
pbr, Parabranchia (= the osphradium or olfactory patch).
x, Glandular lamellae of the inner face of the mantle-skirt.
y, Adrectal (purpuriparous) gland.
t, Testis.

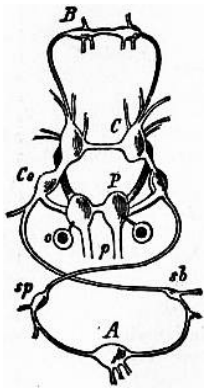


FIG. 21.—Nervous system of *Paludina* as a type of the streptoneurous condition. (From Gegenbaur, after Jhering.)

B, Buccal (suboesophageal) ganglion.
C, Cerebral ganglion.
Co, Pleural ganglion.
P, Pedal ganglion with otocyst attached.
p, Pedal nerve.
A, Abdominal ganglion at the extremity of the twisted visceral "loop."
sp, Supra-intestinal visceral ganglion on the course of the right visceral

vd, Vas deferens.
p, Penis.
mc, Columella muscle (muscular process grasping the shell).
v, Stomach.
h, Liver.
N.B.—Note the simple snout or rostrum not introverted as a "proboscis."
cord.
sb, Sub-intestinal ganglion on the course of the left visceral cord.

The very large assemblage of forms coming under this order comprises the most highly developed predaceous sea-snails, numerous vegetarian species, a considerable number of freshwater and some terrestrial forms. The partial dissection of a male specimen of the common periwinkle, *Littorina littoralis*, drawn in fig. 20, will serve to exhibit the disposition of viscera which prevails in the group. The branchial chamber formed by the mantle-skirt overhanging the head has been exposed by cutting along a line extending backward from the letters vd to the base of the columella muscle mc, and the whole roof of the chamber thus detached from the right side of the animal's neck has been thrown over to the left, showing the organs which lie upon the roof. No opening into the body-cavity has been made; the organs which lie in the coiled visceral hump show through its transparent walls. The head is seen in front resting on the foot and carrying a median non-retractile snout or rostrum, and a pair of cephalic tentacles at the base of each of which is an eye. In many Gastropoda the eyes are not thus sessile but raised upon special eye-tentacles (figs. 25, 56). To the right of the head is seen the muscular penis *p*, close to the termination of the vas deferens (spermatic duct) *vd*. The testis *t* occupies a median position in the coiled visceral mass. Behind the penis on the same side is the hook-like columella muscle, a development of the retractor muscle of the foot, which clings to the spiral column or columella of the shell (see fig. 33). This columella muscle is the same thing as the muscles adhering to the shell in *Patella*, and the posterior adductor of Lamellibranchs.

The surface of the neck is covered by integument forming the floor of the branchial cavity. It has not been cut into. Of the organs lying on the reflected mantle-skirt, that which in the natural state lay nearest to the vas deferens on the right side of the median line of the roof of the branchial chamber is the rectum *i'*, ending in the anus *a*. It can be traced back to the intestine *i* near the surface of the visceral hump, and it is found that the apex of the coil formed by the hump is occupied by the liver *h* and the stomach *v*. Pharynx and oesophagus are concealed in the head. The enlarged glandular structure of the walls of the rectum is frequent in the Pectinibranchia, as is also though not universal the gland marked *y*, next to the rectum. It is the adrectal gland, and in the genera *Murex* and *Purpura* secretes a colourless liquid which turns purple upon exposure to the atmosphere, and was used by the ancients as a dye. Near this and less advanced into the branchial chamber is the single renal organ or nephridium *r* with its opening to the exterior *r'*. Internally this glandular sac presents a second slit or aperture which leads into the pericardium (as is now found to be the case in all Mollusca). The heart *c* lying in the pericardium is seen in close proximity to the renal organ, and consists of a single auricle receiving blood from the gill, and of a single ventricle which pumps it through the body by an anterior and posterior aorta. The surface *x* of the mantle between the rectum and the gill-plume is thrown into folds which in many sea-snails (whelks or *Buccinidae*, &c.) are very strongly developed. The whole of this surface appears to be active in the secretion of a mucous-like substance. The single gill-plume *br* lies to the left of the median line in natural position. It corresponds to the right of the two primitive ctenidia in the untwisted archaic condition of the molluscan body, and does not project freely into the branchial cavity, but its axis is attached (by concrescence) to the mantle-skirt (roof of the branchial chamber). It is rare for the gill-plume of a Pectinibranch Gastropod to stand out freely as a plume, but occasionally this more archaic condition is exhibited as in *Valvata* (fig. 30). Next beyond (to the left of) the gill-plume we find the so-called parabranchia, which is here simple, but sometimes lamellated as in *Purpura* (fig. 22). This organ has, without reason, been supposed to represent the second ctenidium of the typical mollusc, which it cannot do on account of its position. It should be to the right of the anus were this the case. Spengel showed that the parabranchia of Gastropods is the typical olfactory organ or osphradium in a highly developed condition. The minute structure of the epithelium which clothes it, as well as the origin of the nerve which is distributed to the parabranchia, proves it to be the same organ which is found universally in molluscs at the base of each gill-plume, and tests the indrawn current of water by the sense of smell. The nerve to this organ is given off from the superior (original right, see fig. 3) visceral ganglion.

The figures which are given here of various Pectinibranchia are in most cases sufficiently explained by the references attached to them. As an excellent general type of the nervous system, attention may be directed to that of *Paludina* drawn in fig. 21. On the whole the ganglia are strongly individualized in the Pectinibranchia, nerve-cell tissue being concentrated in the ganglia and absent from the cords. At the same time, the junction of the visceral loop above the intestine prevents in all Streptoneura the shortening of the visceral loop, and it is rare to find a fusion of the visceral ganglia with either pleural, pedal or cerebral—a fusion which can and does take place where the visceral loop is not above but below the intestine, *e.g.* in the Euthyneura (fig. 48), Cephalopoda and Lamellibranchia. As contrasted with the Aspidobranchia, we find that in the Pectinibranchia the pedal nerves are distinctly nerves given off from the pedal ganglia, rather than cord-like nerve-tracts containing both nerve-cells or ganglionic elements and nerve-fibres. Yet in some Pectinibranchia (*Paludina*) a ladder-like arrangement of the two pedal nerves and their lateral branches has been detected. The histology of the nervous system of Mollusca has yet to be seriously inquired into.

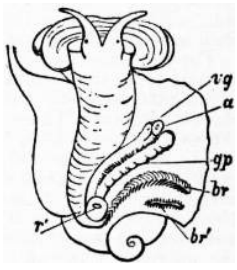


FIG. 22.—Female of *Purpura lapillus* removed from its shell; the mantle-skirt cut along its left line of attachment and thrown over to the right side of the animal so as to expose the organs on its inner face.

a, Anus.
vg, Vagina.
gp, Adrectal purpuriparous gland.
r', Aperture of the nephridium (kidney).
br, Ctenidium (branchial plume).
br', Parabranchia (= the comb-like osphradium or olfactory organ).

The alimentary canal of the Pectinibranchia presents little diversity of character, except in so far as the buccal region is concerned. Salivary glands are present, and in some carnivorous forms (*Dolium*) these secrete free sulphuric acid (as much as 2% is present in the secretion), which assists the animal in boring holes by means of its rasping tongue through the shells of other molluscs upon which it preys. A crop-like dilatation of the gut and a recurved intestine, embedded in the compact yellowish-brown liver, the ducts of which open into it, form the rest of the digestive tract and occupy a large bulk of the visceral hump. The buccal region presents a pair of shelly jaws placed laterally upon the lips, and a wide range of variation in the form of the denticles of the lingual ribbon or radula.

Well-developed glandular invaginations occur in different positions on the foot in Pectinibranchia. The most important of these opens by the ventral pedal pore, situated in the median line in the anterior half of the foot. This organ is probably homologous with the byssogenous gland of Lamellibranchs. The aperture, which was formerly supposed to be an aquiferous pore, leads into an extensive and often

ramified cavity surrounded by glandular tubules. The gland has been found in both sub-orders of the Pectinibranchia, in *Cyclostoma* and *Cypraea* among the Taenioglossa, in *Hemifusus*, *Cassis*, *Nassa*, *Murex*, *Fasciolariidae*, *Turbinellidae*, *Olividae*, *Marginellidae* and *Conidae* among the Stenoglossa. It was discovered by J.T. Cunningham that in *Buccinum* the egg-capsules are formed by this pedal gland and not by any accessory organ of the generative system. Such horny egg-capsules doubtless have the same origin in all other species in which they occur, *e.g. Fusus*, *Pyrula*, *Purpura*, *Murex*, *Nassa*, *Trophon*, *Voluta*, &c. The float of the pelagic *Janthina*, to which the egg-capsules are attached, probably is also formed by the secretion of the pedal gland.

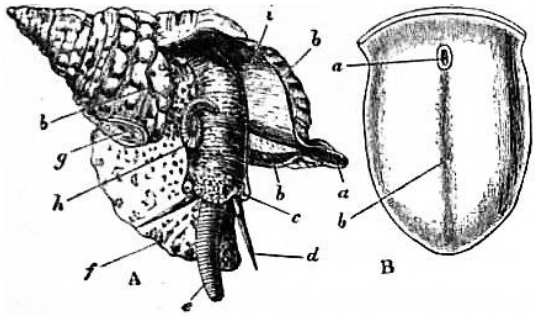


FIG. 23.—A, *Triton variegatum*, to show the proboscis or buccal introvert (*e*) in a state of eversion.

a, Siphonal notch of the shell occupied by the siphonal fold of the mantle-skirt (Siphonochlamyda).
b, Edge of the mantle-skirt resting on the shell.
c, Cephalic eye.
d, Cephalic tentacle.
e, Everted buccal introvert (proboscis).
f, Foot.
g, Operculum.
h, Penis.
i, Under surface of the mantle-skirt forming the roof of the sub-pallial chamber.

B, Sole of the foot of *Pyrula tuba*, to show a, the pore usually said to be "aquiferous" but probably the orifice of a gland; *b*, median line of foot.

Other glands opening on or near the foot are: (1) The suprapedal gland opening in the middle line between the snout and the anterior border of the foot. It is most commonly found in sessile forms and in terrestrial genera such as *Cyclostoma*; (2) the anterior pedal gland opening into the anterior groove of the foot, generally present in aquatic species; (3) dorsal posterior mucous glands in certain *Cyclostomatidae*.

The foot of the Pectinibranchia, unlike the simple muscular disk of the Isopleura and Aspidobranchia, is very often divided into lobes, a fore, middle and hind lobe (pro-, meso- and meta-podium, see figs. 24 and 25). Very usually, but not universally, the metapodium carries an operculum. The division of the foot into lobes is a simple case of that much greater elaboration or breaking up into processes and regions which it undergoes in the class Cephalopoda. Even among some Gastropoda (viz. the Opisthobranchia) we find the lobation of the foot still further carried out by the development of lateral lobes, the parapodia, whilst there are many Pectinibranchia, on the other hand, in which the foot has a simple oblong form without any trace of lobes.

The development of the Pectinibranchia has been followed in several examples, *e.g. Paludina*, *Purpura*, *Nassa*, *Vermetus*, *Neritina*. As in other Molluscan groups, we find a wide variation in the early process of the formation of the first embryonic cells, and their arrangement as a diblastula, dependent on the greater or less amount of food-yolk which is present in the egg-cell when it commences its embryonic changes. In fig. 26 the early stages of *Paludina vivipara* are represented. There is but very little food-material in the egg of this Pectinibranch, and consequently the diblastula forms by invagination; the blastopore or orifice of invagination coincides with the anus, and never closes entirely. A well-marked trochosphere is formed by the development of an equatorial ciliated band; and subsequently, by the disproportionate growth of the lower hemisphere, the trochosphere becomes a veliger. The primitive shell-sac or shell-gland is well marked at this stage, and the pharynx is seen as a new ingrowth (the stomodaeum), about to fuse with and open into the primitively invaginated arch-enteron (fig. 26, F).

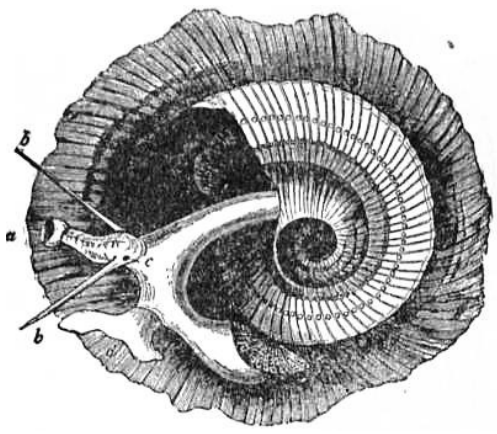


FIG. 24.—Animal and shell of *Phorus exutus*.

a, Snout (not introversible).
b, Cephalic tentacles.
c, Right eye.
d, Pro- and meso-podium; to the right of this is seen the metapodium bearing the sculptured

operculum.

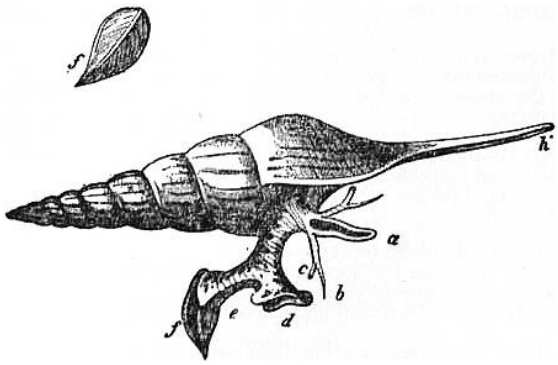


FIG. 25.—Animal and shell of *Rostellaria rectirostris*. (From Owen.)

a, Snout or rostrum.
b, Cephalic tentacle.
c, Eye.
d, Propodium and mesopodium.
e, Metapodium.
f, Operculum.
h´, Prolonged siphonal notch of the shell occupied by the siphon, or trough-like process of the mantle-skirt.

In other Pectinibranchia (and such variations are representative for all Mollusca, and not characteristic only of Pectinibranchia) we find that there is a very unequal division of the egg-cell at the commencement of embryonic development, as in *Nassa*. Consequently there is, strictly speaking, no invagination (emboly), but an overgrowth (epiboly) of the smaller cells to enclose the larger. The general features of this process and of the relation of the blastopore to mouth and anus have been explained in treating of the development of Mollusca generally. In such cases the blastopore may entirely close, and both mouth and anus develop as new ingrowths (stomodaeum and proctodaeum), whilst, according to the observations of N. Bobretzky, the closed blastopore may coincide in position with the mouth in some instances (*Nassa*, &c.), instead of with the anus. But in these epibolic forms, just as in the embolic *Paludina*, the embryo proceeds to develop its ciliated band and shell-gland, passing through the earlier condition of a trochosphere to that of the veliger. In the veliger stage many Pectinibranchia (*Purpura*, *Nassa*, &c.) exhibit, in the dorsal region behind the head, a contractile area of the body-wall. This acts as a larval heart, but ceases to pulsate after a time. Similar rhythmically contractile areas are found on the foot of the embryo Pulmonate *Limax* and on the yolk-sac (distended foot-surface) of the Cephalopod *Loligo*. The preconchylian invagination or shell-gland is formed in the embryo behind the velum, on the surface opposite the blastopore. It is surrounded by a ridge of cells which gradually extends over the visceral sac and secretes the shell. In forms which are naked in the adult state, the shell falls off soon after the reduction of the velum, but in *Cenia*, *Runcina* and *Vaginula* the shell-gland and shell are not developed, and the young animal when hatched has already the naked form of the adult.

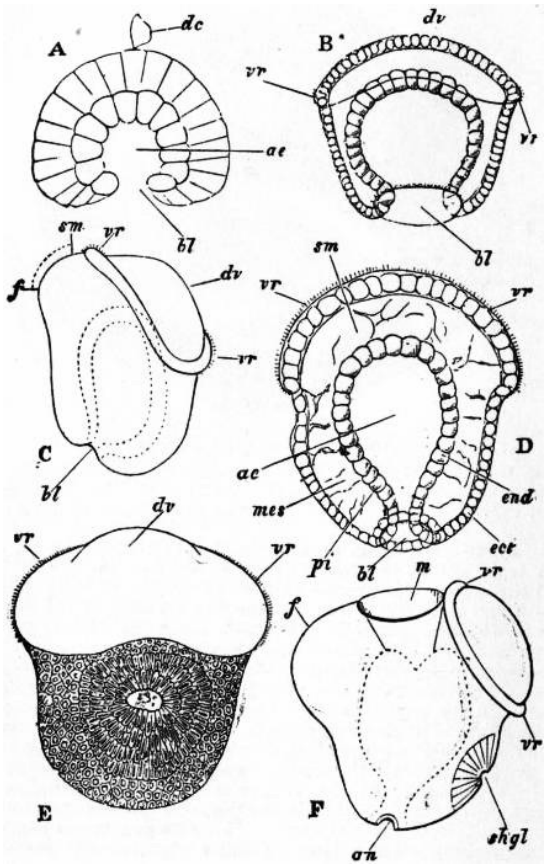


FIG. 26.—Development of the River-Snail, *Paludina vivipara*. (After Lankester, 17.)

dc, Directive corpuscle (outcast cell).
f, Foot.
mes, Rudiments of the

ae, Arch-enteron or cavity lined by the enteric cell-layer or endoderm.
bl, Blastopore.
vr, Velum or circlet of ciliated cells.
dv, Velar area or cephalic dome.
sm, Site of the as yet unformed mouth.
skeleto-trophic tissues.
pi, The pedicle of invagination, the future rectum.
shgl, The primitive shell-sac or shell-gland.
m, Mouth.
an, Anus.

A, Diblastula phase (optical section).

B, The diblastula has become a trochosphere by the development of the ciliated ring vr (optical section).

C, Side view of the trochosphere with commencing formation of the foot.

D, Further advanced trochosphere (optical section).

E, The trochosphere passing to the veliger stage, dorsal view showing the formation of the primitive shell-sac.

F, Side view of the same, showing foot, shell-sac (*shgl*), velum (*vr*), mouth and anus.

N.B.—In this development the blastopore is not elongated; it persists as the anus. The mouth and stomodaeum form independently of the blastopore.

One further feature of the development of the Pectinibranchia deserves special mention. Many Gastropoda deposit their eggs, after fertilization, enclosed in capsules; others, as *Paludina*, are viviparous; others, again, as the Zygobranchia, agree with the Lamellibranch Conchifera (the bivalves) in having simple exits for the ova without glandular walls, and therefore discharge their eggs unenclosed in capsules freely into the sea-water; such unencapsuled eggs are merely enclosed each in its own delicate chorion. When egg-capsules are formed they are often of large size, have tough walls, and in each capsule are several eggs floating in a viscid fluid. In some cases all the eggs in a capsule develop; in other cases one egg only in a capsule (*Neritina*), or a small proportion (*Purpura, Buccinum*), advance in development; the rest are arrested either after the first process of cell-division (cleavage) or before that process. The arrested embryos or eggs are then swallowed and digested by those in the same capsule which have advanced in development. This is clearly the same process in essence as that of the formation of a vitellogenous gland from part of the primitive ovary, or of the feeding of an ovarian egg by the absorption of neighbouring potential eggs; but here the period at which the sacrifice of one egg to another takes place is somewhat late. What it is that determines the arrest of some eggs and the progressive development of others in the same capsule is at present unknown.

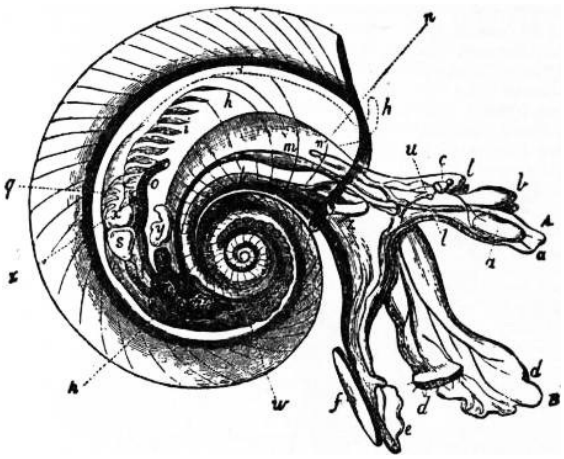


FIG. 27.—*Oxygyrus Keraudrenii*. (From Owen.)

a, Mouth and odontophore.
b, Cephalic tentacles.
c, Eye.
d, Propodium (*B*) and mesopodium.
e, Metapodium.
f, Operculum.
h, Mantle-chamber.
i, Ctenidium (gill-plume).
k, Retractor muscle of foot.
l, Optic tentacle.
m, Stomach.
n, Dorsal surface overhung by the mantle-skirt; the letter is close to the salivary gland.
o, Rectum and anus.
p, Liver.
q, Renal organ (nephridium).
s, Ventricle.
u, The otocyst attached to the cerebral ganglion.
w, Testis.
x, Auricle of the heart.
y, Vesicle on genital duct.
z, Penis.

In the tribe of Pectinibranchia called Heteropoda the foot takes the form of a swimming organ. The nervous system and sense organs are highly developed. The odontophore also is remarkably developed, its lateral teeth being mobile, and it serves as an efficient organ for attacking the other pelagic forms on which the Heteropoda prey. The sexes are distinct, as in all Streptoneura; and genital ducts and accessory glands and pouches are present, as in all Pectinibranchia. The Heteropoda exhibit a series of modifications in the form and proportions of the visceral mass and foot, leading from a condition readily comparable with that of a typical Pectinibranch such as *Rostellaria*, with the three regions of the foot strongly marked and a coiled visceral hump of the usual proportions, up to a condition in which the whole body is of a tapering cylindrical shape, the foot a plate-like vertical fin, and the visceral hump almost completely atrophied. Three steps of this modification may be distinguished as three families: —*Atlantidae*, *Carinariidae* and *Pterotrachaeidae*. They are true Pectinibranchia which have taken to a pelagic life, and the peculiarities of structure which they exhibit are strictly adaptations consequent upon their changed mode of

life. Such adaptations are the transparency and colourlessness of the tissues, and the modifications of the foot, which still shows in *Atlanta* the form common in Pectinibranchia (compare fig. 27 and fig. 24). The cylindrical body of *Pterotrachaea* is paralleled by the slug-like forms of Euthyneura. J.W. Spengel has shown that the visceral loop of the Heteropoda is streptoneurous. Special to the Heteropoda is the high elaboration of the lingual ribbon, and, as an agreement with some of the opisthobranchiate Euthyneura, but as a difference from the Pectinibranchia, we find the otocysts closely attached to the cerebral ganglia. This is, however, less of a difference than it was at one time supposed to be, for it has been shown by H. Lacaze-Duthiers, and also by F. Leydig, that the otocysts of Pectinibranchia even when lying close upon the pedal ganglion (as in fig. 21) yet receive their special nerve (which can sometimes be readily isolated) from the cerebral ganglion (see fig. 11). Accordingly the difference is one of position of the otocyst and not of its nerve-supply. The Heteropoda are further remarkable for the high development of their cephalic eyes, and for the typical character of their osphradium (Spengel's olfactory organ). This is a groove, the edges of which are raised and ciliated, lying near the branchial plume in the genera which possess that organ, whilst in *Firoloida*, which has no branchial plume, the osphradium occupies a corresponding position. Beneath the ciliated groove is placed an elongated ganglion (olfactory ganglion) connected by a nerve to the supra-intestinal (therefore the primitively dextral) ganglion of the long visceral nerve-loop, the strands of which cross one another—this being characteristic of Streptoneura (Spengel).

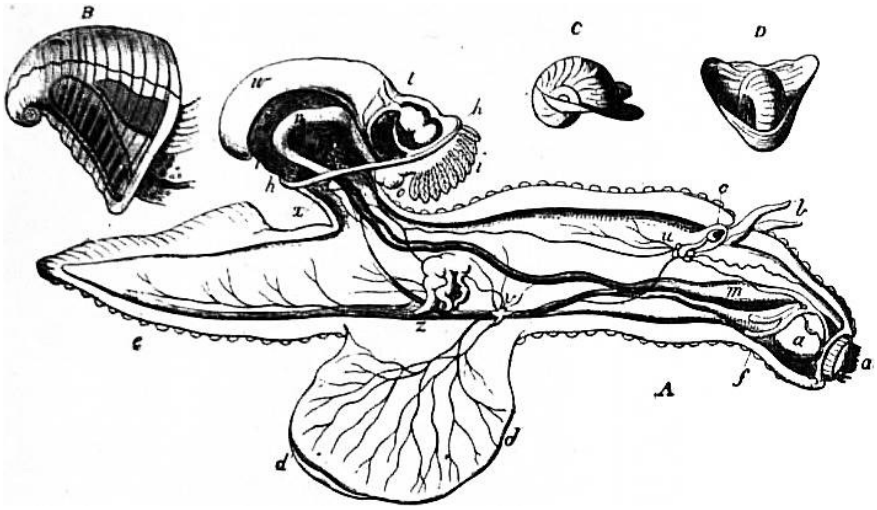


Fig. 28.—*Carinaria mediterranea*. (From Owen.)
A, The animal. B, The shell removed. C, D, Two views of the shell of *Cardiopoda*.

a, Mouth and odontophore.
b, Cephalic tentacles.
c, Eye.
d, The fin-like mesopodium.
d', Its sucker.
e, Metapodium.
f, Salivary glands.
h, Border of the mantle-flap.
i, Ctenidium (gill-plume).
m, Stomach.
n, Intestine.
o, Anus.
p, Liver.
t, Aorta, springing from the ventricle.
u, Cerebral ganglion.
v, Pleural and pedal ganglion.
w, Testis.
x, Visceral ganglion.
y, Vesicula seminalis.
z, Penis.

The Heteropoda belong to the "pelagic fauna" occurring near the surface in the Mediterranean and great oceans in company with the Pteropoda, the Siphonophorous Hydrozoa, Salpae, Leptocephali, and other specially-modified transparent swimming representatives of various groups of the animal kingdom. In development they pass through the typical trochosphere and veliger stages provided with boat-like shell.

Sub-order 1.—Taenioglossa. Radula with a median tooth and three teeth on each side of it. Formula 3 : 1 : 3.

Tribe 1.—Platypoda. Normal Taenioglossa of creeping habit. The foot is flattened ventrally, at all events in its anterior part (*Strombidae*). Otocysts situated close to the pedal nerve-centres. Accessory organs are rarely found on the genital ducts, but occur in *Paludina, Cyclostoma, Naticidae, Calyptraeidae*, &c. Mandibles usually present. This is the largest group of Mollusca, including nearly sixty families, some of which are insufficiently known from the anatomical point of view.

Fam. 1.—*Paludinidae*. Pedal centres in the form of ganglionated cords; kidney provided with a ureter; viviparous; fluviatile. *Paludina*. *Neothauma*, from Lake Tanganyika. *Tylopoma*, extinct, Tertiary.

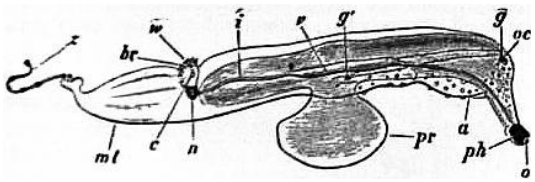


Fig. 29.—*Pterotrachea mutica* seen from the right side.
(After Keferstein.)

a, Pouch for reception of the snout when retracted.
c, Pericardium.
ph, Pharynx.
oc, Cephalic eye.
g, Cerebral ganglion.
g', Pleuro-pedal ganglion.
pr, Foot (mesopodium).
v, Stomach.
i, Intestine.
n, So-called nucleus.
br, Branchial plume (ctenidium).
w, Osphradium.
mt, Foot (metapodium).
z, Caudal appendage.

Fam. 2.—*Cyclophoridae*. No ctenidium, pallial cavity transformed into a lung; aperture of shell circular; terrestrial. *Pomatias*, shell turriculated. *Diplommatina*. *Hybocystis*. *Cyclophorus*, shell umbilicated, with a short spire and horny operculum. Cyclosurus, shell uncoiled. *Dermatocera*, foot with a horn-shaped protuberance at its posterior end. Spiraculum.

Fam. 3.—*Ampullariidae*. To the left of the ctenidium a pulmonary sac, separated from it by an incomplete septum, amphibious. *Ampullaria*, shell dextral, coiled. *Lanistes*, shell sinistral, spire short or obsolete. *Meladomus*.

Fam. 4.—*Littorinidae*. Oesophageal pouches present; pedal nerve-centres concentrated; a pedal penis near the right tentacle. *Littorina*, shell not umbilicated, littoral habit. *Lacuna*, foot with two posterior appendages, marine, entirely aquatic. *Cremnoconchus*, entirely aerial, Indian. *Risella. Tectarius.*

Fam. 5.—*Fossaridae*. Head with two lobes in some Rhipidoglossa. *Fossaria.*

Fam. 6.—*Purpurinidae*, extinct.

Fam. 7.—*Planaxidae*. Shell with pointed spire; a short pallial siphon. Planaxis.

Fam. 8.—*Cyclostomatidae*. Pallial cavity transformed into a lung; pedal centres concentrated; a deep pedal groove. *Cyclostoma*, shell turbinated, operculum calcareous, British. *Omphalotropis.*

Fam. 9.—*Aciculidae*. Pallial cavity transformed into a lung; operculum horny; shell narrow and elongated. *Acicula.*

Fam. 10.—*Valvatidae*. Ctenidium bipectinate, free; hermaphrodite; fluviatile. *Valvata*, British.

Fam. 11.—*Rissoidae*. Epipodial filaments present; one or two pallial tentacles. *Rissoa. Rissoina. Stiva.*

Fam. 12.—*Litiopidae*. An epipodium bearing three pairs of tentacles and an operculigerous lobe with two appendages; inhabitants of the Sargasso weed. *Litiopa.*

Fam. 13.—*Adeorbiidae*. Mantle with two posterior appendages; ctenidium large and capable of protrusion from pallial cavity. *Adeorbis*, British.

Fam. 14.—*Jeffreysiidae*. Head with two long labial palps; shell ovoid; operculum horny, semicircular, carinated. *Jeffreysia.*

Fam. 15.—*Homalogyridae*. Shell flattened; no cephalic tentacles. *Homalogyra*, British. *Ammoniceras.*

Fam. 16.—*Skeneidae*. Shell depressed, with rounded aperture; cephalic tentacles long. *Skenea*, British.

Fam. 17.—*Choristidae*. Shell spiral; four cephalic tentacles; eyes absent; two pedal appendages. *Choristes.*

Fam. 18.—*Assimineidae*. Eyes at free extremities of tentacles. Assiminea, estuarine, British.

Fam. 19.—*Truncatellidae*. Snout very long, bilobed; foot short. *Truncatella.*

Fam. 20.—*Hydrobiidae*. Shell with prominent spire; penis distant from right tentacle, generally appendiculated; brackish water or fluviatile. *Hydrobia*, British. *Baikalia*, from Lake Baikal. *Pomatiopsis*. *Bithynella. Lithoglyphus. Spekia*, viviparous, from Lake Tanganyika. *Tanganyicia*. *Limnotrochus*, from Lake Tanganyika. *Chytra. Littorinida. Bithynia*, British, fluviatile. *Stenothyra.*

Fam. 21.—*Melaniidae*. Spire of shell somewhat elongated; mantle-border fringed; viviparous; fluviatile. *Melania. Faunus. Paludomus. Melanopsis. Nassopsis. Bythoceras*, from Lake Tanganyika.

Fam. 22.—*Typhobiidae*. Foot wide; shell turriculated, with carinated whorls, the carinae tuberculated or spiny. *Typhobia. Bathanalia*, from Lake Tanganyika.

Fam. 23.—*Pleuroceridae*. Like *Melaniidae*, but mantle-border not fringed and reproduction oviparous. *Pleurocera. Anculotus.*

Fam. 24.—*Pseudomelaniidae*. All extinct.

Fam. 25.—*Subulitidae*. All extinct.

Fam. 26.—*Nerineidae*. All extinct.

Fam. 27.—*Cerithiidae*. Shell with numerous tuberculated whorls; aperture canaliculated anteriorly; short pallial siphon. *Cerithium. Bittium. Potamides. Triforis. Laeocochlis. Cerithiopsis.*

Fam. 28.—*Modulidae*. Shell with short spire; no siphon. *Modulus.*

FIG. 30.—*Valvata cristata*, Müll.

o, Mouth.
op, Operculum.
br, Ctenidium (branchial plume).
x, Filiform appendage (? rudimentary ctenidium).

The freely projecting ctenidium of typical form not having its axis fused to the roof of the branchial chamber is the notable character of this genus.

Fam. 29.—*Vermetidae*. Animal fixed by the shell, the last whorls of which are not in contact with each other; foot small; two anterior pedal tentacles. *Vermetus. Siliquaria.*

Fam. 30.—*Caecidae*. Shell almost completely uncoiled, in one plane, with internal septa. *Caecum*, British.

Fam. 31.—*Turritellidae*. Shell very long; head large; foot broad. *Turritella*, British. *Mesalia. Mathilda.*

Fam. 32.—*Struthiolariidae*. Shell conical; aperture slightly canaliculated; siphon slightly developed. *Struthiolaria.*

Fam. 33.—*Chenopodidae*. Shell elongated; aperture expanded; siphon very short. *Chenopus*, British. *Alaria*, *Spinigera*, *Diartema*, extinct.

Fam. 34.—*Strombidae*. Foot narrow, compressed, without sole. *Strombus. Pteroceras. Rostellaria. Terebellum.*

Fam. 35.—*Xenophoridae*. Foot transversely divided into two parts. *Xenophorus. Eotrochus*, Silurian.

Fam. 36.—*Capulidae*. Shell conical, not coiled, but slightly incurved posteriorly; a tongue-shaped projection between snout and foot. *Capulus. Thyca*, parasitic on asterids.

Platyceras, extinct.

Fam. 37.—*Hipponycidae.* Shell conical; foot secreting a ventral calcareous plate; animal fixed. *Hipponyx. Mitrularia.*

Fam. 38.—*Calyptraeidae.* Shell with short spire; lateral cervical lobes present; accessory genital glands. *Calyptraea*, British. *Crepidula. Crucibulum.*

Fam. 39.—*Naricidae.* Foot divided into two, posterior half bearing the operculum; a wide epipodial velum; shell turbinated. Narica.

Fam. 40.—*Naticidae.* Foot large, with aquiferous system; propodium reflected over head; eyes degenerate; burrowing habit. *Natica*, British. *Amaura. Sigaretus.*

Fam. 41.—*Lamellariidae.* Shell thin, more or less covered by the mantle; no operculum. *Lamellaria. Velutina. Marsenina*, *Oncidiopsis*, hermaphrodite.

Fam. 42.—*Trichotropidae.* Shell with short spire, carinate and pointed. *Trichotropis.*

Fam. 43.—*Seguenziidae.* Shell trochiform, with canaliculated aperture and twisted columella. *Seguenzia*, abyssal.

Fam. 44.—*Janthinidae.* Shell thin; operculum absent; tentacles bifid; foot secretes a float; pelagic. *Janthina. Recluzia.*

Fam. 45.—*Cypraeidae.* Shell inrolled, solid, polished, aperture very narrow in adult; short siphon; anus posterior; osphradium with three lobes; mantle reflected over shell. *Cypraea. Pustularia. Ovula. Pedicularia*, attached to corals. *Erato*.

FIG. 31.—Shell of *Crucibulum*, seen from below so as to show the inner whorl *b*, concealed by the cap-like outer whorl *a*.

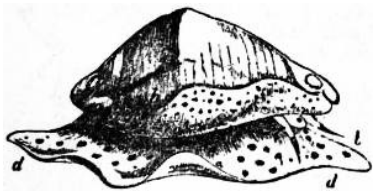


FIG. 32.—Animal and shell of *Ovula*.

b, Cephalic tentacles.
d, Foot.
h, Mantle-skirt, which is naturally carried in a reflected condition so as to cover the sides of the shell.

Fam. 46.—*Tritonidae.* Shell turriculated and siphonated, thick, each whorl with varices; foot broad and truncated anteriorly; pallial siphon well developed; proboscis present. *Triton. Persona. Ranella.*

Fam. 47.—*Columbellinidae.* All extinct.

Fam. 48.—*Cassididae.* Shell ventricose, with elongated aperture, and short spire; proboscis and siphon long; operculum with marginal nucleus. *Cassis. Cassidaria. Oniscia.*

Fam. 49—*Oocorythidae.* Shell globular and ventricose; aperture oval and canaliculated; operculum spiral. *Oocorys*, abyssal.

Fam. 50.—*Doliidae.* Shell ventricose, with short spire, and wide aperture; no varices and no operculum; foot very broad, with projecting anterior angles; siphon long. *Dolium. Pyrula.*

Fam. 51.—*Solariidae. Solarium. Torinia. Fluxina.*

Fam. 52.—*Scalariidae.* Shell turriculated, with elongated spire; proboscis short; siphon rudimentary. *Scalaria. Eglisia.* Crossea. Aclis.

The three following families have neither radula nor jaws, and are therefore called *Aglossa*. They have a well-developed proboscis which is used as a suctorial organ; some are abyssal, but the majority are either commensals or parasites of Echinoderms.

Fam. 53.—*Pyramidellidae.* Summit of spire heterostrophic; a projection, the mentum, between head and foot; operculum present. *Pyramidella. Turbonilla. Odostomia*, British. *Myxa.*

Fam. 54.—*Eulimidae.* Visceral mass still coiled spirally; shell thin and shining. *Eulima*, foot well developed, with an operculum, animal usually free, but some live in the digestive cavity of Holothurians. *Mucronalia*, foot reduced, but still operculate, eyes present, animal fixed by its very long proboscis which is deeply buried in the tissues of an Echinoderm, no pseudopallium. *Stylifer*, the operculum is lost, animal fixed by a large proboscis which forms a pseudopallium covering the whole shell except the extremity of the spire, parasitic on all groups of Echinoderms. *Entosiphon*, visceral mass still coiled; shell much reduced, proboscis very long forming a pseudopallium which covers the whole body and projects beyond in the form of a siphon, foot and nervous system present, eyes, branchia and anus absent, parasite in the Holothurian *Deima blakei* in the Indian Ocean.

Fam. 55.—*Entoconchidae.* No shell; visceral mass not coiled; no sensory organs, nervous system, branchia or anus; body reduced to a more or less tubular sac; hermaphrodite and viviparous; parasitic in Holothurians; larvae are veligers, with shell and operculum. *Entocolax*, mouth at free extremity, animal fixed by aboral orifice of pseudopallium, Pacific. *Entoconcha*, body elongated and tubular, animal fixed by the oral extremity, protandric hermaphrodite, parasitic in testes of Holothurians causing their abortion. *Enteroxenos*, no pseudopallium and no intestine, hermaphrodite, larvae with operculum.

FIG. 33.—Section of the shell of *Triton*, Cuv. (From Owen.)

a, Apex.
ac, Siphonal notch of the mouth of the shell.
ac to *pc*, Mouth of the shell.
w, w, Whorls of the shell.
s, s. Sutures.

Occupying the axis, and exposed by the section, is seen the "columella" or spiral pillar.

Tribe 2.—HETEROPODA. Pelagic Taenioglossa with foot large and laterally compressed to form a fin.

Fam. 1. *Atlantidae.* Visceral sac and shell coiled in one plane; foot divided transversely into two parts, posterior part bearing an

operculum, anterior part forming a fin provided with a sucker. *Atlanta. Oxygyrus.*

Fam. 2.—*Carinariidae.* Visceral sac and shell small in proportion to the rest of the body, which cannot be withdrawn into the shell; foot elongated, fin-shaped, with sucker, but without operculum. *Carinaria. Cardiopoda.*

The upper whorls of the shell are seen to be divided into separate chambers by the formation of successively formed "septa."

Fam. 3.—*Pterotrachaeidae.* Visceral sac very much reduced; without shell or mantle; anus posterior; foot provided with sucker in male only. *Pterotrachaea. Firoloida. Pterosoma.*

Sub-order 2.—Stenoglossa. Radula narrow with one lateral tooth on each side, and one median tooth or none.

Tribe 1.—Rachiglossa. Radula with a median tooth and a single tooth on each side of it. Formula 1 : 1 : 1. Rudimentary jaws present.

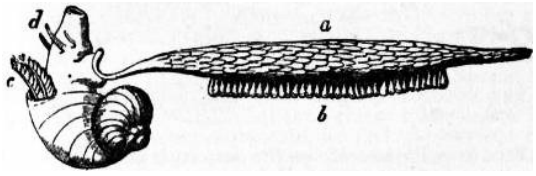


Fig. 34.—Female *Janthina*, with egg-float (*a*) attached to the foot; *b*, egg-capsules; *c*, ctenidium (gill-plume); *d*, cephalic tentacles.

Fam. 1.—*Turbinellidae.* Shell solid, piriform, with thick folded columella; lateral teeth of radula bicuspidate. *Turbinella. Cynodonta. Fulgur. Hemifusus. Tudicla. Strepsidura.*

Fam. 2.—*Fasciolariidae.* Shell elongated, with long siphon; lateral teeth of radula multicuspidate. *Fasciolaria. Fusus. Clavella. Latirus.*

Fam. 3.—*Mitridae.* Shell fusiform and solid, aperture elongated, columella folded; no operculum; eyes on sides of tentacles. *Mitra. Turricula. Cylindromitra. Imbricaria.*

Fam. 4.—*Buccinidae.* Foot large and broad; eyes at base of tentacles; operculum horny. *Buccinum. Chrysodomus. Liomesus. Cominella. Tritonidea. Pisania. Euthria. Phos. Dipsacus.*

Fam. 5.—*Nassidae.* Foot broad, with two slender posterior appendages; operculum unguiculate. *Nassa*, marine, British. *Canidia*, fluviatile. *Bullia.*

Fam. 6.—*Muricidae.* Shell with moderately long spire and canal, ornamented with ribs, often spiny; foot truncated anteriorly. *Murex*, British. *Trophon*, British. *Typhis. Urosalpinx. Lachesis.*

Fam. 7.—*Purpuridae.* Shell thick, with short spire, last whorl large and canal short; aperture wide; operculum horny. *Purpura*, British. *Rapana. Monoceros. Sistrum. Concholepas.*

Fam. 8.—*Haliidae.* Shell ventricose, thin and smooth, with wide aperture; foot large and thick, without operculum. *Halia.*

Fam. 9.—*Cancellariidae.* Shell ovoid, with short spire and folded columella; foot small, no operculum; siphon short. *Cancellaria.*

Fam. 10.—*Columbellidae.* Spire of shell prominent, aperture narrow, canal very short, columella crenelated; foot large. *Columbella.*

Fam. 11.—*Coralliophilidae.* Shell irregular; radula absent; foot and siphon short; sedentary animals, living in corals. *Coralliophila. Rhizochilus. Leptoconchus. Magilus. Rapa.*

Fam. 12.—*Volutidae.* Head much flattened and wide, with eyes on sides; foot broad; siphon with internal appendages. *Valuta. Guivillea. Cymba.*

Fam. 13.—*Olividae.* Foot with anterior transverse groove; a posterior pallial tentacle; generally burrowing. *Olivia. Olivella. Ancillaria. Agaronia.*

Fam. 14.—*Marginellidae.* Foot very large; mantle reflected over shell. *Marginella. Pseudomarginella.*

Fam. 15.—*Harpidae.* Foot very large; without operculum; shell with short spire and longitudinal ribs; siphon long. *Harpa.*

Tribe 2.—Toxiglossa. No jaws. No median tooth in radula. Formula: 1 : 0 : 1. Poison-gland present whose duct traverses the nerve-collar.

Fam. 1.—*Pleurotomatidae.* Shell fusiform, with elongated spire; margin of shell and mantle notched. *Pleurotoma. Clavatula. Mangilia. Bela. Pusionella. Pontiothauma.*

Fam. 2.—*Terebridae.* Shell turriculated, with numerous whorls; aperture and operculum oval; eyes at summits of tentacles; siphon long. *Terebra.*

Fam. 3.—*Conidae.* Shell conical, with very short spire, and narrow aperture with parallel borders; operculum unguiform *Conus.*

Sub-Class II.—Euthyneura

The most important general character of the Euthyneura is the absence of torsion in the visceral commissure, and the more posterior position of the anus and pallial organs. Comparative anatomy and embryology prove that this condition is due, not as formerly supposed to a difference in the relations of the visceral commissure which prevented it from being included in the torsion of the visceral hump, but to an actual detorsion which has taken place in evolution and is repeated to a great extent in individual development. In several of the more primitive forms the same torsion occurs as in Streptoneura, viz. in *Actaeon* and *Limacina* among Opisthobranchia, and *Chilina* among Pulmonata. *Actaeon* is proso-branchiate, the visceral commissure is twisted in *Actaeon* and *Chilina*, and even slightly still in *Bulla* and *Scaphander*; in *Actaeon* and *Limacina* the osphradium is to the left, innervated by the supra-intestinal ganglion. But in the other members of the sub-class the detorsion of the visceral mass has

carried back the anus and circumanal complex from the anterior dorsal region to the right side, as in *Bulla* and *Aplysia*, or even to the posterior end of the body, as in *Philine*, *Oncidium*, *Doris*, &c. Different degrees of the same process of detorsion are, as we have seen, exhibited by the Heteropoda among the Streptoneura, and both in them and in the Euthyneura the detorsion is associated with degeneration of the shell. Where the modification is carried to its extreme degree, not only the shell but the pallial cavity, ctenidium and visceral hump disappear, and the body acquires a simple elongated form and a secondary external symmetry, as in *Pterotrachaea* and in *Doris*, *Eolis*, and other Nudibranchia. These facts afford strong support to the hypothesis that the weight of the shell is the original cause of the torsion of the dorsal visceral mass in Gastropods. But this hypothesis leaves the elevation of the visceral mass and the exogastric coiling of the shell in the ancestral form unexplained. In those Euthyneura in which the shell is entirely absent in the adult, it is, except in the three genera *Cenia*, *Runcina* and *Vaginula*, developed in the larva and then falls off. In other cases (Tectibranchs) the reduced shell is enclosed by upgrowths of the edge of the mantle and becomes internal, as in many Cephalopods. A few Euthyneura in which the shell is not much reduced retain an operculum in the adult state, *e.g. Actaeon*, *Limacina*, and the marine Pulmonate, *Amphibola*. The detorted visceral commissure shows a tendency to the concentration of all its elements round the oesophagus, so that except in the Bullomorpha and in *Aplysia* the whole nervous system is aggregated in the cephalic region, either dorsally or ventrally. The radula has a number of uniform teeth on each side of the median tooth in each transverse row. The head in most cases bears two pairs of tentacles. All the Euthyneura are hermaphrodite.

Fig. 35.—*Acera bullata.* A single row of teeth of the Radula. (Formula, x.l.x.)

In the most primitive condition the genital duct is single throughout its length and has a single external aperture; it is therefore said to be monaulic. The hermaphrodite aperture is on the right side near the opening of the pallial cavity, and a ciliated groove conducts the spermatozoa to the penis, which is situated more anteriorly. This is the condition in the Bullomorpha, the Aplysiomorpha, and in one Pulmonate, *Pythia*. In some cases while the original aperture remains undivided, the seminal groove is closed and so converted into a canal. This is the modification found in *Cavolinia longirostris* among the Bullomorpha, and in all the *Auriculidae* except *Pythia*. A further degree of modification occurs when the male duct takes its origin from the hermaphrodite duct above the external opening, so that there are two distinct apertures, one male and one female, the latter being the original opening. The genital duct is now said to be diaulic, as in *Valvata*, *Oncidiopsis*, *Actaeon*, and *Lobiger* among the Bullomorpha, in the *Pleurobranchidae*, in the Nudibranchia, except the Doridomorpha and most of the Elysiomorpha, and in the Pulmonata. Originally in this condition the female aperture is at some distance from the male, as in the Basommatophora and in other cases; but in some forms the female aperture itself has shifted and come to be contiguous with the male opening and penis as in the Stylommatophora. In all these cases the female duct bears a bursa copulatrix or receptaculum seminis. In some forms this receptacle acquires a separate external opening remaining connected with the oviduct internally. There are thus two female openings, one for copulation, the other for oviposition, as well as a male opening. The genital duct is now trifurcated or triaulic, a condition which is confined to certain Nudibranchs, viz. the Doridomorpha and most of the Elysiomorpha.

The Pteropoda, formerly regarded as a distinct class of the Mollusca, were interpreted by E.R. Lankester as a branch of the Cephalopoda, chiefly on account of the protrusible sucker-bearing processes at the anterior end of *Pneumonoderma*. These he considered to be homologous with the arms of Cephalopods. He fully recognized, however, the similarity of Pteropods to Gastropods in their general asymmetry and in the torsion of the visceral mass in *Limacinidae*. It is now understood that they are Euthyneurous Gastropods adapted to natatory locomotion and pelagic life. The sucker-bearing processes of *Pneumonoderma* are outgrowths of the proboscis. The fins of Pteropods are now interpreted as the expanded lateral margins of the foot, termed parapodia, not homologous with the siphon of Cephalopods which is formed from epipodia. The Thecosomatous Pteropoda are allied to *Bulla*, the Gymnosomatous forms to *Aplysia*. The Euthyneura comprises two orders, Opisthobranchia and Pulmonata.

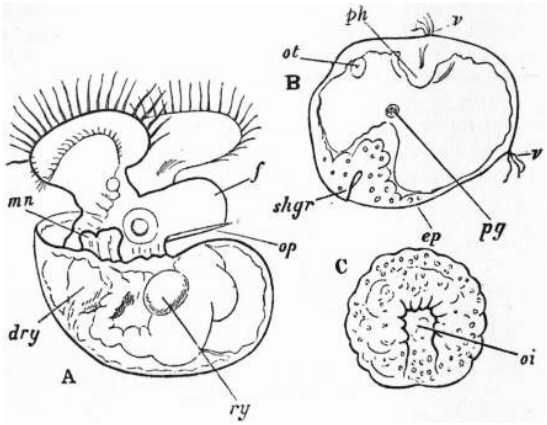


Fig. 36.

A, Veliger-larva of an Opisthobranch (*Polycera*). *f*, Foot; *op*, operculum; *mn*, anal papilla; *ry*, *dry*, two portions of unabsorbed nutritive yolk on either side of the intestine. The right otocyst is seen at the root of the foot.

B, Trochosphere of an Opisthobranch (*Pleurobranchidium*) showing—*shgr*, the shell-gland or primitive shell-sac; *v*, the cilia of the velum; *ph*, the commencing stomodaeum or oral invagination; *ot*, the left otocyst; *pg*, red-coloured pigment spot.

C, Diblastula of an Opisthobranch (*Polycera*) with elongated blastopore *oi*.

(All from Lankester.)

Order 1.—Opisthobranchia. Marine Euthyneura, the more archaic forms of which have a relatively large foot and a small visceral hump, from the base of which projects on the right side a short mantle-skirt. The anus is placed in such forms far back beyond the mantle-skirt. In front of the anus, and only partially covered by the mantle-skirt, is the ctenidium with its free end turned backwards. The heart lies in front of, instead of to the side of, the attachment of the ctenidium—hence Opisthobranchia as opposed to "Prosobranchia," which correspond to the Streptoneura. A shell is possessed in the adult state by but few Opisthobranchia, but all pass through a veliger larval stage with a nautiloid shell (fig. 36). Many Opisthobranchia have by a process of atrophy lost the typical ctenidium and the mantle-skirt, and have developed other organs in their place. As in some Pectinibranchia, the free margin of the mantle-skirt is frequently reflected over the shell when a shell exists; and, as in some Pectinibranchia, broad lateral outgrowths of the foot (parapodia) are often developed which may be thrown over the shell or naked dorsal surface of the body.

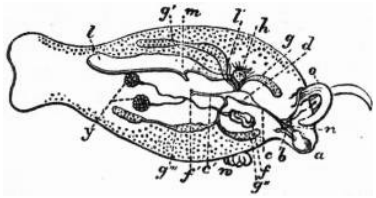


Fig. 37.—*Phyllirhoë bucephala*, twice the natural size, a transparent pisciform pelagic Opisthobranch. The internal organs are shown as seen by transmitted light. (After W. Keferstein.)

a, Mouth.
b, Radular sac.
c, Oesophagus.
d, Stomach.
c′, Intestine.
f′, Anus.
g, *g′*, *g″*, *g‴*, The four lobes of the liver.
h, The heart (auricle and ventricle).
l, The renal sac (nephridium).
l′, The ciliated communication of the renal sac with the pericardium.
m, The external opening of the renal sac.
n, The cerebral ganglion.
o, The cephalic tentacles.
f, The genital pore.
y, The ovo-testes.
w, The parasitic hydromedusa Mnestra, usually found attached in this position by the aboral pole of its umbrella.

The variety of special developments of structure accompanying the atrophy of typical organs in the Opisthobranchia and general degeneration of organization is very great. The members of the order present the same wide range of superficial appearance as do the Pectinibranchiate Streptoneura, forms carrying well-developed spiral shells and large mantle-skirts being included in the group, together with flattened or cylindrical slug-like forms. But in respect of the substitution of other parts for the mantle-skirt and for the gill which the more degenerate Opisthobranchia exhibit, this order stands alone. Some Opisthobranchia are striking examples of degeneration (some Nudibranchia), having none of those regions or processes of the body developed which distinguish the archaic Mollusca from such flat-worms as the Dendrocoel Planarians. Indeed, were it not for their retention of the characteristic odontophore we should have little or no indication that such forms as *Phyllirhoë* and *Limapontia* really belong to the Mollusca at all. The interesting little *Rhodope veranyii*, which has no odontophore, has been associated by systematists both with these simplified Opisthobranchs and with Rhabdocoel Planarians.

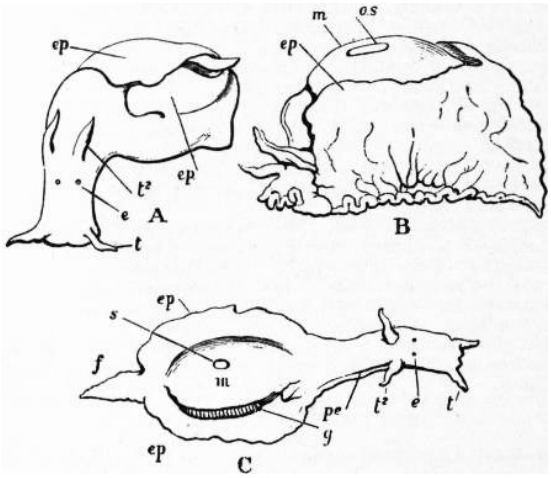


Fig. 38.—Three views of *Aplysia sp.*, in various conditions of expansion and retraction. (After Cuvier.)

t, Anterior cephalic tentacles.
t², Posterior cephalic tentacles.
e, Eyes.
f, Metapodium.
ep, Epipodium.
g, Gill-plume (ctenidium).
m, Mantle-flap reflected over the thin oval shell.
os, *s*, Orifice formed by the unclosed border of the reflected mantle-skirt, allowing the shell to show.
pe, The spermatic groove.

In many respects the sea-hare (*Aplysia*), of which several species are known (some occurring on the English coast), serves as a convenient example of the fullest development of the organization characteristic of Opisthobranchia. The woodcut (fig. 38) gives a faithful representation of the great mobility of the various parts of the body. The head is well marked and joined to the body by a somewhat constricted neck. It carries two pairs of cephalic tentacles and a pair of sessile eyes. The visceral hump is low and not drawn out into a spire. The foot is long, carrying the oblong visceral mass upon it, and projecting (as metapodium) a little beyond it (*f*). Laterally the foot gives rise to a pair of mobile fleshy lobes, the parapodia (*ep*), which can be thrown up so as to cover in the dorsal surface of the animal. Such parapodia are

common, though by no means universal, among Opisthobranchia. The torsion of the visceral hump is not carried out very fully, the consequence being that the anus has a posterior position a little to the right of the median line above the metapodium, whilst the branchial chamber formed by the overhanging mantle-skirt faces the right side of the body instead of lying well to the front as in Streptoneura and as in Pulmonate Euthyneura. The gill-plume, which in *Aplysia* is the typical Molluscan ctenidium, is seen in fig. 39 projecting from the branchial sub-pallial space. The relation of the delicate shell to the mantle is peculiar, since it occupies an oval area upon the visceral hump, the extent of which is indicated in fig. 38, C, but may be better understood by a glance at the figures of the allied genus *Umbrella* (fig. 40), in which the margin of the mantle-skirt coincides, just as it does in the limpet, with the margin of the shell. But in *Aplysia* the mantle is reflected over the edge of the shell, and grows over its upper surface so as to completely enclose it, excepting at the small central area *s* where the naked shell is exposed. This enclosure of the shell is a permanent development of the arrangement seen in many Streptoneura (*e.g. Pyrula*, *Ovula*, see figs. 18 and 32), where the border of the mantle can be, and usually is, drawn over the shell, though it is withdrawn (as it cannot be in *Aplysia*) when they are irritated. From the fact that *Aplysia* commences its life as a free-swimming veliger with a nautiloid shell not enclosed in any way by the border of the mantle, it is clear that the enclosure of the shell in the adult is a secondary process. Accordingly, the shell of *Aplysia* must not be confounded with a primitive shell in its shell-sac, such as we find realized in the shells of *Chiton* and in the plugs which form in the remarkable transitory “shell-sac” or “shell-gland” of Molluscan embryos (see figs. 26, 60). *Aplysia*, like other Mollusca, develops a primitive shell-sac in its trochosphere stage of development, which disappears and is succeeded by a nautiloid shell (fig. 36). This forms the nucleus of the adult shell, and, as the animal grows, becomes enclosed by a reflection of the mantle-skirt. When the shell of an *Aplysia* enclosed in its mantle is pushed well to the left, the sub-pallial space is fully exposed as in fig. 39, and the various apertures of the body are seen. Posteriorly we have the anus, in front of this the lobate gill-plume, between the two (hence corresponding in position to that of the Pectinibranchia) we have the aperture of the renal organ. In front, near the anterior attachment of the gill-plume, is the osphradium (olfactory organ) discovered by J.W. Spengel, yellowish in colour, in the typical position, and overlying an olfactory ganglion with typical nerve-connexion (see fig. 43). To the right of Spengel’s osphradium is the opening of a peculiar gland which has, when dissected out, the form of a bunch of grapes; its secretion is said to be poisonous. On the under side of the free edge of the mantle are situated the numerous small cutaneous glands which, in the large *Aplysia camelus* (not in other species), form the purple secretion which was known to the ancients. In front of the osphradium is the single genital pore, the aperture of the common or hermaphrodite duct. From this point there passes forward to the right side of the head a groove—the spermatic groove—down which the spermatic fluid passes. In other Euthyneura this groove may close up and form a canal. At its termination by the side of the head is the muscular introverted penis. In the hinder part of the foot (not shown in any of the diagrams) is the opening of a large mucus-forming gland very often found in the Molluscan foot.

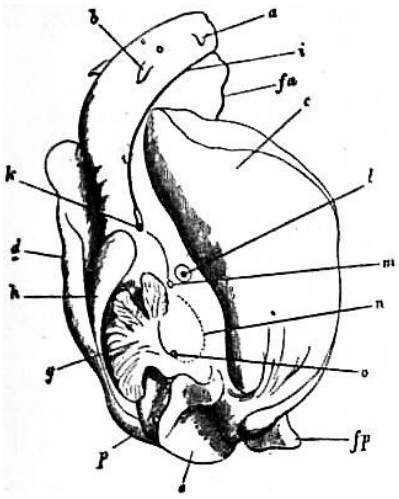


Fig. 39.—*Aplysia leporina* (*camelus*, Cuv.), with epipodia and mantle reflected away from the mid-line. (Lankester.)

a, Anterior cephalic tentacle.
b, Posterior cephalic tentacle; between *a* and *b*, the eyes.
c, Right epipodium.
d, Left epipodium.
e, Hinder part of visceral hump.
fp, Posterior extremity of the foot.
fa, Anterior part of the foot underlying the head.
g, The ctenidium (branchial plume).
h, The mantle-skirt tightly spread over the horny shell and pushed with it towards the left side.
i, The spermatic groove.
k, The common genital pore (male and female).
l, Orifice of the grape-shaped (supposed poisonous) gland.
m, The osphradium (olfactory organ of Spengel).
n, Outline of part of the renal sac (nephridium) below the surface.
o, External aperture of the nephridium.
p, Anus.

With regard to internal organization we may commence with the disposition of the renal organ (nephridium), the external opening of which has already been noted. The position of this opening and other features of the renal organ were determined by J.T. Cunningham.

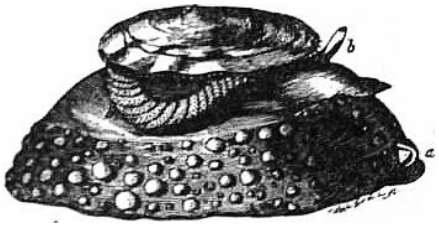


Fig. 40.—*Umbrella mediterranea*. *a*, mouth; *b*, cephalic tentacle; *h*, gill (ctenidium). The free edge of the mantle is seen just below the margin of the shell (compare with *Aplysia*, fig. 39). (From Owen.)

There is considerable uncertainty with respect to the names of the species of *Aplysia*. There are two forms which are very common in the Gulf of Naples. One is quite black in colour, and measures when outstretched 8 or 9 in. in length. The other is light brown and somewhat smaller, its length usually not exceeding 7 in. The first is flaccid and sluggish in its movements, and has not much power of contraction; its epipodial lobes are enormously developed and extend far forward along the body; it gives out when handled an abundance of purple liquid, which is derived from cutaneous glands situated on the under side of the free edge of the mantle. According to F. Blochmann it is identical with *A. camelus* of Cuvier. The other species is *A. depilans*; it is firm to the touch, and contracts forcibly when irritated; the secretion of the mantle-glands is not abundant, and is milky white in appearance. The kidney has similar relations in both species, and is identical with the organ spoken of by many authors as the triangular gland. Its superficial extent is seen when the folds covering the shell are cut away and the shell removed; the external surface forms a triangle with its base bordering the pericardium, and its apex directed posteriorly and reaching the the left-hand posterior corner of the shell-chamber. The dorsal surface of the kidney extends to the left beyond the shell-chamber beneath the skin in the space between the shell-chamber and the left parapodium.

When the animal is turned on its left-hand side and the mantle-chamber widely opened, the gill being turned over to the left, a part of the kidney is seen beneath the skin between the attachment of the gill and the right parapodium (fig. 39). On examination this is found to be the under surface of the posterior limb of the gland, the upper surface of which has just been described as lying beneath the shell. In the posterior third of this portion, close to that edge which is adjacent to the base of the gill, is the external opening (fig. 39, *o*).

When the pericardium is cut open from above in an animal otherwise entire, the anterior face of the kidney is seen forming the posterior wall of the pericardial chamber; on the deep edge of this face, a little to the left of the attachment of the auricle to the floor of the pericardium, is seen a depression; this depression contains the opening from the pericardium into the kidney.

To complete the account of the relations of the organ: the right anterior corner can be seen superficially in the wall of the mantle-chamber above the gill. Thus the base of the gill passes in a slanting direction across the right-hand side of the kidney, the posterior end being dorsal to the apex of the gland, and the anterior end ventral to the right-hand corner.

As so great a part of the whole surface of the kidney lies adjacent to external surfaces of the body, the remaining part which faces the internal organs is small; it consists of the left part of the under surface; it is level with the floor of the pericardium, and lies over the globular mass formed by the liver and convoluted intestine.

Thus the renal organ of *Aplysia* is shown to conform to the Molluscan type. The heart lying within the adjacent pericardium has the usual form, a single auricle and ventricle. The vascular system is not extensive, the arteries soon ending in the well-marked spongy tissue which builds up the muscular foot, parapodia, and dorsal body-wall.

The alimentary canal commences with the usual buccal mass; the lips are cartilaginous, but not armed with horny jaws, though these are common in other Opisthobranchs; the lingual ribbon is multidenticulate, and a pair of salivary glands pour in their secretion. The oesophagus expands into a curious gizzard, which is armed internally with large horny processes, some broad and thick, others spinous, fitted to act as crushing instruments. From this we pass to a stomach and a coil of intestine embedded in the lobes of a voluminous liver; a caecum of large size is given off near the commencement of the intestine. The liver opens by two ducts into the digestive tract.

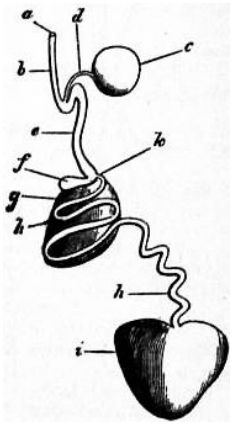


FIG. 41.—Gonad, and accessory glands and ducts of *Aplysia*. (Lankester.)

i, Ovo-testis.
h, Hermaphrodite duct.
g, Albuminiparous gland.
f, Vesicula seminalis.
k, Opening of the albuminiparous gland into the hermaphrodite duct.
e, Hermaphrodite duct (uterine portion).
b, Vaginal portion of the uterine duct.
c, Spermatheca.
d, Its duct.
a, Genital pore.

The generative organs lie close to the coil of intestine and liver, a little to the left side. When dissected out they appear as represented in fig. 41. The essential reproductive organ or gonad consists of both ovarian and testicular cells (see fig. 42). It is an ovo-testis. From it passes a common or hermaphrodite duct, which very soon becomes entwined in the spire of a gland—the albuminiparous gland. The latter opens into the common duct at the point *k*, and here also is a small diverticulum of the duct *f*. Passing on, we find not far from the genital pore a glandular spherical body (the spermatheca *c*) opening by means of a longish duct into the common duct, and then we reach the pore (fig. 39, *k*). Here the female apparatus terminates. But when the male secretion of the ovo-testis is active, the seminal fluid passes from the genital pore along the spermatic groove (fig. 39) to the penis, and is by the aid of that eversible muscular organ introduced into the genital pore of a second *Aplysia*, whence it passes into the spermatheca, there to await the activity of the female element of the ovo-testis of this second *Aplysia*. After an interval of some days—possibly weeks—the ova of the second *Aplysia* commence to descend the hermaphrodite duct; they become enclosed in a viscid secretion at the point where the albuminiparous gland opens into the duct intertwined with it; and on reaching the point where the spermathecal duct debouches they are impregnated by the spermatozoa which escape now from the spermatheca and meet the ova.

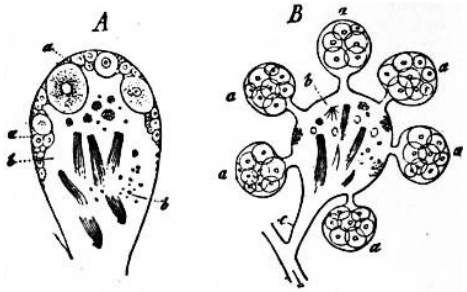


FIG. 42.—Follicles of the hermaphrodite gonads of Euthyneurous Gastropods. *A*, of *Helix*; *B*, of *Eolis*; *a*, ova; *b*, developing spermatozoa; *c*, common efferent duct.

The development of *Aplysia* from the egg presents many points of interest from the point of view of comparative embryology, but in relation to the morphology of the Opisthobranchia it is sufficient to point to the occurrence of a trochosphere and a veliger stage (fig. 36), and of a shell-gland or primitive shell-sac (fig. 36, *shgr*), which is succeeded by a nautiloid shell.

In the nervous system of *Aplysia* the great ganglion-pairs are well developed and distinct. The euthyneurous visceral loop is long, and presents only one ganglion (in *Aplysia camelus*, but two distinct ganglia joined to one another in *Aplysia hybrida* of the English coast), placed at its extreme limit, representing both the right and left visceral ganglia and the third or abdominal ganglion, which are so often separately present. The diagram (fig. 43) shows the nerve connecting this abdomino-visceral ganglion with the olfactory

ganglion of Spengel. It is also seen to be connected with a more remote ganglion—the genital. Such special irregularities in the development of ganglia upon the visceral loop, and on one or more of the main nerves connected with it, are very frequent. Our figure of the nervous system of *Aplysia* does not give the small pair of buccal ganglia which are, as in all glossophorous Molluscs, present upon the nerves passing from the cerebral region to the odontophore.

For a comparison of various Opisthobranchs, *Aplysia* will be found to present a convenient starting-point. It is one of the more typical Opisthobranchs, that is to say, it belongs to the section Tectibranchia, but other members of the suborder, namely, *Bulla* and *Actaeon* (figs. 44 and 45), are less abnormal than *Aplysia* in regard to their shells and the form of the visceral hump. They have naked spirally twisted shells which may be concealed from view in the living animal by the expansion and reflection of the parapodia, but are not enclosed by the mantle, whilst *Actaeon* is remarkable for possessing an operculum like that of so many Streptoneura.

The great development of the parapodia seen in *Aplysia* is usual in Tectibranchiate Opisthobranchs. The whole surface of the body becomes greatly modified in those Nudibranchiate forms which have lost, not only the shell, but also the ctenidium. Many of these have peculiar processes developed on the dorsal surface (fig. 46, A, B), or retain purely negative characters (fig. 46, D). The chief modification of internal organization presented by these forms, as compared with *Aplysia*, is found in the condition of the alimentary canal. The liver is no longer a compact organ opening by a pair of ducts into the median digestive tract, but we find very numerous hepatic diverticula on a shortened axial tract (fig. 47). These diverticula extend usually one into each of the dorsal papillae or "cerata" when these are present. They are not merely digestive glands, but are sufficiently wide to act as receptacles of food, and in them the digestion of food proceeds just as in the axial portion of the canal. A precisely similar modification of the liver or great digestive gland is found in the scorpions, where the axial portion of the digestive canal is short and straight, and the lateral ducts sufficiently wide to admit food into the ramifications of the gland there to be digested; whilst in the spiders the gland is reduced to a series of simple caeca.

Fig. 43.—Nervous system of *Aplysia*, as a type of the long-looped Euthyneurous condition. The untwisted visceral loop is lightly shaded. (After Spengel.)

ce, Cerebral ganglion.
pl, Pleural ganglion.
pe, Pedal ganglion.
ab. sp, Abdominal ganglion which represents also the supra-intestinal ganglion of Streptoneura and gives off the nerve to the osphradium (olfactory organ) *o*, and another to an unlettered so-called "genital" ganglion. The buccal nerves and ganglia are omitted.

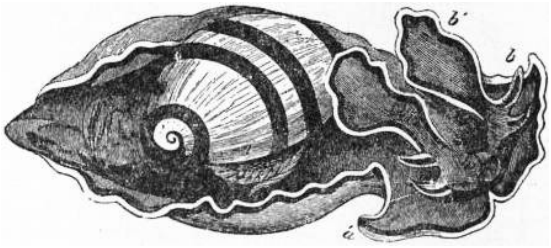


Fig. 44.—*Bulla vexillum* (Chemnitz), as seen crawling. *á*, oral hood (compare with Tethys, fig. 46, B), possibly a continuation of the epipodia; *b, b'*, cephalic tentacles. (From Owen.)

The typical character is retained by the heart, pericardium, and the communicating nephridium or renal organ in all Opisthobranchs. An interesting example of this is furnished by the fish-like transparent *Phyllirhoë* (fig. 37), in which it is possible most satisfactorily to study in the living animal, by means of the microscope, the course of the blood-stream, and also the reno-pericardial communication. In many of the Nudibranchiate Opisthobranchs the nervous system presents a concentration of the ganglia (fig. 48), contrasting greatly with what we have seen in *Aplysia*. Not only are the pleural ganglia fused to the cerebral, but also the visceral to these (see in further illustration the condition attained by the Pulmonate *Limnaeus*, fig. 59), and the visceral loop is astonishingly short and insignificant (fig. 48, *e'*). That the parts are rightly thus identified is probable from J.W. Spengel's observation of the osphradium and its nerve-supply in these forms; the nerve to that organ, which is placed somewhat anteriorly—on the dorsal surface—being given off from the hinder part (visceral) of the right compound ganglion—the fellow to that marked A in fig. 48. The Eolid-like Nudibranchs, amongst other specialities of structure, possess (in some cases at any rate) apertures at the apices of the "cerata" or dorsal papillae, which lead from the exterior into the hepatic caeca. Some amongst them (*Tergipes, Eolis*) are also remarkable for possessing peculiarly modified cells placed in sacs (cnidosacs) at the apices of these same papillae, which resemble the "thread-cells" of the Coelentera. According to T.S. Wright and J.H. Grosvenor these nematocysts are derived from the hydroids on which the animals feed.

The development of many Opisthobranchia has been examined—*e.g. Aplysia, Pleurobranchidium, Elysia, Polycera, Doris, Tergipes*. All pass through trochosphere and veliger stages, and in all a nautiloid or boat-like shell is developed, preceded by a well-marked "shell-gland" (see fig. 36). The transition from the free-swimming veliger larva with its nautiloid shell (fig. 36) to the adult form has not been properly observed, and many interesting points as to the true nature of folds (whether parapodia or mantle or velum) have yet to be cleared up by a knowledge of such development in forms like *Tethys, Doris, Phyllidia*, &c. As in other Molluscan groups, we find even in closely-allied genera (for instance, in *Aplysia* and *Pleurobranchidium*, and other genera), the greatest differences as to the *amount* of food-material by which the egg-shell is encumbered. Some form their diblastula by emboly, others by epiboly; and in the later history of the further development of the enclosed cells (arch-enteron) very marked variations occur in closely-allied forms, due to the influence of a greater or less

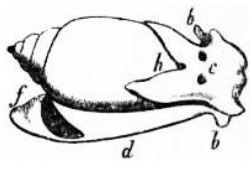


Fig. 45.—*Actaeon. h*, shell; *b*, oral hood; *d*, foot; *f*, operculum.

abundance of food-material mixed with the protoplasm of the egg.

Sub-order 1.—Tectibranchia. Opisthobranchs provided in the adult state with a shell and a mantle, except *Runcina, Pleurobranchaea, Cymbuliidae,* and some Aplysiomorpha. There is a ctenidium, except in some Thecosomata and Gymnosomata, and an osphradium.

Tribe 1.—Bullomorpha. The shell is usually well developed, except in *Runcina* and *Cymbuliidae*, and may be external or internal. No operculum, except in *Actaeonidae* and *Limacinidae*. The pallial cavity is always well developed, and contains the ctenidium, at least in part; ctenidium, except in *Lophocercidae*, of folded type. With the exception of the *Aplustridae*, *Lophocercidae* and *Thecosomata*, the head is devoid of tentacles, and its dorsal surface forms a digging disk or shield. The edges of the foot form parapodia, often transformed into fins. Posteriorly the mantle forms a large pallial lobe under the pallial aperture. Stomach generally provided with chitinous or calcified masticatory plates. Visceral commissure fairly long, except in *Runcina, Lobiger* and *Thecosomata*. Hermaphrodite genital aperture, connected with the penis by a ciliated groove, except in *Actaeon, Lobiger* and *Cavolinia longirostris*, in which the spermiduct is a closed tube. Animals either swim or burrow.

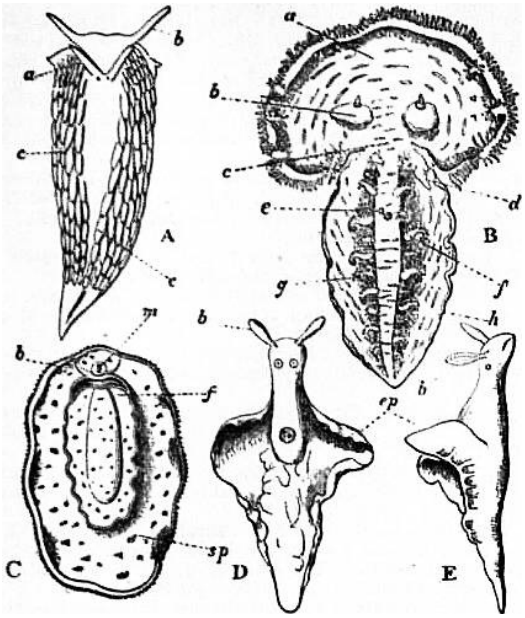


Fig. 46.

A, *Eolis papillosa* (Lin.), dorsal view.

a, *b*, Posterior and anterior cephalic tentacles.
c, The dorsal "cerata."

B, *Tethys leporina*, dorsal view.

a, The cephalic hood.
b, Cephalic tentacles.
c, Neck.
d, Genital pore.
e, Anus.
f, Large cerata.
g, Smaller cerata.
h, Margin of the foot.

C, *Doris* (*Actinocyclus*) *tuberculatus* (Cuv.), seen from the pedal surface.

m, Mouth.
b, Margin of the head.
f, Sole of the foot.
sp, The mantle-like epipodium.

D, E, Dorsal and lateral view of *Elysia* (*Actaeon*) *viridis*. *ep*, epipodial outgrowths. (After Keferstein.)

Fig. 47.—Enteric Canal of *Eolis papillosa*. (From Gegenbaur, after Alder and Hancock.)

ph, Pharynx.
m, Midgut, with its hepatic appendages *h*, all of which are not figured.
e, Hind gut.

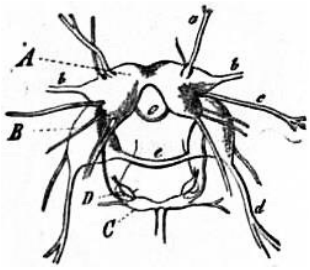


Fig. 48.—Central Nervous System of *Fiona* (one of the Nudibranchia), showing a tendency to fusion of the great ganglia. (From Gegenbaur, after Bergh.)

A, Cerebral, pleural and visceral ganglia united.
B, Pedal ganglion.
C, Buccal ganglion.
D, Oesophageal ganglion connected with, the Buccal.
a, Nerve to superior cephalic tentacle.
b, Nerves to inferior cephalic tentacles.
c, Nerve to generative organs.
d, Pedal nerve.
e, Pedal commissure.
e′, Visceral loop or commissure (?).

an, Anus.

Fam. 1.—*Actaeonidae.* Cephalic shield bifid posteriorly; margins of foot slightly developed; genital duct diaulic; visceral commissure streptoneurous; shell thick, with prominent spire and elongated aperture; a horny operculum. *Actaeon*, British. *Solidula. Tornatellaea*, extinct. *Adelactaeon. Bullina. Bullinula.*

Fam. 2.—*Ringiculidae.* Cephalic disk enlarged anteriorly, forming an open tube posteriorly; shell external, thick, with prominent spire; no operculum. *Ringicula. Pugnus.*

Fam. 3.—*Tornatinidae.* Margins of foot not prominent; no radula; shell external, with inconspicuous spire. *Tornatina*, British. *Retusa. Volvula.*

Fam. 4.—*Scaphandridae.* Cephalic shield short, truncated posteriorly; eyes deeply embedded; three calcareous stomachal plates; shell external, with reduced spire. *Scaphander*, British. *Atys. Smaragdinella. Cylichna*, British. *Amphisphyra*, British.

Fam. 5.—*Bullidae.* Margins of foot well developed; eyes superficial; three chitinous stomachal plates; shell external, with reduced spire. Bulla, British. *Haminea*, British.

Fam. 6.—*Aceratidae.* Cephalic shield continuous with neck; twelve to fourteen stomachal plates; a posterior pallial filament passing through a notch in shell. *Acera*, British. *Cylindrobulla. Volutella.*

Fam. 7.—*Aplustridae.* Foot very broad; cephalic shield with four tentacles; shell external, thin, without prominent spire. *Aplustrum. Hydatina. Micromelo.*

Fam. 8.—*Philinidae.* Cephalic shield broad, thick and simple; shell wholly internal, thin, spire much reduced, aperture very large. *Philine*, British. *Cryptophthalmus. Chelinodura. Phanerophthalmus. Colpodaspis*, British. *Colobocephalus.*

Fam. 9.—*Doridiidae.* Cephalic shield ending posteriorly in a median point; shell internal, largely membranous; no radula or stomachal plates. *Doridium. Navarchus.*

Fam. 10.—*Gastropteridae.* Cephalic shield pointed behind; shell internal, chiefly membranous, with calcified nucleus, nautiloid; parapodia forming fins. *Gastropteron.*

Fam. 11.—*Runcinidae.* Cephalic shield continuous with dorsal integument; no shell; ctenidium projecting from mantle cavity. *Runcina.*

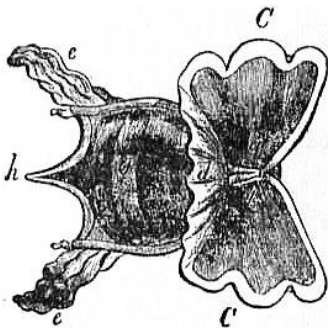


FIG. 49.—*Cavolinia tridentata*, Forsk. from the Mediterranean, magnified two diameters. (From Owen.)

a, Mouth.
b, Pair of cephalic tentacles.
C, C, Pteropodial lobes of the foot.
d, Median web connecting these.
e, e, Processes of the mantle-skirt reflected over the surface of the shell.
g, The shell enclosing the visceral hump.
h. The median spine of the shell.

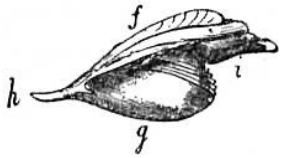


FIG. 50.—Shell of *Cavolinia tridentata*, seen from the side.

f, Postero-dorsal surface.
g, Antero-ventral surface.
h, Median dorsal spine.
i, Mouth of the shell.

Fam. 12.—*Lophocercidae.* Shell external, globular or ovoid; foot elongated, parapodia separate from ventral surface; genital duct diaulic. *Lobiger. Lophocercus.*

The next three families form the group formerly known as Thecosomatous Pteropods. They are all pelagic, the foot being entirely transformed into a pair of anterior fins; eyes are absent, and the nerve centres are concentrated on the ventral side of the oesophagus.

Fam. 13.—*Limacinidae.* Dextral animals, with shell coiled pseudo-sinistrally; operculum with sinistral spiral; pallial cavity dorsal. *Limacina*, British. *Peraclis*, ctenidium present.

Fam. 14.—*Cymbuliidae.* Adult without shell; a sub-epithelial pseudoconch formed by connective tissue; pallial cavity ventral. *Cymbulia. Cymbuliopsis. Gleba. Desmopterus.*

Fam. 15.—*Cavoliniidae.* Shell not coiled, symmetrical; pallial cavity ventral. *Cavolinia. Clio. Cuvierina.*

Tribe 2.—APLYSIOMORPHA. Shell more or less internal, much reduced or absent. Head bears two pairs of tentacles. Parapodia separate from ventral surface, and generally transformed into swimming lobes. Visceral commissure much shortened, except in *Aplysia*. Genital duct monaulic; hermaphrodite duct connected with penis by a ciliated groove. Animals either swim or crawl.

Fam. 1.—*Aplysiidae*. Shell partly or wholly internal, or absent; foot long, with well-developed ventral surface. *Aplysia. Dolabella. Dolabrifer. Aplysiella. Phyllaplysia. Notarchus*.

The next six families include the animals formerly known as Gymnosomatous Pteropods, characterized by the absence of mantle and shell, the reduction of the ventral surface of the foot, and the parapodial fins at the anterior end of the body. They are all pelagic.

Fam. 2.—*Pneumonodermatidae*. Pharynx evaginable, with suckers. *Pneumonoderma. Dexiobranchaea. Spongiobranchaea. Schizobrachium*.

Fam. 3.—*Clionopsidae*. No buccal appendages or suckers; a very long evaginable proboscis; a quadriradiate terminal branchia. *Clionopsis*.

Fam. 4.—*Notobranchaeidae*. Posterior branchia triradiate. Notobranchaea.

Fam. 5.—*Thliptodontidae*. Head very large, not marked off from the body; neither branchia nor suckers; fins situated near the middle of the body. *Thliptodon*.

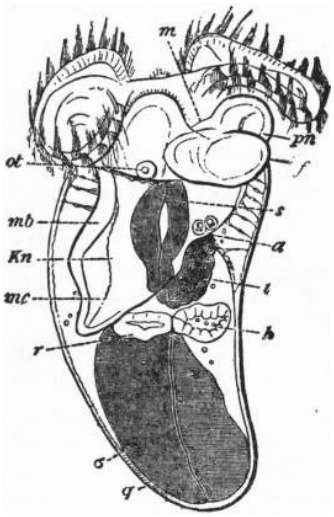


FIG. 51.—Embryo of *Cavolinia tridentata*. (From Balfour, after Fol.)

a, Anus.
f, Median portion of the foot.
pn, Pteropodial lobe of the foot.
h, Heart.
i, Intestine.
m. Mouth.
ot, Otocyst.
q, Shell.
r, Nephridium.
s, Oesophagus.
σ, Sac containing nutritive yolk.
mb, Mantle-skirt.
mc, Sub-pallial chamber.
Kn, Contractile sinus.

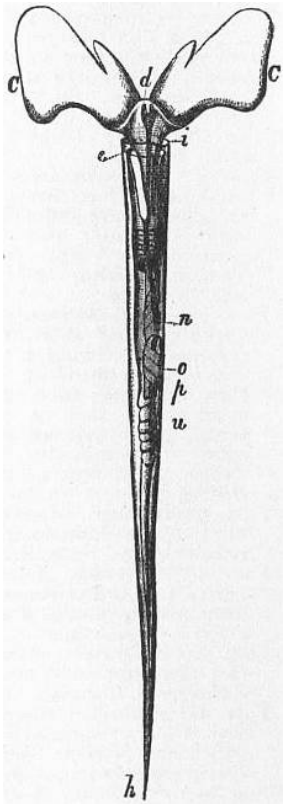


FIG. 52.—*Styliola acicula*, Rang. sp. enlarged. (From Owen.)

C, C, The wing-like lobes of the foot.
d, Median fold of same.
e, Copulatory organ.
h, Pointed extremity of the shell.
i, Anterior margin of the shell.
n, Stomach.
o, Liver.
u. Hermaphrodite gonad.

Fam. 6.—*Clionidae*. No branchia of any kind; a short evaginable pharynx, bearing paired conical buccal appendages or "cephalocones." *Clione. Paraclione. Fowlerina*.

Fam. 7.—*Halopsychidae*. No branchia; two long and branched buccal appendages. *Halopsyche*.

Tribe 3.—PLEUROBRANCHOMORPHA. Two pairs of tentacles. Foot without parapodia; no pallial cavity, but always a single ctenidium situated on the right side between mantle and foot. Genital duct diaulic, without open seminal groove; male and female apertures contiguous. Visceral commissure short, tendency to concentration of all ganglia in dorsal side of oesophagus.

Fam. 1.—*Tylodinidae*. Shell external and conical; anterior tentacles form a frontal veil; ctenidium extending only over right side; a distinct osphradium. *Tylodina*.

Fam. 2.—*Umbrellidae*. Shell external, conical, much flattened; anterior tentacles very small, and situated with the mouth in a notch of the foot below the head; ctenidium very large. *Umbrella*.

Fam. 3.—*Pleurobranchidae*. Shell covered by mantle, or absent; anterior tentacles form a frontal veil; mantle contains spicules. *Pleurobranchus. Berthella. Haliotinella. Oscanius*, British. *Oscaniella. Oscaniopsis. Pleurobranchaea.*

Sub-order 2.—NUDIBRANCHIA. Shell absent in the adult; no ctenidium or osphradium. Body generally slug-like, and externally symmetrical. Visceral mass not marked off from the foot, except in *Hedylidae.* Dorsal respiratory appendages frequently present. Visceral commissure reduced; nervous system concentrated on dorsal side of oesophagus. Marine; generally carnivorous, and brightly coloured, affording many instances of protective resemblance.

Tribe 1.—TRITONIOMORPHA. Liver wholly or partially contained in the visceral mass. Anus lateral, on the right side. Usually two rows of ramified dorsal appendages. Genital duct diaulic; male and female apertures contiguous.

Fam. 1.—*Tritoniidae.* Anterior tentacles form a frontal veil; foot rather broad. *Tritonia*, British. *Marionia.*

Fam. 2.—*Scyllaeidae.* No anterior tentacles; dorsal appendages broad and foliaceous; foot very narrow; stomach with horny plates. *Scyllaea*, pelagic.

Fam. 3.—*Phyllirhoidae.* No anterior tentacles, and no dorsal appendages; body laterally compressed, transparent; pelagic. *Phyllirhoë.*

Fam. 4.—*Tethyidae.* Head broad, surrounded by a funnel-shaped velum or hood; no radula; dorsal appendages foliaceous. *Tethys. Melibe.*

Fam. 5.—*Dendronotidae.* Anterior tentacles forming a scalloped frontal veil; dorsal appendages and tentacles similarly ramified. *Dendronotus. Campaspe.*

Fam. 6.—*Bornellidae.* Dorsum furnished on either side with papillae, at the base of which are ramified appendages. *Bornella.*

Fam. 7.—*Lomanotidae.* Body flattened, the two dorsal borders prominent and foliaceous. *Lomanotus*, British.

Tribe 2.—DORIDOMORPHA. Body externally symmetrical; anus median, posterior, and generally dorsal, surrounded

by ramified pallial appendages, constituting a secondary branchia. Liver not ramified in the integuments. Genital duct triaulic. Spicules present in the mantle.

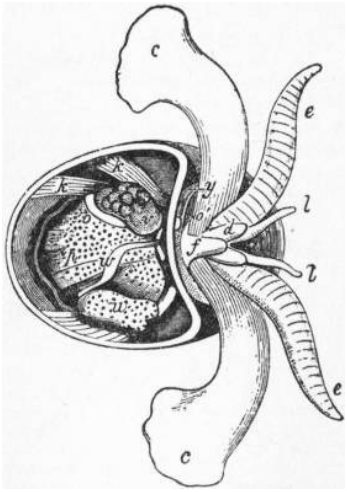


FIG. 53.—*Halopsyche gaudichaudii*, Soul. (From Owen.) Much enlarged; the body-wall removed.

a, The mouth.
c, The pteropodial lobes of the foot.
f, The centrally-placed hind-foot.
d, l, e, Three pairs of tentacle-like processes placed at the sides of the mouth, and developed (in all probability) from the fore-foot.
o´, Anus.
y, Genital pore.
k, Retractor muscles.
o and *p*, The liver.
u, v, w, Genitalia.

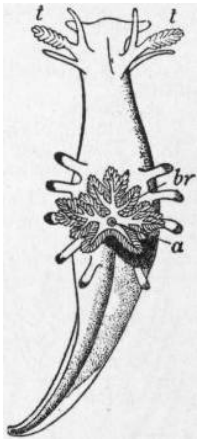


FIG. 54.—*Ancula cristata*, one of the pygobranchiate Opisthobranchs (dorsal view). (From Gegenbaur, after Alder and Hancock.)

a, Anus.
br, Secondary branchia surrounding the anus.
t, Cephalic tentacles.
External to the branchia are seen ten club-like processes of the dorsal wall, these are the "cerata" which are characteristically developed in another suborder of Opisthobranchs.

Fam. 1.—*Polyceratidae.* A more or less prominent frontal veil; branchiae non-retractile. *Euplocamus. Polycera*, British. *Thecacera*, British. *Aegirus*, British. *Plocamopherus. Palio. Crimora. Triopa*, British. *Triopella.*

Fam. 2.—*Goniodorididae.* Mantle-border projecting; frontal veil reduced, and often covered by the anterior border of the mantle. *Goniodoris*, British. *Acanthodoris*, British. *Idalia*, British. *Ancula*, British. *Doridunculus. Lamellidoris. Ancylodoris*, the only fresh-water Nudibranch, from Lake Baikal.

Fam. 3.—*Heterodoridae*. No branchia. *Heterodoris*.

Fam. 4.—*Doridae*. Mantle oval, covering the head and the greater part of the body; anterior tentacles, ill-developed; branchiae generally retractile. *Doris*, British. *Hexabranchus*. *Chromodoris*.

Fam. 5.—*Doridopsidae*. Pharynx suctorial; no radula; branchial rosette on the dorsal surface, above the mantle-border. *Doridopsis*.

Fam. 6.—*Corambidae*. Anus and branchia posterior, below the mantle-border. *Corambe*.

Fam. 7.--*Phyllidiidae*. Pharynx suctorial; branchiae surrounding the body, between the mantle and foot. *Phyllidia*. *Fryeria*.

The last three families constitute the sub-tribe Porostomata, characterized by the reduction of the buccal mass, which is modified into a suctorial apparatus.

Tribe 3.—EOLIDOMORPHA (*Cladohepatica*). The whole of the liver contained in the integuments and tegumentary papillae. Genital duct diaulic; male and female apertures contiguous. The anus is antero-lateral, except in the *Proctonotidae*, in which it is median. Tegumentary papillae not ramified, and containing cnidosacs with nematocysts.

Fam. 1.—*Eolididae*. Dorsal papillae spindle-shaped or club-shaped. *Eolis*, British. *Facelina*, British. *Tergipes*, British. *Gonieolis*. *Cuthona*. *Embletonia*. *Galvina*. *Calma*. *Hero*.

Fam. 2.—*Glaucidae*. Body furnished with three pairs of lateral lobes, bearing the tegumentary papillae; foot very narrow; pelagic. *Glaucus*.

Fam. 3.—*Hedylidae*. Body elongated; visceral mass marked off from foot posteriorly; dorsal appendages absent, or reduced to a single pair; spicules in the integument. *Hedyle*.

Fam. 4.—*Pseudovermidae*. Head without tentacles; body elongated; anus on right side. *Pseudovermis*.

Fam. 5.—*Proctonotidae*. Anus posterior, median; anterior tentacles, atrophied; foot broad. *Janus*, British. *Proctonotus*, British.

Fam. 6.—*Dotonidae*. Bases of the rhinophores surrounded by a sheath; dorsal papillae tuberculated and club-shaped, in a single row on either side of the dorsum; no cnidosacs. *Doto*, British. *Gellina*. *Heromorpha*.

Fam. 7.—*Fionidae*. Dorsal papillae with a membranous expansion; male and female apertures at some distance from each other; pelagic. *Fiona*.

Fam. 8.—*Pleurophyllidae*. Anterior tentacles in the form of a digging shield; mantle without appendages, but respiratory papillae beneath the mantle-border. *Pleurophyllidia*.

Fam. 9.—*Dermatobranchidae*. Like the last, but wholly without branchiae. *Dermatobranchus*.

Tribe 4.—Elysiomorpha. Liver ramifies in integuments and extends into dorsal papillae, but there are no cnidosacs. Genital duct always triaulic, and male and female apertures distant from each other. No mandibles, and radula uniserial. Never more than one pair of tentacles, and these are absent in *Alderia* and some species of *Limapontia*.

Fam. 1.—*Hermaeidae*. Foot narrow; dorsal papillae linear or fusiform, in several series. *Hermaea*, British. *Stiliger*. *Alderia*, British.

Fam. 2.—*Phyllobranchidae*. Foot broad; dorsal papillae flattened and foliaceous. *Phyllobranchus*. *Cyerce*.

Fam. 3.—*Plakobranchidae*. Body depressed, without dorsal papillae, but with two very large lateral expansions, with dorsal plications. *Plakobranchus*.

Fam. 4.—*Elysiidae*. Body elongated, with lateral expansions; tentacles large; foot narrow. *Elysia*, British. *Tridachia*.

Fam. 5.—*Limapontiidae*. No lateral expansions, and no dorsal papillae; body planariform; anus dorsal, median and posterior. *Limapontia*, British. *Actaeonia*, British. *Cenia*.

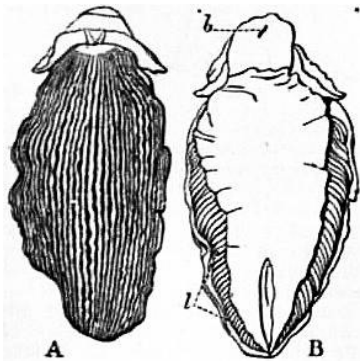


Fig. 55.—Dorsal and Ventral View of *Pleurophyllidia lineata* (Otto), one of the Eolidomorph Nudibranchs. (After Keferstein.)

b, The mouth.
l, The lamelliform sub-pallial gills, which (as in Patella) replace the typical Molluscan ctenidium.

Order 2 (of the Euthyneura).—Pulmonata. Euthyneurous Gastropoda, probably derived from ancestral forms similar to the Tectibranchiate Opisthobranchia by adaptation to a terrestrial life. The ctenidium is atrophied, and the edge of the mantle-skirt is fused to the dorsal integument by concrescence, except at one point which forms the aperture of the mantle-chamber, thus converted into a nearly closed sac. Air is admitted to this sac for respiratory and hydrostatic purposes, and it thus becomes a lung. An operculum is present only in *Amphibola*; a contrast being thus afforded with the operculate pulmonate Streptoneura (*Cyclostoma*, &c.), which differ in other essential features of structure from the Pulmonata. The Pulmonata are, like the other Euthyneura, hermaphrodite, with elaborately developed copulatory organs and accessory glands. Like other Euthyneura, they have very numerous small denticles on the lingual ribbon. In aquatic Pulmonata the osphradium is retained.

In some Pulmonata (snails) the foot is extended at right angles to the visceral hump, which rises from it in the form of a coil as in Streptoneura; in others the visceral hump is not elevated, but is extended with the foot, and the shell is small or absent (slugs).

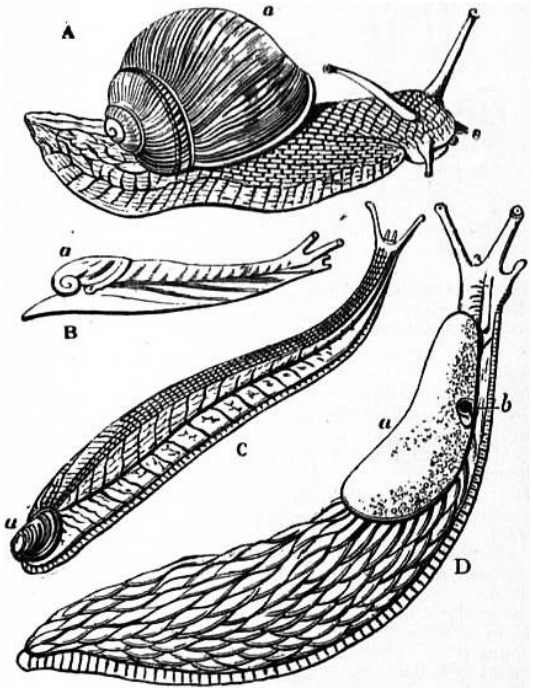


Fig. 56.—A Series of Stylommatophorous Pulmonata, showing transitional forms between snail and slug.

A, *Helix pomatia*. (From Keferstein.)
B, *Helicophanta brevipes*. (From Keferstein, after Pfeiffer.)
C, *Testacella haliotidea*. (From Keferstein.)
D, *Arion ater*, the great black slug. (From Keferstein.)
a, Shell in A, B, C, shell-sac (closed) in D; *b*, orifice leading into the sub-pallial chamber (lung).

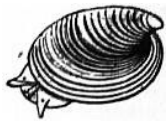


Fig. 57.—*Ancylus fluviatilis*, a patelliform aquatic Pulmonate.

Pulmonata are widely distinguished from a small number of Streptoneura at one time associated with them on account of their mantle-chamber being converted, as in Pulmonata, into a lung, and the ctenidium or branchial plume aborted. The terrestrial Streptoneura (represented in England by the common genus *Cyclostoma*) have a twisted visceral nerve-loop, an operculum on the foot, a complex rhipidoglossate or taenioglossate radula, and are of distinct sexes. The Pulmonata have a straight visceral nerve-loop, usually no operculum even in the embryo, and a multidenticulate radula, the teeth being equi-formal; and they are hermaphrodite. Some Pulmonata (*Limnaea*, &c.) live in fresh waters although breathing air. The remarkable discovery has been made that in deep lakes such *Limnaei* do not breathe air, but admit water to the lung-sac and live at the bottom. The lung-sac serves undoubtedly as a hydrostatic apparatus in the aquatic Pulmonata, as well as assisting respiration.

The same general range of body-form is shown in Pulmonata as in the Heteropoda and in the Opisthobranchia; at one extreme we have snails with coiled visceral hump, at the other cylindrical or flattened slugs (see fig. 56). Limpet-like forms are also found (fig. 57, *Ancylus*). The foot is always simple, with its flat crawling surface extending from end to end, but in the embryo *Limnaea* it shows a bilobed character, which leads on to the condition characteristic of Pteropoda.

The adaptation of the Pulmonata to terrestrial life has entailed little modification of the internal organization. In one genus (*Planorbis*) the plasma of the blood is coloured red by haemoglobin, this being the only instance of the presence of this body in the blood of Glossophorous Mollusca, though it occurs in corpuscles in the blood of the bivalves *Arca* and *Solen* (Lankester).

The generative apparatus of the snail (*Helix*) may serve as an example of the hermaphrodite apparatus common to the Pulmonata and Opisthobranchia (fig. 58). From the ovo-testis, which lies near the apex of the visceral coil, a common hermaphrodite duct *ve* proceeds, which receives the duct of the compact white albuminiparous gland, *Ed*, and then becomes much enlarged, the additional width being due to the development of glandular folds, which are regarded as forming a uterus *u*. Where these folds cease the common duct splits into two portions, a male and a female. The male duct *vd* becomes fleshy and muscular near its termination at the genital pore, forming the penis *p*. Attached to it is a diverticulum *fl*, in which the spermatozoa which have descended from the ovo-testis are stored and modelled into sperm ropes or spermatophores. The female portion of the duct is more complex. Soon after quitting the uterus it is joined by a long duct leading from a glandular sac, the spermatheca (*Rf*). In this duct and sac the spermatophores received in copulation from another snail are lodged. In *Helix hortensis* the spermatheca is simple. In other species of *Helix* a second duct (as large in *Helix aspersa* as the chief one) is given off from the spermathecal duct, and in the natural state is closely adherent to the wall of the uterus. This second duct has normally no spermathecal gland at its termination, which is simple and blunt. But in rare cases in *Helix aspersa* a second spermatheca is found at the end of this second duct. Tracing the widening female duct onwards we now come to the openings of the digitate accessory glands *d*, *d*, which probably assist in the formation of the egg-capsule. Close to them is the remarkable dart-sac *ps*, a thick-walled sac, in the lumen of which a crystalline four-fluted rod or dart consisting of carbonate of lime is found. It is supposed to act in some way as a stimulant in copulation, but possibly has to do with the calcareous covering of the egg-capsule. Other Pulmonata exhibit variations of secondary importance in the details of this hermaphrodite apparatus.

Fig. 58.—Hermaphrodite Reproductive Apparatus of the Garden Snail (*Helix hortensis*).

τ, Ovo-testis.
ve, Hermaphrodite duct.
Ed, Albuminiparous gland.
u, Uterine dilatation of the hermaphrodite duct.
d, Digitate accessory glands on the female duct.
ps, Calciferous gland or dart-sac on the female duct.
Rf, Spermatheca or receptacle of the sperm in copulation, opening into the female duct.
vd, Male duct (vas deferens).
p, Penis.
fl, Flagellum.

The nervous system of *Helix* is not favourable as an example on account of the fusion of the ganglia to form an almost uniform ring of nervous matter around the oesophagus. The pond-snail (*Limnaeus*) furnishes, on the other hand, a very beautiful case of distinct ganglia and connecting cords (fig. 59). The demonstration which it affords of the extreme shortening of the Euthyneurous visceral nerve-loop is most instructive and valuable for comparison with and explanation of the condition of the nervous centres in Cephalopoda, as also of some Opisthobranchia. The figure (fig. 59) is sufficiently described in the letterpress attached to it; the pair of buccal ganglia joined by the connectives to the cerebrals are, as in most of our figures, omitted. Here we need only further draw attention to the osphradium, discovered by Lacaze-Duthiers, and shown by Spengel to agree in its innervation with that organ in all other Gastropoda. On account of the shortness of the visceral loop and the proximity of the right visceral ganglion to the oesophageal nerve-ring, the nerve to the osphradium and olfactory ganglion is very long. The position of the osphradium corresponds more or less closely with that of the vanished right ctenidium, with which it is normally associated. In *Helix* and *Limax* the osphradium has not been described, and possibly its discovery might clear up the doubts which have been raised as to the nature of the mantle-chamber of those genera. In *Planorbis*, which is sinistral (as are a few other genera or exceptional varieties of various Anisopleurous Gastropods), instead of being dextral, the osphradium is on the left side, and receives its nerve from the left visceral ganglion, the whole series of unilateral organs being reversed. This is, as might be expected, what is found to be the case in all “reversed” Gastropods.

The shell of the Pulmonata, though always light and delicate, is in many cases a well-developed spiral “house” into which the creature can withdraw itself; and, although the foot possesses no operculum, yet in *Helix* the aperture of the shell is closed in the winter by a complete lid, the “hybernaculum” more or less calcareous in nature, which is secreted by the foot. In *Clausilia* a peculiar modification of this lid exists permanently in the adult, attached by an elastic stalk to the mouth of the shell, and known as the “clausilium.” In *Limnaeus* the permanent shell is preceded in the embryo by a well-marked shell-gland or primitive shell-sac (fig. 60), at one time supposed to be the developing anus, but shown by Lankester to be identical with the “shell-gland” discovered by him in other Mollusca (*Pisidium*, *Pleurobranchidium*, *Neritina*, &c.). As in other Gastropoda Anisopleura, this shell-sac may abnormally develop a plug of chitinous matter, but normally it flattens out and disappears, whilst the cap-like rudiment of the permanent shell is shed out from the dome-like surface of the visceral hump, in the centre of which the shell-sac existed for a brief period.

In *Clausilia*, according to the observations of C. Gegenbaur, the primitive shell-sac does not flatten out and disappear, but takes the form of a flattened closed sac. Within this closed sac a plate of calcareous matter is developed, and after a time the upper wall of the sac disappears, and the calcareous plate continues to grow as the nucleus of the permanent shell. In the slug *Testacella* (fig. 56, C) the shell-plate never attains a large size, though naked. In other slugs, namely, *Limax* and *Arion*, the shell-sac remains permanently closed over the shell-plate, which in the latter genus consists of a granular mass of carbonate of lime. The permanence of the primitive shell-sac in these slugs is a point of considerable interest. It is clear enough that the sac is of a different origin from that of *Aplysia*

(described in the section treating of Opisthobranchia), being primitive instead of secondary. It seems probable that it is identical with one of the open sacs in which each shell-plate of a *Chiton* is formed, and the series of plate-like imbrications which are placed behind the single shell-sac on the dorsum of the curious slug, *Plectrophorus*, suggest the possibility of the formation of a series of shell-sacs on the back of that animal similar to those which we find in *Chiton*. Whether the closed primitive shell-sac of the slugs (and with it the transient embryonic shell-gland of all other Mollusca) is precisely the same thing as the closed sac in which the calcareous pen or shell of the Cephalopod *Sepia* and its allies is formed, is a further question which we shall consider when dealing with the Cephalopoda. It is important here to note that *Clausilia* furnishes us with an exceptional instance of the *continuity* of the shell or secreted product of the primitive shell-sac with the adult shell. In most other Mollusca (Anisopleurous Gastropods, Pteropods and Conchifera) there is a want of such continuity; the primitive shell-sac contributes no factor to the permanent shell, or only a very minute knob-like particle (*Neritina* and *Paludina*). It flattens out and disappears before the work of forming the permanent shell commences. And just as there is a break at this stage, so (as observed by A. Krohn in *Marsenia* = *Echinospira*) there *may* be a break at a later stage, the nautiloid shell formed on the larva being cast, and a new shell of a different form being formed afresh on the surface of the visceral hump. It is, then, in this sense that we may speak of primary, secondary and tertiary shells in Mollusca recognizing the fact that they *may* be merely phases fused by continuity of growth so as to form but one shell, or that in other cases they *may* be presented to us as separate individual things, in virtue of the non-development of the later phases, or in virtue of sudden changes in the activity of the mantle-surface causing the shedding or disappearance of one phase of shell-formation before a later one is entered upon.

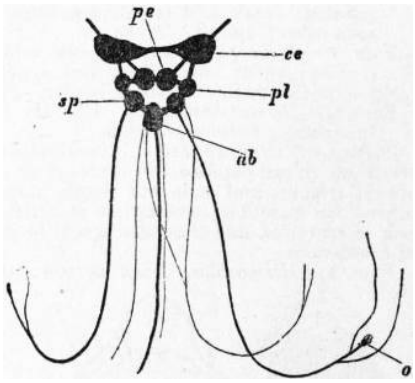


FIG. 59.—Nervous System of the Pond-Snail, *Limnaeus stagnalis*, as a type of the short-looped euthyneurous condition. The short visceral "loop" with its three ganglia is lightly-shaded.

ce, Cerebral ganglion.
pe, Pedal ganglion.
pl, Pleural ganglion.
ab, Abdominal ganglion.
sp, Visceral ganglion of the left side; opposite to it is the visceral ganglion of the right side, which gives off the long nerve to the olfactory ganglion and osphradium *o*.

In *Planorbis* and in *Auricula* (Pulmonata, allied to *Limnaeus*) the olfactory organ is on the *left* side and receives its nerve from the *left* visceral ganglion. (After Spengel.)

The development of the aquatic Pulmonata from the egg offers considerable facilities for study, and that of *Limnaeus* has been elucidated by E.R. Lankester, whilst H. Rabl has with remarkable skill applied the method of sections to the study of the minute embryos of *Planorbis*. The chief features in the development of *Limnaeus* are exhibited in fig. 60. There is not a very large amount of food-material present in the egg of this snail, and accordingly the cells resulting from division are not so unequal as in many other cases. The four cells first formed are of equal size, and then four smaller cells are formed by division of these four so as to lie at one end of the first four (the pole corresponding to that at which the "directive corpuscles" are extruded and remain). The smaller cells now divide and spread over the four larger cells; at the same time a space—the cleavage cavity or blastocoel—forms in the centre of the mulberry-like mass. Then the large cells recommence the process of division and sink into the hollow of the sphere, leaving an elongated groove, the blastopore, on the surface. The invaginated cells (derived from the division of the four big cells) form the endoderm or arch-enteron; the outer cells are the ectoderm. The blastopore now closes along the middle part of its course, which coincides in position with the future "foot." One end of the blastopore becomes nearly closed, and an ingrowth of ectoderm takes place around it to form the stomodaeum or fore-gut and mouth. The other extreme end closes, but the invaginated endoderm cells remain in continuity with this extremity of the blastopore, and form the "rectal peduncle" or "pedicle of invagination" of Lankester, although the endoderm cells retain no contact with the middle region of the now closed-up blastopore. The anal opening forms at a late period by a very short ingrowth or proctodaeum coinciding with the blind termination of the rectal peduncle (fig. 60, *pi*).

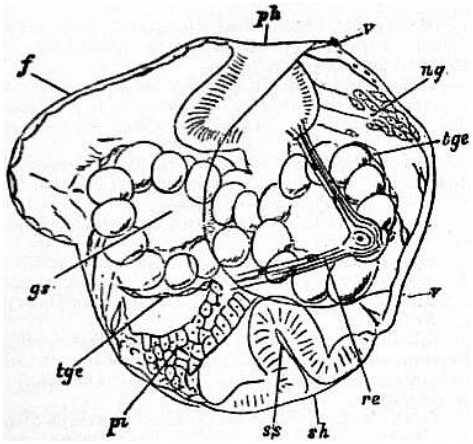


FIG. 60.—Embryo of *Limnaeus stagnalis*, at a stage when the Trochosphere is developing foot and shell-gland and becoming a Veliger, seen as a transparent object under slight pressure. (Lankester.)

ph, Pharynx (stomodaeal invagination).
v, *v*, The ciliated band marking out the velum.
ng, Cerebral nerve-ganglion.
re, Stiebel's canal (left side), probably an
pi, The rectal peduncle or pedicle of invagination; its attachment to the ectoderm is coincident with the hindmost extremity of the elongated blastopore of fig. 3,

evanescent embryonic nephridium.
sh, The primitive shell-sac or shell-gland.
C.
tge, Mesoblastic (skeleto-trophic and muscular) cells investing *gs*, the bilobed arch-enteron or lateral vesicles of invaginated endoderm, which will develop into liver.
f, The foot.

The body-cavity and the muscular, fibrous and vascular tissues are traced partly to two symmetrically disposed "mesoblasts," which bud off from the invaginated arch-enteron, partly to cells derived from the ectoderm, which at a very early stage is connected by long processes with the invaginated endoderm. The external form of the embryo goes through the same changes as in other Gastropods, and is not, as was held previously to Lankester's observations, exceptional. When the middle and hinder regions of the blastopore are closing in, an equatorial ridge of ciliated cells is formed, converting the embryo into a typical trochosphere.

The foot now protrudes below the mouth, and the post-oral hemisphere of the trochosphere grows more rapidly then the anterior or velar area. The young foot shows a bilobed form. Within the velar area the eyes and the cephalic tentacles commence to rise up, and on the surface of the post-oral region is formed a cap-like shell and an encircling ridge, which gradually increases in prominence and becomes the freely depending mantle-skirt. The outline of the velar area becomes strongly emarginated and can be traced through the more mature embryos to the cephalic lobes or labial processes of the adult *Limnaeus* (fig. 61).

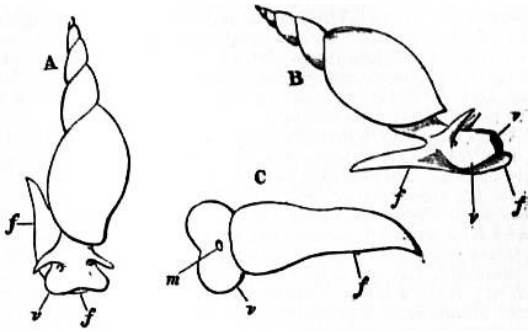


FIG. 61.—A, B, C. Three views of *Limnaeus stagnalis*, in order to show the persistence of the larval velar area *v*, as the circum-oral lobes of the adult. *m*, Mouth; *f*, foot; *v*, velar area, the margin *v* corresponding with the ciliated band which demarcates the velar area or velum of the embryo Gastropod (see fig. 4, D, E, F, H, I, *v*). (Original.)

The increase of the visceral dome, its spiral twisting, and the gradual closure of the space overhung by the mantle-skirt so as to convert it into a lung-sac with a small contractile aperture, belong to stages in the development later than any represented in our figures.

We may now revert briefly to the internal organization at a period when the trochosphere is beginning to show a prominent foot growing out from the area where the mid-region of the elongated blastopore was situated, and having therefore at one end of it the mouth and at the other the anus. Fig. 60 represents such an embryo under slight compression as seen by transmitted light. The ciliated band of the left side of the velar area is indicated by a line extending from *v* to *v*; the foot *f* is seen between the pharynx *ph* and the pedicle of invagination *pi*. The mass of the arch-enteron or invaginated endodermal sac has taken on a bilobed form, and its cells are swollen (*gs* and *tge*). This bilobed sac becomes *entirely* the liver in the adult; the intestine and stomach are formed from the pedicle of invagination, whilst the pharynx, oesophagus and crop form from the stomodaeal invagination *ph*. To the right (in the figure) of the rectal peduncle is seen the deeply invaginated shell-gland *ss*, with a secretion *sh* protruding from it. The shell-gland is destined in *Limnaeus* to become very rapidly stretched out, and to disappear. Farther up, within the velar area, the rudiments of the cerebral nerve-ganglion *ng* are seen separating from the ectoderm. A remarkable cord of cells having a position just below the integument occurs on each side of the head. In the figure the cord of the left side is seen, marked *re*. This paired organ consists of a string of cells which are perforated by a duct opening to the exterior and ending internally in a flame-cell. Such cannulated cells are characteristic of the nephridia of many worms, and the organs thus formed in the embryo *Limnaeus* are embryonic nephridia. The most important fact about them is that they disappear, and are in no way connected with the typical nephridium of the adult. In reference to their first observer they were formerly called "Stiebel's canals." Other Pulmonata possess, when embryos, Stiebel's canals in a more fully developed state, for instance, the common slug *Limax*. Here too they disappear during embryonic life. Similar larval nephridia occur in other Gastropoda. In the marine Streptoneura they are ectodermic projections which ultimately fall off; in the Opisthobranchs they are closed pouches; in *Paludina* and *Bithynia* they are canals as in Pulmonata.

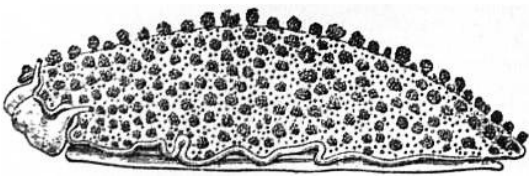


FIG. 62.—*Oncidium tonganum*, a littoral Pulmonate, found on the shores of the Indian and Pacific Oceans (Mauritius, Japan).

Marine Pulmonata.—Whilst the Pulmonata are essentially a terrestrial and fresh-water group, there is one genus of slug-like Pulmonates which frequent the sea-coast (*Oncidium*, fig. 62). Karl Semper has shown that these slugs have, in addition to the usual pair of cephalic eyes, a number of eyes developed upon the dorsal integument. These dorsal eyes are very perfect in elaboration, possessing lens, retinal nerve-end cells, retinal pigment and optic nerve. Curiously enough, however, they differ from the cephalic Molluscan eye in the fact that, as in the vertebrate eye,

the filaments of the optic nerve penetrate the retina, and are connected with the surfaces of the nerve-end cells nearer the lens instead of with the opposite end. The significance of this arrangement is not known, but it is important to note, as shown by V. Henson, S.J. Hickson and others, that in the bivalves *Pecten* and *Spondylus*, which also have eyes upon the mantle quite distinct from typical cephalic eyes, there is the same relationship as in Oncidiidae of the optic nerve to the retinal cells. In both Oncidiidae and *Pecten* the pallial eyes have probably been developed by the modification of tentacles, such as coexist in an unmodified form with the eyes. The Oncidiidae are, according to K. Semper, pursued as food by the leaping fish *Periophthalmus*, and the dorsal eyes are of especial value to them in aiding them to escape from this enemy.

Sub-order 1.—Basommatophora. Pulmonata with an external shell. The head bears a single pair of contractile but not invaginable tentacles, at the base of which are the eyes. Penis at some distance from the female aperture, except in *Amphibola* and *Siphonaria*. All have an osphradium, except the *Auriculidae*, which are terrestrial, and it is situated outside the pallial cavity in those forms in which water is not admitted into the lung. There is a veliger stage in development, but the velum is reduced.

Fam. 1.—*Auriculidae*. Terrestrial and usually littoral; genital duct monaulic, the penis being connected with the aperture by an open or closed groove; shell with a prominent spire, the internal partitions often absorbed and the aperture denticulated. *Auricula*. *Cassidula*. *Alexia*. *Melampus*. *Carychium*, terrestrial, British. *Scarabus*. *Leuconia*, British. *Blauneria*. *Pedipes*.

Fam. 2.—*Otinidae*. Shell with short spire, and wide oval aperture; tentacles short. *Otina*, British. *Camptonyx*, terrestrial.

Fam. 3.—*Amphibolidae*. Shell spirally coiled; head broad, without prominent tentacles; foot short, operculated; marine. *Amphibola*.

Fam. 4.—*Siphonariidae*. Visceral mass and shell conical; tentacles atrophied; head expanded; genital apertures contiguous; marine animals, with an aquatic pallial cavity containing secondary branchial laminae. *Siphonaria*.

Fam. 5.—*Gadiniidae*. Visceral mass and shell conical; head flattened; pallial cavity aquatic, but without a branchia; genital apertures separated. *Gadinia*.

Fam. 6.—*Chilinidae*. Shell ovoid, with short spire, wide aperture and folded columella; inferior pallial lobe thick; visceral commissure still twisted. *Chilina*.

Fam. 7.—*Limnaeidae*. Shell thin, dextral, with prominent spire and oval aperture; no inferior pallial lobe. *Limnaea*, British. *Amphipeplea*, British.

Fam. 8.—*Pompholygidae*. Shell dextral, hyperstrophic, animal sinistral. *Pompholyx*. *Choanomphalus*.

Fam. 9.—*Planorbidae*. Visceral mass and shell sinistral; inferior pallial lobe very prominent, and transformed into a branchia. *Planorbis*, British. *Bulinus*. *Miratesta*.

Fam. 10.—*Ancylidae*. Shell conical, not spiral; inferior pallial lobe transformed into a branchia. *Ancylus*, British. *Latia*. *Grundlachia*.

Fam. 11.—*Physidae*. Visceral mass and shell sinistrally coiled; shell thin, with narrow aperture; no inferior pallial lobe. *Physa*, British. *Aplexa*, British.

Sub-order 2.—Stylommatophora. Pulmonata with two pairs of tentacles, except *Janellidae* and *Vertigo*; these tentacles are invaginable, and the eyes are borne on the summits of the posterior pair. Male and female genital apertures open into a common vestibule, except in *Vaginulidae* and *Oncidiidae*. Except in *Oncidium*, there is no longer a veliger stage in development.

Tribe 1.—Hologhatha. Jaw simple, without a superior appendage.

Fam. 1.—*Selenitidae*. Radula with elongated and pointed teeth, like those of the Agnatha; a jaw present. *Plutonia*. *Trigonochlamys*.

Fam. 2.—*Zonitidae*. Shell external, smooth, heliciform or flattened; radula with pointed marginal teeth. *Zonites*, British. *Ariophanta*. *Orpiella*. *Vitrina*. *Helicarion*.

Fam. 3.—*Limacidae*. Shell internal. *Limax*, British. *Parmacella*. *Urocyclus*. *Parmarion*. *Amalia*. *Agriolimax*. *Mesolimax*. *Monochroma*. *Paralimax*. *Metalimax*.

Fam. 4.—*Philomycidae*. No shell; mantle covers the whole surface of the body; radula with squarish teeth. *Philomycus*.

Fam. 5.—*Ostracolethidae*. Shell largely chitinous, not spiral, its calcareous apex projecting through a small hole in the mantle. *Ostracolethe*.

Fam. 6.—*Arionidae*. Shell internal, or absent; mantle restricted to the anterior and middle part of the body; radula with squarish teeth. *Arion*, British. *Geomalacus*. *Ariolimax*. *Anadenus*.

Fam. 7.—*Helicidae*. Shell with medium spire, external or partly covered by the mantle; genital aperture below the right posterior tentacle; genital apparatus generally provided with a dart-sac and multifid vesicles. *Helix*, British. *Bulimus*. *Hemphillia*. *Berendtia*. *Cochlostyla*. *Rhodea*.

Fam. 8.—*Endodontidae*. Shell external, spiral, generally ornamented with ribs; borders of aperture thin and not reflected; radula with square teeth; genital ducts without accessory organs. *Endodonta. Punctum. Sphyradium. Laoma. Pyramidula.*

Fam. 9.—*Orthalicidae*. Shell external, ovoid, the last whorl swollen, aperture oval with a simple border; radular teeth in oblique rows. *Orthalicus*.

Fam. 10.—*Bulimulidae*. Jaw formed of folds imbricated externally and meeting at an acute angle near the base. *Bulimulus. Peltella. Amphibulimus.*

Fam. 11.—*Cylindrellidae*. Shell turriculated, with numerous whorls, the last more or less detached. *Cylindrella.*

Fam. 12.—*Pupidae*. Shell external, with elongated spire and numerous whorls, aperture generally narrow; male genital duct without multifid vesicles. *Pupa*, British. *Eucalodium. Vertigo*, British. *Buliminus*, British. *Clausilia*, British. *Balea. Zospeum. Megaspira. Strophia. Anostoma.*

Fam. 13.—*Stenogyridae*. Shell elongated, with a more or less obtuse summit; aperture with a simple border. *Achatina. Stenogyra. Ferussacia*, British. *Cionella. Caecilianella. Azeca. Opeas.*

Fam. 14.—*Helicteridae.* Shell bulimoid, dextral or sinistral; radular teeth, expanded at their extremities and multicuspidate. *Helicter. Tornatellina.*

Tribe 2.—Agnatha. No jaws; teeth narrow and pointed; carnivorous.

Fam. 1.—*Oleacinidae.* Shell oval, elongated, with narrow aperture; neck very long; labial palps prominent. *Oleacina (Glandina). Streptostyla.*

Fam. 2.—*Testacellidae.* Shell globular or auriform, external or partly covered by the mantle. *Streptaxis. Gibbulina. Aerope. Rhytida. Daudebardia. Testacella. Chlamydophorus. Schizoglossa.*

Fam. 3.—*Rathouisiidae.* No shell, a carinated mantle covering the whole body; male and female apertures distant, the female near the anus. *Rathouisia. Atopos.*

Tribe 3.—Elasmognatha. Jaw with a well-developed dorsal appendage.

Fam. 1.—*Succineidae.* Anterior tentacles much reduced; male and female apertures contiguous but distinct; shell thin, spiral, with short spire. *Succinea,* British. *Homalonyx. Hyalimax. Neohyalimax.*

Fam. 2.—*Janellidae.* Limaciform, with internal rounded shell; mantle very small and triangular; pulmonary chamber with tracheae; no anterior tentacles. *Janella. Aneitella. Aneitea. Triboniophorus.*

Tribe 4.—Ditremata. Male and female apertures distant.

Fam. 1.—*Vaginulidae.* No shell; limaciform; terrestrial; female aperture on right side in middle of body; anus posterior. *Vaginula.*

Fam. 2.—*Oncidiidae.* No shell; limaciform; littoral; female aperture posterior, near anus; a reduced pulmonary cavity with a distinct aperture. *Oncidium. Oncidiella,* British. *Peronia.*

Authorities.—L. Boutan, "La Cause principale de l'asymétrie des mollusques gastéropodes," *Arch. de zool. expér.* (3), vii. (1899); A. Lang, "Versuch einer Erklärung der Asymmetrie der Gastropoder," *Vierteljahrsschr. naturforsch. Gesellschaft,* Zürich, 36 (1892); A. Robert, "Recherches sur le développement des Troques," *Arch. de zool. expér.* (3), x. (1903); P. Pelseneer, "Report on the Pteropoda," *Zool. "Challenger" Expedit.* pts. lviii., lxv., lxvi. (1887, 1888); P. Pelseneer, "Protobranches aériens et Pulmonés branchifères," *Arch. de biol.* xiv. (1895); W.A. Herdman, "On the Structure and Functions of the Cerata or Dorsal Papillae in some Nudibranchiate Mollusca," *Quart. Journ. Mic. Sci.* (1892); J.T. Cunningham, "On the Structure and Relations of the Kidney in Aplysia," *Mitt. Zool. Stat. Neapel,* iv. (1883); Böhmig, "Zur feineren Anatomie von *Rhodope veranyi,* Kölliker," *Zeitschr. f. wiss. Zool.* vol. lvi. (1893).

Treatises.—S.P. Woodward, *Manual of the Mollusca* (2nd ed., with appendix, London, 1869); E. Forbes and S. Hanley, *History of British Mollusca* (4 vols., London, 1853); Alder and Hancock, *Monograph of British Nudibranchiate Mollusca* (London, Roy. Society, 1845); P. Pelseneer, *Mollusca. Treatise on Zool.,* edited by E. Ray Lankester, pt. v. (1906); E. Ray Lankester, "Mollusca," in 9th ed. of this Encyclopaedia, to which this article is much indebted.

(J. T. C)

GASTROTRICHA, a small group of fairly uniform animals which live among Rotifers and Protozoa at the bottom of ponds and marshes, biding amongst the recesses of the algae and sphagnum and other fresh-water plants and eating organic débris and Infusoria. They are of minute size varying from one-sixtieth to one-three-hundredth of an inch, and they move by means of long cilia. Two ventral bands composed of regular transverse rows of cilia are usually found. The head bears some especially large cilia. The cuticle which covers the body is here and there raised into overlapping scales which may be prolonged into bristles. An enlarged, frontal scale may cover the head, and a row of scales separates the ventral ciliated areas from one another, whilst two series of alternating rows cover the back and side. The body, otherwise circular in section, is slightly flattened ventrally. The mouth is anterior and slightly ventral; it leads into a protrusible pharynx armed with recurved teeth that can be everted. This leads to a muscular oesophagus with a triradiate lumen, which acts as a sucking pump and ends in a funnel-valve projecting into the stomach. The last named is oval and formed of four rows of large cells; it is separated by a sphincter from the rectum, which opens posteriorly and dorsally. The nitrogenous excretory apparatus consists of a coiled tube on each side of the stomach; internally the tubes end in large flame-cells, and externally by small pores which lie on the edges of the ventral row of scales. A cerebral ganglion rests on the oesophagus and supplies the cephalic cilia and hairs; it is continued some way back as two dorsal nerve trunks. The sense organs are the hairs and bristles and in some species eyes. The muscles are simple and unstriated and for the most part run longitudinally.

The two ovaries lie at the level of the juncture of the stomach and rectum. The eggs become very large, sometimes half the length of the mother; they are laid amongst water weeds. The male reproductive system is but little known, a small gland lying between the ovaries has been thought to be a testis, and if it be, the Gastrotricha are hermaphrodite.

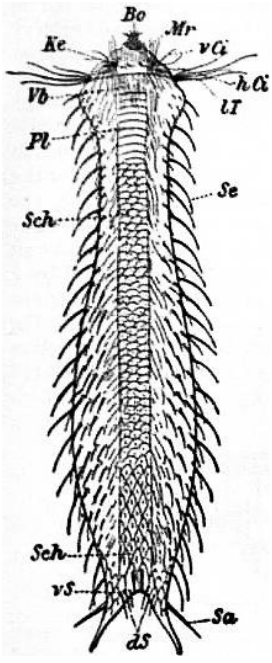
Zelinka classifies the group as follows:—

Sub-order 1.—Euichthydina with a forked tail.

(i.) Fam. Ichthydidae, without bristles. Genera: *Ichthydium, Lepidoderma.*

(ii.) Fam. Chaetonotidae, with bristles. Genera: *Chaetonotus, Chaetura.*

Sub-order 2.—Apodina, tail not forked. Genera: *Dasydytes, Gossea,*



From *Zeitschrift für Wissenschaft Zoologie,* vol. xlix. p. 209, by permission of Wilhelm Engelmann.

Chaetonotus maximus, Ehrb., ventral side. (After Zelinka.)

Bo, Bristles surrounding the mouth.
ds, Dorsal bristles.
hCi, Posterior lateral cilia.
Ke, Cuticular dome.
Mr, Oral cavity.
lT, Lateral sensory hairs.

Stylochaeta.

The genus *Aspidiophorus* recently described by Voigt seems in some respects intermediate between *Lepidoderma* and *Chaetonotus*. *Zelinkia* and *Philosyrtis* are two slightly aberrant forms described by Giard from certain diatomaceous sands. Altogether there must be some forty to fifty described species.

The group is an isolated one and shows no clear affinities with any of the great phyla. Those that are usually dwelt on are treated with the Rotifers and Nematoda and Turbellaria.

Pl, Cuticular plates.
Sa, Dorsal bristle of the basal part.
Sch, Plates.
Se, Lateral bristles.
Vb, Point of union of ciliated tract.
vCi, Anterior group of cilia.
vS, Ventral bristles of the basal part.

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(A. E. S.)

GATAKER, THOMAS (1574-1654), English divine, was born in London in September 1574, and educated at St John's College, Cambridge. From 1601 to 1611 he held the appointment of preacher to the society of Lincoln's Inn, which he resigned on accepting the rectory of Rotherhithe. In 1642 he was chosen a member of the assembly of divines at Westminster, and annotated for that assembly the books of Isaiah, Jeremiah and Lamentations. He disapproved of the introduction of the Covenant, and declared himself in favour of episcopacy. He was one of the forty-seven London clergymen who disapproved of the trial of Charles I. He was married four times, and died in July 1654.

His principal works, besides some volumes of sermons are—*On the Nature and Use of Lots* (1619), a curious treatise which led to his being accused of favouring games of chance; *Dissertatio de stylo Novi Testamenti* (1648); *Cinnus, sive Adversaria miscellanea, in quibus Sacrae Scripturae primo, deinde aliorum scriptorum, locis aliquam multis lux redditur* (1651), to which was afterwards subjoined *Adversaria Posthuma*; and his edition of *Marcus Antoninus* (1652), which, according to Hallam, is the "earliest edition of any classical writer published in England with original annotations," and, for the period at which it was written, possesses remarkable merit. His collected works were published at Utrecht in 1698.

GATCHINA, a town of Russia, in the government of St Petersburg, 29 m. by rail S. of the city of St Petersburg, in 59° 34′ N. and 30° 6′ E. Pop. (1860) 9184; (1897) 14,735. It is situated in a flat, well-wooded, and partly marshy district, and on the south side of the town are two lakes. Among its more important buildings are the imperial palace, which was founded in 1770 by Prince Orlov, and constructed according to the plans of the Italian architect Rinaldi; a military orphanage, founded in 1803; and a school for horticulture. Among the few industrial establishments is a porcelain factory. At Gatchina an alliance was concluded between Russia and Sweden on the 29th of October 1799.

GATE, an opening into any enclosure for entrance or exit, capable of being closed by a barrier at will. The word is of wide application, embracing not only the defensive entrance ways into a fortified place, with which this article mainly deals, or the imposing architectural features which form the main entrances to palaces, colleges, monastic buildings, &c., but also the common five-barred barrier which closes an opening into a field. The most general distinction that can be made between "door" and "gate" is that of size, the greater entrance into a court containing other buildings being the "gate," the smaller entrances opening directly into the particular buildings the "doors," or that of construction, the whole entrance way being a "gate" or gateway, the barrier which closes it a "door." A further distinction is drawn by applying "door" to the solid barriers or "valves" of wood, metal, &c., made in panels and fitted to a framework, and "gate" to an openwork structure, whether of metal or wood (see further DOOR and METAL-WORK). The ultimate origin of the word is obscure; the early forms appear with a palatalized initial letter, still surviving in such dialectical forms as "yate," or in Scots "yett." It is probably connected with the root of "get," in the sense either of "means of access" or of "holding," "receptacle"; cf. Dutch *gat*, hole. There may be a connexion, however, with "gate," now usually spelled "gait," a manner of walking,[1] but originally a way, passage; cf. Ger. *Gasse*, narrow street, lane.

The entrance through the enclosing walls of a city or fortification has been from the earliest times a place of the utmost importance, considered architecturally, socially or from the point of view of the military engineer. In the East the "gate" was and still is in many Mahommedan countries the central place of civic life. Here was the seat of justice and of audience, the most important market-place, the spot where men gathered to receive and exchange news. The references in the Bible to the gates of the city in all these varied aspects are innumerable (cf. Gen. xix. 1; Deut. xxv. 7; Ruth iv. 1; 2 Sam. xix. 8; 2 Kings vii. 1). Later the seat of justice and of government is transferred to the gate of the palace of the king (cf. Dan. ii. 49, and Esther ii. 19), and this use is preserved to-day in the official title of the seat of government of the Turkish empire at Constantinople, the "Sublime Porte," a translation of the Turkish *Bab Aliy* (*bab*, gate, and *aliy*, high). A full account with many modern instances of Eastern customs will be found in Sir Charles Warren's article "Gate" in Hastings's *Dict. of Bible*. For the "pylon," the typical gate of Egyptian architecture, see ARCHITECTURE.

The gates into a walled town or other fortified place were necessarily in early times the chief points on which the

attack concentrated, and the features, common throughout the ages, of flanking or surmounting towers and of galleries over the entrance way, are found in the Assyrian gate at Khorsabad (cf. 2 Chron. xxvi. 9; 2 Sam. xviii. 24). With the coming of peaceful times to a city or the removal of the fear of sudden attack, the gateways would take a form adapted more for ready exit and entrance than for defence, though the possibility of defending them was not forgotten. Such city gates often had separate openings for entrance and exit, and again for foot passengers and for vehicles. The Gallo-Roman gate at Autun has four entrances, two just wide enough to admit carriages, and two narrow alleys for foot passengers. A fine example of a Roman city gate, dating from the time of Constantine, is at Trèves. It is four storeys high, with ornamental windows, and decorated with columns on each storey. The two outer wings project beyond the central part, the two entrance ways are 14 ft. wide, and could be closed by doors and a portcullis. The chambers in the storeys above were used for the purposes of civil administration. In more modern times city gateways have often followed the type of the Roman triumphal arch, with a single wide opening and purely ornamental superstructure. On the other hand, the defensive gate formed by an archway entering as it were through a tower has been constantly followed as a type of entrance to buildings of an entirely peaceful character. A fine example of such a gateway, originally built for defence, is at Battle Abbey; this was built by Abbot Retlynge in 1338, when Edward III. granted a licence to fortify and crenellate the abbey. Such gateways are typical of Tudor palaces, as at St James's or at Hampton Court, and are the most common form in the colleges of Oxford and Cambridge. The Tom Gate at Christ Church, Oxford, with its surmounted domed bell tower, or the cupola resting on columns at Queen's College, Oxford, are further examples of the gate architecturally considered.

The changes the fortified gateway has undergone in construction and the varying relative importance it has held in the scheme of defence follow the lines of development taken by the history of Fortification and Siegecraft (*q.v.*). The following is a short sketch of the main stages in its history. A good example of the Roman fortified city gate still remains at Pompeii. Here there is one passage way for vehicles, 14 ft. wide; this is open to the sky. The two footways on either side are arched, with openings in the centre on to the central way. The doors of the gate are on the city side, but a portcullis (*cataracta*) closed it on the country side. The gateways of the Roman permanent camps (*castra stativa*) were four in number, the *porta praetoria* and *Decumana* at either end, with *principalis dextra* and *sinistra* on the side (see also Camp). At Pevensey (*Anderida*) a small postern on the north side of the Roman walls was laid bare in 1906-1907, in which the passage curves in the thickness of the wall, and from a width admitting two men abreast narrows so that one alone could block it. Flanking towers or bastions guarded the main entrances, while in front were built outworks, of palisades, &c., to protect it; these were known as *procastra* or *antemuralia*, and the entrances to these were placed so that they could be flanked from the main walls.

In the defence of a fortified place the gate had not only to be protected from sudden surprise, but also had to undergo protracted attacks concentrated upon it during a siege. Thus until the coming of gunpowder, the ingenuity of military engineers was exhausted in accumulating the most complicated defences round the gateways, and the strength of a fortified place could be estimated by the fewness of its gates. Viollet-le-Duc (*Dict. de l'arch. du moyen âge*, s.v. *Porte*) takes the Narbonne and Aude gates (E. and W.) of Carcassonne as typical instances of this complication. The following brief account of the Narbonne Gate (fig. 1), one of the principal parts of the work on the fortifications begun by Philip the Bold in 1285, will give some idea of the varied means of defence, which may be found individually if not always in such collective abundance in the fortified gateways of the middle ages. Two massive towers flanked the actual entrance and were linked across by an iron chain; over the entrance (E) was a machicolation, further added to in time of war by a hoarding of timber; and an outer portcullis fell in front of the heavy iron-lined doors. On to the passage way between the first and second doors opened a square machicolation (G) from which the defenders in the upper chambers of the gate could attack an enemy that had succeeded in breaking through the first entrance or had been trapped by the falling of the first portcullis. Another machicolation (I) opened from the roof in front of the second portcullis and second door. So much for the gate itself; but before an attack could reach that point, the following defences had to be passed: an immense circular barbican (A) protected the entrance across the moat and through the outer *enceinte* of the city. This entrance was flanked by a masked return of the wall (C), while palisades (P) still further hampered the assailant in his passage across the "lists" to the foot of the gate towers. Here sappers would find themselves exposed to a fire from the loopholes and from the machicolated hoardings above them, while the projecting horns with which the face of the towers terminated forced them to uncover themselves to a flanking fire from the indents in the main curtain on either side of the towers.

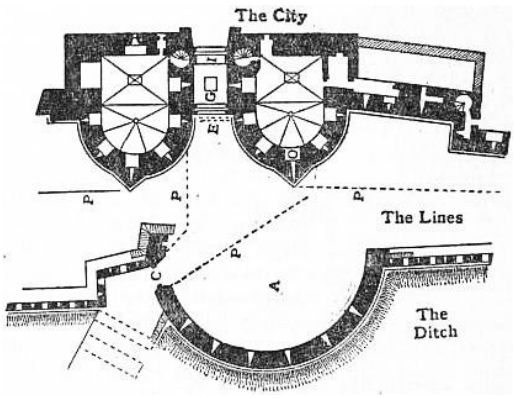


Fig. 1.—Plan of the Narbonne Gate of the city of Carcassonne.

The later history of the gateway is merged in that of modern fortification. The more elaborate the gate defences the greater was the inducement for the besieger to attack the walls, and improvements in methods of siegecraft ultimately compelled the defender to develop the *enceinte* from its medieval form of a ring wall with flanking towers to the 17th century form of bastions, curtains, tenailles and ravelins, all intimately connected in one general scheme of defence. By Vauban's time there is little to distinguish the position and defences of the gateways from the rest of the fortifications surrounding a town. A road from the country usually entered one of the ravelins, sinking into the glacis, crossing the ditch of the ravelin and piercing the parapet almost at right angles to its proper direction (see fig. 2, which also shows a typical arrangement of minor communications such as ramps and staircases). From the interior of the ravelin it passed across the main ditch to a gate in the curtain of the enceinte. The road was in fact artificially made to wind in such a way that it was kept under fire from the defences throughout, while the part of it inside the works was bent so as to place a covering mass between the enemy's fire

and troops using the road for a sortie. Thus the gate itself was merely a barrier against a *coup de main* and to keep out unauthorized persons. In conditions precluding the making of a breach in the walls, *i.e.* in surprises and assaults *de vive force*, the gateway and accompanying drawbridge continue to play their part in the 16th, 17th and 18th centuries, but they seldom or never appear as the objectives of a siege *en règle*. In Vauban's works, and those of most other engineers, there was generally a postern giving access to the floor of the main ditch, in the centre of the curtain escarp. The gates of Vauban's and later fortresses are strong heavy wooden doors, and the gateways more or less ornamental archways, exactly as in many private mansions of castellar form. In modern fortresses the gate of a detached fort or an *enceinte de sureté* is intended purely as a defence against an unexpected rush. The usual method is to have two gates, the outer one a lattice or portcullis of iron bars and the inner one a plate of half-inch steel armour, backed by wood and loopholed. The defenders of the gate can by this arrangement fire from the inner loopholes through the outer gate upon the approaches, and also keep the enemy under fire whilst he is trying to force the outer gate itself. The ditches are crossed either by drawbridges or by ramps leading the road down to the floor of the ditch.

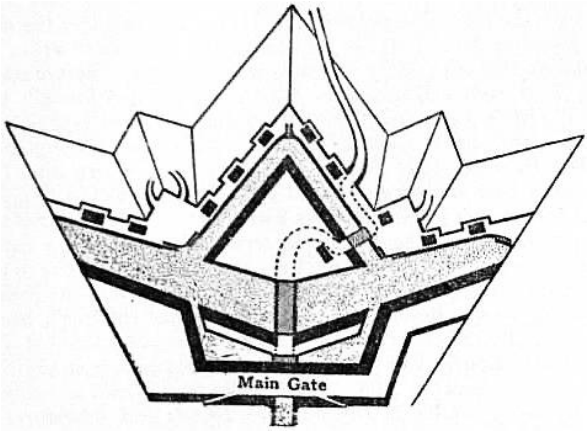


FIG. 2.—Plan of Gate Arrangements of an 18th Century Fortress.

The "gate" as a barrier to be removed and as an entrance to be passed is of constant occurrence in figurative language and in symbolical usage. The gates of the temple of Janus (*q.v.*) at Rome stood open in war and closed in peace. The *pylon* of ancient Egypt had a symbolical meaning in the Book of the Dead, and religious significance attaches to the *torii*, one of the outward signs of the Shinto religion in Japan, the Buddhist *toran*, and to the Chinese *pai-loo*, the honorific gateways erected to ancestors. The gates of heaven and hell, the gates of death and darkness, the wide and narrow gates that lead to destruction and life (Matt. vii. 13 and 14), are familiar metaphorical phrases in the Bible. In Greek and Roman legend dreams pass through gates of transparent horn if true, if deceptive and false through opaque gates of ivory (Hom. *Od.* xix. 560 sq.; Virg. *Aen.* vi. 893).

(C. WE.)

1 The spelling "gait" is confined to this meaning—the only literary one surviving. In the form "gate" it appears dialectally in this sense and in such particular meanings as a right to run cattle on common or private ground or as a passage way in mines. The principal survival is in names of streets in the north and midlands of England and in Scotland, *e.g.* Briggate at Leeds, Wheeler Gate and Castle Gate at Nottingham, Gallow Tree Gate at Leicester, and Canongate and Cowgate at Edinburgh.

GATEHOUSE. In the second half of the 16th century in England the entrance gateway, which formed part of the principal front of the earlier feudal castles, became a detached feature attached to the mansions only by a wall enclosing the entrance court. The gatehouse then constituted a structure of some importance, and included sometimes many rooms as at Stanway Hall, Gloucestershire, where it measures 44 ft. by 22 ft. and has three storeys; at Westwood, Worcestershire, it had a frontage of 54 ft. with two storeys; and at Burton Agnes, Yorkshire, it was still larger and was flanked by great octagonal towers at the angles and had three storeys. At a later period smaller accommodation was provided so that it virtually became a lodge, but being designed to harmonize with the mansion it presented sometimes a monumental structure. On the continent of Europe the gatehouse forms a much more important building, as it formed part of the town fortifications, where it sometimes defended the passage of a bridge across the stream or moat. There are numerous examples in France and Germany.

GATES, HORATIO (1728-1806), American general, was born at Maldon in Essex, England, in 1728. He entered the English army at an early age, and was rapidly promoted. He accompanied General Braddock in his disastrous expedition against Fort Duquesne in 1755, and was severely wounded in the battle of July 9; and he saw other active service in the Seven Years' War. After the peace of 1763 he purchased an estate in Virginia, where he lived till the outbreak of the War of Independence in 1775, when he was named by Congress adjutant-general. In 1776 he was appointed to command the troops which had lately retreated from Canada, and in August 1777, as a result of a successful intrigue, was appointed to supersede General Philip Schuyler in command of the Northern Department. In the two battles of Saratoga (*q.v.*) his army defeated General Burgoyne, who, on the 17th of October, was forced to surrender his whole army. This success was, however, largely due to the previous manœuvres of Schuyler and to Gates's subordinate officers. The intrigues of the Conway Cabal to have Washington superseded by Gates completely failed, but Gates was president for a time of the Board of War, and in 1780 was placed in chief command

in the South. He was totally defeated at Camden, S. C., by Cornwallis on the 17th of August 1780, and in December was superseded by Greene, though an investigation into his conduct terminated in acquittal (1782). He then retired to his Virginian estate, whence he removed to New York in 1790, after emancipating his slaves and providing for those who needed assistance. He died in New York on the 10th of April 1806.

GATESHEAD, a municipal, county and parliamentary borough of Durham, England; on the S. bank of the Tyne opposite Newcastle, and on the North Eastern railway. Pop. (1891) 85,692; (1901) 109,888. Though one of the largest towns in the county, neither its streets nor its public buildings, except perhaps its ecclesiastical buildings, have much claim to architectural beauty. The parish church of St Mary is an ancient cruciform edifice surmounted by a lofty tower; but extensive restoration was necessitated by a fire in 1854 which destroyed a considerable part of the town. The town-hall, public library and mechanic's institute are noteworthy buildings. Education is provided by a grammar school, a large day school for girls, and technical and art schools. There is a service of steam trams in the principal streets, and three fine bridges connect the town with Newcastle-upon-Tyne. There are large iron works (including foundries and factories for engines, boilers, chains and cables), shipbuilding yards, glass manufactories, chemical, soap and candle works, brick and tile works, breweries and tanneries. The town also contains a depot of the North Eastern railway, with large stores and locomotive works. Extensive coal mines exist in the vicinity; and at Gateshead Fell are large quarries for grindstones, which are much esteemed and are exported to all parts of the world. Large gas-works of the Newcastle and Gateshead Gas Company are also situated in the borough. The parliamentary borough returns one member. The corporation consists of a mayor, 9 aldermen, and 27 councillors. Area, 3132 acres.

Gateshead (Gateshewed) probably grew up during late Saxon times, the mention of the church there in which Bishop Walcher was murdered in 1080 being the first evidence of settlement. The borough probably obtained its charter during the following century, for Hugh de Puiset, bishop of Durham (1153-1195), confirmed to his burgesses similar rights to those of the burgesses of Newcastle, freedom of toll within the palatinate and other privileges. The bishop had a park here in 1348, and in 1438 Bishop Nevill appointed a keeper of the "tower." The position of the town led to a struggle with Newcastle over both fishing and trading rights. An inquisition of 1322 declared that the water of the Tyne was divided into three parts: the northern, belonging to Northumberland; the southern to Durham; and the central, common to all. At another inquisition held in 1336 the men of Gateshead claimed liberty of trading and fishing along the coast of Durham, and freedom to sell their fish where they would. In 1552, on the temporary extinction of the diocese of Durham, Gateshead was attached to Newcastle, but in 1554 was regranted to Bishop Tunstall. As compensation the bishop granted to Newcastle, at a nominal rent, the Gateshead salt-meadows, with rights of way to the High Street, thus abolishing the toll previously paid to the bishop. During the next century Bishop Tunstall's successors incorporated nearly all the various trades of Gateshead, and Cromwell continued this policy. The town government during this period was by the bishop's bailiff, and the holders of the burgages composed the juries of the bishop's courts leet and baron. No charter of incorporation is extant, but in 1563 contests were carried on under the name of the bailiffs, burgesses and commonalty, and a list of borough accounts exists for 1696. The bishop appointed the last borough bailiff in 1681, and though the inhabitants in 1772 petitioned for a bailiff the town remained under a steward and grassmen until the 19th century. As part of the palatinate of Durham, Gateshead was not represented in parliament until 1832. At the inquisition of 1336 the burgesses claimed an annual fair on St Peter's Day, and depositions in 1577 mention a borough market held on Tuesday and Friday, but these were apparently extinct in Camden's day, and no grant of them is extant. The medieval trade seems to have centred round the fisheries and the neighbouring coal mines which are mentioned in 1364 and also by Leland.

GATH, one of the five chief cities of the Philistines. It is frequently mentioned in the historical books of the Old Testament, and from Amos vi. 2 we conclude that, like Ashdod, it fell to Sargon in 711. Its site appears to have been known in the 4th century, but the name is now lost. Eusebius (in the *Onomasticon*) places it near the road from Eleutheropolis (Beit Jibrīn) to Diospolis (Ludd) about five Roman miles from the former. The Roman road between these two towns is still traceable, and its milestones remain in places. East of the road at the required distance rises a white cliff, almost isolated, 300 ft. high and full of caves. On the top is the little mud village of Tell eṣ-Ṣāfi ("the shining mound"), and beside the village is the mound which marks the site of the Crusaders' castle of Blanchegarde (Alba Custodia), built in 1144. Tell eṣ-Ṣāfi was known by its present name as far back as the 12th century; but it appears not improbable that the strong site here existing represents the ancient Gath. The cliff stands on the south side of the mouth of the Valley of Elah, and Gath appears to have been near this valley (1 Sam. xvii. 2, 52). This identification is not certain, but it is at least much more probable than the theory which makes Gath, Eleutheropolis, and Beit Jibrīn one and the same place. The site was partially excavated by the Palestine Exploration Fund in 1899, and remains extending in date back to the early Canaanite period were discovered.

GATLING, RICHARD JORDAN (1818-1903), American inventor, was born in Hertford county, North Carolina, on the 12th of September 1818. He was the son of a well-to-do planter and slave-owner, from whom he inherited a genius for mechanical invention and whom he assisted in the construction and perfecting of machines for sowing cotton seeds, and for thinning the plants. He was well educated and was successively a school teacher and a merchant, spending all his spare time in developing new inventions. In 1839 he perfected a practical screw propeller for steamboats, only to find that a patent had been granted to John Ericsson for a similar invention a few months earlier. He established himself in St Louis, Missouri, and taking the cotton-sowing machine as a basis he

adapted it for sowing rice, wheat and other grains, and established factories for its manufacture. The introduction of these machines did much to revolutionize the agricultural system in the country. Becoming interested in the study of medicine through an attack of smallpox, he completed a course at the Ohio Medical College, taking his M.D. degree in 1850. In the same year he invented a hemp-breaking machine, and in 1857 a steam plough. At the outbreak of the Civil War he was living in Indianapolis, and devoted himself at once to the perfecting of fire-arms. In 1861 he conceived the idea of the rapid fire machine-gun which is associated with his name. By 1862 he had succeeded in perfecting a gun that would discharge 350 shots per minute; but the war was practically over before the Federal authorities consented to its official adoption. From that time, however, the success of the invention was assured, and within ten years it had been adopted by almost every civilized nation. Gatling died in New York City on the 26th of February 1903.

GATTY, MARGARET (1809-1873), English writer, daughter of the Rev. Alexander Scott (1768-1840), chaplain to Lord Nelson, was born at Burnham, Essex, in 1809. She early began to draw and to etch on copper, being a regular visitor to the print-room of the British Museum from the age of ten. She also illuminated on vellum, copying the old strawberry borders and designing initials. In 1839 Margaret Scott married the Rev. Alfred Gatty, D.D., vicar of Ecclesfield near Sheffield, subdean of York cathedral, and the author of various works both secular and religious. In 1842 she published in association with her husband a life of her father; but her first independent work was *The Fairy Godmother and other Tales*, which appeared in 1851. This was followed in 1855 by the first of five volumes of *Parables from Nature*, the last being published in 1871. It was under the *nom de plume* of Aunt Judy, as a pleasant and instructive writer for children, that Mrs Gatty was most widely known. Before starting *Aunt Judy's Magazine* in May 1866, she had brought out *Aunt Judy's Tales* (1858) and *Aunt Judy's Letters* (1862), and among the other children's books which she subsequently published were *Aunt Judy's Song Book for Children* and *The Mother's Book of Poetry*. "Aunt Judy" was the nickname given by her daughter Juliana Horatia Ewing (*q.v.*). The editor of the magazine was on the friendliest terms with her young correspondents and subscribers, and her success was largely due to the sympathy which enabled her to look at things from the child's point of view. Besides other excellences her children's books are specially characterized by wholesomeness of sentiment and cheerful humour. Her miscellaneous writings include, in addition to several volumes of tales, *The Old Folks from Home*, an account of a holiday ramble in Ireland; *The Travels and Adventures of Dr Wolff the Missionary* (1861), an autobiography edited by her; *British Sea Weeds* (1862); *Waifs and Strays of Natural History* (1871); *A Book of Emblems* and *The Book of Sun-Dials* (1872). She died at Ecclesfield vicarage on the 4th of October 1873.

GAU, JOHN (*c.* 1495-? 1553), Scottish translator, was born at Perth towards the close of the 15th century. He was educated in St Salvator's College at St Andrews. He appears to have been in residence at Malmö in 1533, perhaps as chaplain to the Scots community there. In that year John Hochstraten, the exiled Antwerp printer, issued a book by Gau entitled: *The Richt vay to the Kingdome of Heuine*, of which the chief interest is that it is the first Scottish book written on the side of the Reformers. It is a translation of Christiern Pedersen's *Den rette vey till Hiemmerigis Rige* (Antwerp, 1531), for the most part direct, but showing intimate knowledge in places of the German edition of Urbanus Rhegius. Only one copy of Gau's text is extant, in the library of Britwell Court, Bucks. It has been assumed that all the copies were shipped from Malmö to Scotland, and that the cargo was intercepted by the Scottish officers on the look out for the heretical works which were printed abroad in large numbers. This may explain the silence of all the historians of the Reformed Church—Knox, Calderwood and Spottiswood. Gau married in 1536 a Malmö citizen's daughter, bearing the Christian name Birgitta. She died in 1551, and he in or about 1553.

The first reference to the *Richt Vay* appeared in Chalmers's *Caledonia*, ii. 616. Chalmers, who was the owner of the unique volume before it passed into the Britwell Court collection, considered it to be an original work. David Laing printed extracts for the Bannatyne Club (*Miscellany*, iii., 1855). The evidence that the book is a translation was first given by Sonnenstein Wendt in a paper "Om Reformatorerna i Malmö," in Rördam's *Ny Kirkehistoriske Samlinger*, ii. (Copenhagen, 1860). A complete edition was edited by A.F. Mitchell for the Scottish Text Society (1888). See also Lorimer's *Patrick Hamilton*.

GAUDEN, JOHN (1605-1662), English bishop and writer, reputed author of the *Eikon Basilike*, was born in 1605 at Mayland, Essex, where his father was vicar of the parish. Educated at Bury St Edmunds school and at St John's College, Cambridge, he took his M.A. degree in 1625/6. He married Elizabeth, daughter of Sir William Russell of Chippenham, Cambridgeshire, and was tutor at Oxford to two of his wife's brothers. He seems to have remained at Oxford until 1630, when he became vicar of Chippenham. His sympathies were at first with the parliamentary party. He was chaplain to Robert Rich, second earl of Warwick, and preached before the House of Commons in 1640. In 1641 he was appointed to the rural deanery of Bocking. Apparently his views changed as the revolutionary tendency of the Presbyterian party became more pronounced, for in 1648/9 he addressed to Lord Fairfax *A Religious and Loyal Protestation* ... against the proceedings of the parliament. Under the Commonwealth he faced both ways, keeping his ecclesiastical preferment, but publishing from time to time pamphlets on behalf of the Church of England. At the Restoration he was made bishop of Exeter. He immediately began to complain to Hyde, earl of Clarendon, of the poverty of the see, and based claims for a better benefice on a certain secret service, which he explained on the 20th of January 1661 to be the sole invention of the *Eikon Basilike, The Pourtraicture of his sacred Majestie in his Solitudes and Sufferings* put forth within a few hours after the execution of Charles I. as written by the king himself. To which Clarendon replied that he had been before acquainted with the secret and had often wished he had remained ignorant of it. Gauden was advanced in 1662, not as he had wished to the see of

Winchester, but to Worcester. He died on the 23rd of May of the same year.

The evidence in favour of Gauden's authorship rests chiefly on his own assertions and those of his wife (who after his death sent to her son John a narrative of the claim), and on the fact that it was admitted by Clarendon, who should have had means of being acquainted with the truth. Gauden's letters on the subject are printed in the appendix to vol. iii. of the *Clarendon Papers*. The argument is that Gauden had prepared the book to inspire sympathy with the king by a representation of his pious and forgiving disposition, and so to rouse public opinion against his execution. In 1693 further correspondence between Gauden, Clarendon, the duke of York, and Sir Edward Nicholas was published by Mr Arthur North, who had found them among the papers of his sister-in-law, a daughter-in-law of Bishop Gauden; but doubt has been thrown on the authenticity of these papers. Gauden stated that he had begun the book in 1647 and was entirely responsible for it. But it is contended that the work was in existence at Naseby,[1] and testimony to Charles's authorship is brought forward from various witnesses who had seen Charles himself occupied with it at various times during his imprisonment. It is stated that the MS. was delivered by one of the king's agents to Edward Symmons, rector of Raine, near Bocking, and that it was in the handwriting of Oudart, Sir Edward Nicholas's secretary. The internal evidence has, as is usual in such cases, been brought forward as a conclusive argument in favour of both contentions. Doubt was thrown on Charles's authorship in Milton's *Eikonoklastes* (1649), which was followed almost immediately by a royalist answer, *The Princely Pelican. Royall Resolves—Extracted from his Majesty's Divine Meditations, with satisfactory reasons ... that his Sacred Person was the only Author of them* (1649). The history of the whole controversy, which has been several times renewed, was dealt with in Christopher Wordsworth's tracts in a most exhaustive way. He eloquently advocated Charles's authorship. Since he wrote in 1829, some further evidence has been forthcoming in favour of the Naseby copy. A correspondence relating to the French translation of the work has also come to light among the papers of Sir Edward Nicholas. None of the letters show any doubt that King Charles was the author. S.R. Gardiner (*Hist. of the Great Civil War*, iv. 325) regards Mr Doble's articles in the *Academy* (May and June 1883) as finally disposing of Charles's claim to the authorship, but this is by no means the attitude of other recent writers. If Gauden was the author, he may have incorporated papers, &c., by Charles, who may have corrected the work and thus been joint-author. This theory would reconcile the conflicting evidence, that of those who saw Charles writing parts and read the MS. before publication, and the deliberate statements of Gauden.

See also the article by Richard Hooper in the *Dict. Nat. Biog.*; Christopher Wordsworth, *Who wrote Eikon Basilike?* two letters addressed to the archbishop of Canterbury (1824), and *King Charles the First, the Author of Icon Basilikè* (1828); H.J. Todd, *A Letter to the Archbishop of Canterbury concerning Eikon Basilike* (1825); *Bishop Gauden, The Author of the Icôn Basilikè* (1829); W.G. Broughton, *A Letter to a Friend* (1826), *Additional Reasons ...* (1829), supporting the contention in favour of Dr Gauden; Mr E.J.L. Scott's introduction to his reprint (1880) of the original edition; articles in the *Academy*, May and June 1883, by Mr C.E. Doble; another reprint edited by Mr Edward Almack for the King's Classics (1904); and Edward Almack, *Bibliography of the King's Book* (1896). This last book contains a summary of the arguments on either side, a full bibliography of works on the subject, and facsimiles of the title pages, with full descriptions of the various extant copies.

1 See a note in Archbishop Tenison's handwriting in his copy of the *Eikon Basilike* preserved at Lambeth Palace, and quoted in Almack's *Bibliography*, p. 15.

GAUDICHAUD-BEAUPRÉ, CHARLES (1789-1854), French botanist, was born at Angoulême on the 4th of September 1789. He studied pharmacy first in the shop of a brother-in-law at Cognac, and then under P.J. Robiquet at Paris, where from R.L. Desfontaines and L.C. Richard he acquired a knowledge of botany. In April 1810 he was appointed dispenser in the military marine, and from July 1811 to the end of 1814 he served at Antwerp. In 1817 he joined the corvette "Uranie" as pharmaceutical botanist to the circumpolar expedition commanded by D. de Freycinet. The wreck of the vessel on the Falkland Isles, at the close of 1819, deprived him of more than half the botanical collections he had made in various parts of the world. In 1830-1833 he visited Chile, Peru and Brazil, and in 1836-1837 he acted as botanist to "La Bonite" during its circumnavigation of the globe. His theory accounting for the growth of plants by the supposed coalescence of elementary "phytons" involved him, during the latter years of his life, in much controversy with his fellow-botanists, more especially C.F.B. de Mirbel. He died in Paris on the 16th of January 1854.

Besides accounts of his voyages round the world, Gaudichaud-Beaupré wrote "Lettres sur l'organographie et la physiologie," *Arch. de botanique*, ii., 1883; "Recherches générales sur l'organographie," &c. (prize essay, 1835), *Mém. de l'Académie des Sciences*, t. viii. and kindred treatises, with memoirs on the potato-blight, the multiplication of bulbous plants, the increase in diameter of dicotyledonous plants, and other subjects; and *Réfutation de toutes les objections contre les nouveaux principes physiologiques* (1852).

GAUDRY, JEAN ALBERT (1827-1908), French geologist and palaeontologist, was born at St Germain-en-Laye on the 16th of September 1827, and was educated at the college, Stanislas. At the age of twenty-five he made explorations in Cyprus and Greece, residing in the latter country from 1855 to 1860. He then investigated the rich deposit of fossil vertebrata at Pikermi and brought to light a remarkable mammalian fauna, Miocene in age, and intermediate in its forms between European, Asiatic and African types. He also published an account of the geology of the island of Cyprus (*Mém. Soc. Géol. de France*, 1862). In 1853, while still in Cyprus, he was appointed assistant to A. d'Orbigny, who was the first to hold the chair of palaeontology in the museum of natural history at Paris. In 1872 he succeeded to this important post; in 1882 he was elected member of the Academy of Sciences; and in 1900 he presided over the meetings of the eighth International Congress of Geology then held in Paris. He died on the 27th of November 1908. He is distinguished for his researches on fossil mammalia, and for the support which his studies have rendered to the theory of evolution.

PUBLICATIONS.—*Animaux fossiles et géologie de l'Attique* (2 vols., 1862-1867); *Cours de paléontologie* (1873);

Animaux fossiles du Mont Lebéron (1873); *Les Enchaînements du monde animal dans les temps géologiques* (*Mammifères Tertiaires*, 1878; *Fossiles primaires*, 1883; *Fossiles secondaires*, 1890); *Essai de paléontologie philosophique* (1896). Brief memoir with portrait in *Geol. Mag.* (1903), p. 49.

(H. B. W.)

GAUDY, an adjective meaning showy, very bright, gay, especially with a sense of tasteless or vulgar extravagance, of colour or ornament. The accurate origin of the various senses which this word and the substantive "gaud" have taken are somewhat difficult to trace. They are all ultimately to be referred to the Lat. *gaudere*, to rejoice, *gaudium*, joy, some of them directly, others to the French derivative *gaudir*, to rejoice, and O. Fr. *gaudie*. As a noun, in the sense of rejoicing or feast, "gaudy" is still used of a commemoration dinner at a college at the university of Oxford. "Gaud," meaning generally a toy, a gay adornment, a piece of showy jewelry, is more specifically applied to larger and more decorative beads in a rosary.

GAUERMANN, FRIEDRICH (1807-1862), Austrian painter, son of the landscape painter Jacob Gauermann (1773-1843), was born at Wiesenbach near Gutenstein in Lower Austria on the 20th of September 1807. It was the intention of his father that he should devote himself to agriculture, but the example of an elder brother, who, however, died early, fostered his inclination towards art. Under his father's direction he began studies in landscape, and he also diligently copied the works of the chief masters in animal painting which were contained in the academy and court library of Vienna. In the summer he made art tours in the districts of Styria, Tirol and Salzburg. Two animal pieces which he exhibited at the Vienna Exhibition of 1824 were regarded as remarkable productions for his years, and led to his receiving commissions in 1825 and 1826 from Prince Metternich and Caraman, the French ambassador. His reputation was greatly increased by his picture "The Storm," exhibited in 1829, and from that time his works were much sought after and obtained correspondingly high prices. His "Field Labourer" was regarded by many as the most noteworthy picture in the Vienna exhibition of 1834, and his numerous animal pieces have entitled him to a place in the first rank of painters of that class of subjects. The peculiarity of his pictures is the representation of human and animal figures in connexion with appropriate landscapes and in characteristic situations so as to manifest nature as a living whole, and he particularly excels in depicting the free life of animals in wild mountain scenery. Along with great mastery of the technicalities of his art, his works exhibit patient and keen observation, free and correct handling of details, and bold and clear colouring. He died at Vienna on the 7th of July 1862.

Many of his pictures have been engraved, and after his death a selection of fifty-three of his works was prepared for this purpose by the Austrian *Kunstverein* (Art Union).

GAUGE, or Gage (Med. Lat. *gauja*, *jaugia*, Fr. *jauge*, perhaps connected with Fr. *jale*, a bowl, *galon*, gallon), a standard of measurement, and also the name given to various instruments and appliances by which measurement is effected. The word seems to have been primarily used in connexion with the process of ascertaining the contents of wine casks; the name gauger is still applied to certain custom-house officials in the United States, and in Scotland it means an exciseman. Thence it was extended to other measurements, and used of the instruments used in making them or of the standards to which they were referred. In the mechanical arts gauges are employed in great variety to enable the workmen to ascertain whether the object he is making is of the proper dimensions (see Tool), and similar gauges of various forms are employed to ascertain and to specify the sizes of manufactured articles such as wire and screws. A rain gauge is an apparatus for measuring the amount of the rainfall at any locality, and a wind gauge indicates the pressure and force of the wind. The boilers of steam engines are provided with a water gauge and a steam or pressure gauge. The purpose of the former is to enable the attendant to see whether or not there is a sufficient quantity of water in the boiler. It consists of two cocks or taps communicating with the interior, one being placed at the lowest point to which it is permissible for the water to fall, and the other at the point above which it should not rise; a glass tube connects the two cocks, and when they are both open the water in this stands at the same level as in the boiler. The steam gauge shows the pressure of the steam in the boiler. One of the commonest forms, known as the Bourdon gauge, depends on the fact that a curved tube tends to straighten itself if the pressure within it is greater than that outside it. This gauge therefore consists of a curved or coiled tube of elastic material, and preferably of elliptic section, connected with the boiler and arranged with a multiplying gear so that its bending or unbending actuates a pointer moving over a graduated scale. If the pressure within the tube is less than that outside it, the tube tends to bend or coil itself up further; with a pointer arranged as before, the gauge then becomes a vacuum gauge, indicating how far the pressure in the vessel to which it is attached is below that of the atmosphere. In railway engineering the gauge of a line is the distance between the two rails (see Railway). In nautical language, a ship is said to have the weather gage when she is to windward of another, and similarly the lee gage when to leeward of another; in this sense the word is usually spelt "gage," a spelling which prevails in America for all senses.

GAUHATI, a town of British India, in the Kamrup district of Eastern Bengal and Assam, mainly on the left or

south, but partly on the right bank of the Brahmaputra. Pop. (1901) 14,244. It is beautifully situated, with an amphitheatre of wooded hills to the south, but is not very healthy. There are many evidences, such as ancient earthworks and tanks, of its historical importance. During the 17th century it was taken and retaken by Mahommedans and Ahoms eight times in fifty years, but in 1681 it became the residence of the Ahom governor of lower Assam, and in 1786 the capital of the Ahom raja. On the cession of Assam to the British in 1826 it was made the seat of the British administration of Assam, and so continued till 1874, when the headquarters were removed to Shillong in the Khasi hills, 67 m. distant, with which Gauhati is connected by an excellent cart-road. Two much-frequented places of Hindu pilgrimage are situated in the immediate vicinity, the temple of Kamakhya on a hill 2 m. west of the town, and the rocky island of Umananda in the mid-channel of the Brahmaputra. Gauhati is still the headquarters of the district and of the Brahmaputra Valley division, though no longer a military cantonment. It is the river terminus of a section of the Assam-Bengal railway. There are a second-grade college, a government high school, a law class and a training school for masters. Gauhati is an important centre of river trade, and the largest seat of commerce in Assam. Cotton-ginning, flour-milling, and an export trade in mustard seed, cotton, silk and forest produce are carried on. Gauhati suffered very severely from the earthquake of the 12th of June 1897.

GAUL, GILBERT WILLIAM (1855-), American artist, was born in Jersey City, New Jersey, on the 31st of March 1855. He was a pupil of J.G. Brown and L.E. Wilmarth, and he became a painter of military pictures, portraying incidents of the American Civil War. He was elected an associate of the National Academy of Design in 1880, and in 1882 a full academician, and in the latter year became a member of the Society of American Artists. His important works include: “Charging the Battery,” “News from Home,” “Cold Comfort on the Outpost,” “Silenced,” “On the Look-out,” and “Guerillas returning from a Raid.”

GAUL, the modern form of the Roman *Gallia*, the name of the two chief districts known to the Romans as inhabited by Celtic-speaking peoples, (*a*) *Gallia Cisalpina* (or *Citerior*, “Hither”), *i.e.* north Italy between Alps and Apennines and (*b*) the far more important *Gallia Transalpina* (or *Ulterior*, “Further”), usually called *Gallia* (Gaul) simply, the land bounded by the Alps, the Mediterranean, the Pyrenees, the Atlantic, the Rhine, *i.e.* modern France and Belgium with parts of Holland, Germany and Switzerland. The Greek form of *Gallia* was Γαλατία, but Galatia in Latin denoted another Celtic region in central Asia Minor, sometimes styled *Gallograecia*.

(*a*) Gallia Cisalpina was mainly conquered by Rome by 222 B.C.; later it adopted Roman civilization; about 42 B.C. it was united with Italy and its subsequent history is merged in that of the peninsula. Its chief distinctions are that during the later Republic and earlier Empire it yielded excellent soldiers, and thus much aided the success of Caesar against Pompey and of Octavian against Antony, and that it gave Rome the poet Virgil (by origin a Celt), the historian Livy, the lyrist Catullus, Cornelius Nepos, the elder and the younger Pliny and other distinguished writers.[1]

(*b*) Gaul proper first enters ancient history when the Greek colony of Massilia was founded (? 600 B.C.). Roman armies began to enter it about 218 B.C. In 121 B.C. the coast from Montpellier to the Pyrenees (*i.e.* all that was not Massiliot) with its port of Narbo (mod. *Narbonne*) and its trade route by Toulouse to the Atlantic, was formed into the province of Gallia Narbonensis and Narbo itself into a Roman municipality. Commercial motives prompted the step, and Roman traders and land speculators speedily flocked in. Gradually the province was extended north of Massilia, up the Rhone, while the Greek town itself became weak and dependent on Rome.

It is not, however, until the middle of the 1st century B.C. that we have any detailed knowledge of pre-Roman Gaul. The earliest account is that contained in the *Commentaries* of Julius Caesar. According to this authority, Gaul was at that time divided among three peoples, more or less distinct from one another, the Aquitani, the Gauls, who called themselves Celts, and the Belgae. The first of these extended from the Pyrenees to the Garumna (Garonne); the second, from that river to the Sequana (Seine) and its chief tributary the Matrona (Marne), reaching eastward presumably as far as the Rhenus (Rhine); and the third, from this bounding line to the mouth of the last-named river, thus bordering on the Germans. By implication Caesar recognizes as a fourth division the province of Gallia Narbonensis. By far the greater part of the country was a plain watered by numerous rivers, the chief of which have already been mentioned, with the exception of its great central stream, the Liger or Ligeris (Loire). Its principal mountain ranges were Cebenna or Gebenna (Cévennes) in the south, and Jura, with its continuation Vosegus or Vogesus (Vosges), in the east. The tribes inhabiting Gaul in Caesar’s time, and belonging to one or other of the three races distinguished by him, were numerous. Prominent among them, and dwelling in the division occupied by the Celts, were the Helvetii, the Sequani and the Aedui, in the basins of the Rhodanus and its tributary the Arar (Saône), who, he says, were reckoned the three most powerful nations in all Gaul; the Arverni in the mountains of Cebenna; the Senones and Carnutes in the basin of the Liger; the Veneti and other Armorican tribes between the mouths of the Liger and Sequana. The Nervii, Bellovaci, Suessiones, Remi, Morini, Menapii and Aduatuci were Belgic tribes; the Tarbelli and others were Aquitani; while the Allobroges inhabited the north of the Provincia, having been conquered in 121 B.C. The ethnological divisions thus set forth by Caesar have been much discussed (see Celt, and articles on the chief tribes).

The Gallic Wars (58-51) of Caesar (*q.v.*) added all the rest of Gaul, north-west of the Cévennes, to the Rhine and the Ocean, and in 49 also annexed Massilia. All Gaul was now Roman territory. Now the second period of her history opens; it remained for Roman territory to become romanized.

Caesar had no time to organize his conquest; this work was left to Augustus. As settled by him, and in part perhaps also by his successor Tiberius, it fell into the following five administrative areas.

(i) *Narbonensis*, that is, the land between Alps, sea and Cévennes, extending up the Rhone to Vienne, was as Augustus found it, distinct in many ways from the rest of Gaul. By nature it is a sun-steeped southern region, the home of the vine and olive, of the minstrelsy of the Provençal and the exuberance of Tartarin, distinct from the

colder and more sober north. By history it had already (in the time of Augustus) been Roman for from 80 to 100 years and was familiar with Roman ways. It was ready to be Italianized and it was civilized enough to need no garrison. Accordingly, it was henceforward governed by a proconsul (appointed by the senate) and freed from the burden of troops, while its local government was assimilated to that of Italy. The old Celtic tribes were broken up: instead, municipalities of Roman citizens were founded to rule their territories. Thus the Allobroges now disappear and the *colonia* of Vienna takes their place: the Volcae vanish and we find Nemausus (Nîmes). Thus thrown into Italian fashion, the province took rapidly to Italian ways. By A.D. 70 it was "Italia verius quam provincia" (Pliny). The Gauls obviously had a natural bias towards the Italian civilization, and there soon became no difference between Italy and southern Gaul. But though education spread, the results were somewhat disappointing. Trade flourished; the corporations of bargemen and the like on the Rhone made money; the many towns grew rich and could afford splendid public buildings. But no great writer and no great administrator came from Narbonensis; itinerant lecturers and journalists alone were produced in plenty, and at times minor poets.

(ii.-iv.) Across the Cévennes lay Caesar's conquests, Atlantic in climate, new to Roman ways. The whole area, often collectively styled "Gallia Comata," often "Tres Provinciae," was divided into three provinces, each under a *legatus pro praetore* appointed by the emperor, with a common capital at Lugudunum (Lyons). The three provinces were: *Aquitania*, reaching from the Pyrenees almost to the Loire; *Lugudunensis*, the land between Loire and Seine, reaching from Brittany in the west to Lyons in the south-east; and *Belgica* in the north. The boundaries, it will be observed, were wholly artificial. Here also it was found possible to dispense with garrisons, not because the provinces were as peaceful as Narbonensis, but because the Rhine army was close at hand. As befitted an unromanized region, the local government was unlike that of Italy or Narbonensis. Roman municipalities were not indeed unknown, but very few: the local authorities were the magistrates of the old tribal districts. Local autonomy was here carried to an extreme. But the policy succeeded. The Gauls of the Three Provinces, or some of them, revolted in A.D. 21 under Florus and Sacrovir, in 68 under Vindex, and in 70 under Classicus and Tutor (see Civilis, Claudius). But all five leaders were romanized nobles, with Roman names and Roman citizenship, and their risings were directed rather against the Roman government than the Roman empire. In general, the Gauls of these provinces accepted Roman civilization more or less rapidly, and in due course became hardly distinguishable from the Italian. In particular, they eagerly accepted the worship of "Augustus and Rome," devised by the first emperor as a bond of state religion connecting the provinces with Rome. Each August, despite the heat, representatives from the 60 (or 64) tribes of Gallia Comata met at Lyons, elected a priest, "sacerdos ad aram Augusti et Romae," and held games. The post of representative, and still more that of priest, was eagerly coveted and provided a scope for the ambitions which despotism usually crushes. It agrees with the vigorous development of this worship that the Three Provinces, though romanized, retained their own local feeling. Even in the 3rd century the cult of Celtic deities (Hercules Magusanus, Deusoniensis, &c.) were revived, the Celtic *leuga* reintroduced instead of the Roman mile on official milestones, and a brief effort made to establish an independent, though romanized, Gaul under Postumus and his short-lived successors (A.D. 250-273). Not only was the area too large and strong to lose its individuality: it was also too rural and too far from the Mediterranean to be romanized as fully and quickly as Narbonensis. It is even probable that Celtic was spoken in forest districts into the 4th century A.D. Town life, however, grew. The *chefs-lieux* of the tribes became practically, though not officially, municipalities, and many of these towns reached considerable size and magnificence of public buildings. But they attest their tribal relations by their appellations, which are commonly drawn from the name of the tribe and not of the town itself. Thus the capitals of the Remi and Parisii were actually Durocortorum and Lutetia: the appellations in use were Remis or Remus, Parisiis or Parisius—these forms being indeclinable nouns formed from a sort of locative of the tribe names. Literature also flourished. In the latest empire Ausonius, Symmachus, Apollinaris, Sidonius and other Gaulish writers, chiefly of Gallia Comata, kept alive the classical literary tradition, not only for Gaul but for the world.

(v.) The fifth division of Gaul was the Rhenish military frontier. Augustus had planned the conquest of Germany up to the Elbe. His plans were foiled by the courage of Arminius and the inability of the Roman exchequer to pay a larger army. Instead, his successor Tiberius organized the Rhine frontier in two military districts. The northern one was the valley of the Meuse and that of the Rhine to a point just south of Bonn: the southern was the rest of the Rhine valley to Switzerland. Each district was garrisoned at first by four, later by fewer legions, which were 534
disposed at various times in some of the following fortresses: Vetera (Xanten), Novaesium (Neuss), Bonne (Bonn), Moguntiacum (Mainz), Argentorate (Strassburg) and Vindonissa (Windisch in Switzerland). At first the districts were purely military, were called, after the garrisons, "exercitus Germanicus superior" (south) and "inferior" (north). Later one or two municipalities were founded—Colonia Agrippinensis at Cologne (A.D. 51), Colonia Augusta Treverorum at Trier (date uncertain), Colonia Ulpia Traiana outside Vetera—and about 80-90 A.D. the two "Exercitus" were turned into the two provinces of Upper and Lower Germany. The armies in these districts formed the defence of Gaul against German invaders. They also helped to keep Gaul itself in order and their presence explains why the four provinces of Gaul proper contained no troops.

These provincial divisions were modified by Diocletian but without seriously affecting the life of Gaul. The whole country, indeed, continued Roman and fairly safe from barbarian invasions till after 400. In 407 a multitude of Franks, Vandals, &c., burst over Gaul: Roman rule practically ceased and the three kingdoms of the Visigoths, Burgundians and Franks began to form. There were still a Roman general and Roman troops when Attila was defeated in the *campi Catalaunici* in A.D. 451, but the general, Aetius, was "the last of the Romans," and in 486 Clovis the Frank ended the last vestige of Roman rule in Gaul.

For Roman antiquities in Gaul see, beside articles on the modern towns (Arles, Nîmes, Orange &c.), Bibracte, Alesia, Itius Portus, Aqueduct, Architecture, Amphitheatre, &c.; for religion see Druidism; for the famous schools of Autun, Lyons, Toulouse, Nîmes, Vienne, Marseilles and Narbonne, see J.E. Sandys, *History of Classical Scholarship* (ed. 1906-1908), i. pp. 247-250; for the Roman provinces, Th. Mommsen, *Provinces of the Roman Empire* (trans. 1886), vol. i. chap. iii. See also Desjardins, *Géographie historique et administrative de la Gaule romaine* (Paris, 1877); Fustel de Coulanges, *Histoire des institutions politiques de l'ancienne France* (Paris, 1877); for Caesar's campaigns, article Caesar, Julius, and works quoted; for coins, art. Numismatics and articles in the *Numismatische Zeitschrift* and *Revue numismatique* (*e.g.* Blanchet, 1907, pp. 461 foll.).

(F. J. H.)

1 When Cisalpine Gaul became completely Romanized, it was often known as "Gallia Togata," while the Province was distinguished as "Gallia Bracata" (*bracae*, incorrectly *braccae*, "trousers"), from the long trousers worn by the inhabitants, and the rest of Gaul as "Gallia Comata," from the inhabitants wearing their hair long.

GAULT, in geology, one of the members of the Lower Cretaceous System. The name is still employed provincially in parts of England for a stiff blue clay of any kind; by the earlier writers it was sometimes spelt “Galt” or “Golt.”

The formation now known as Gault in England has been variously designated “Blue Marle,” “Brick Earth,” “Golt Brick Earth” and “Oak-tree-soil.” In certain parts of the south of England the Gault appears as a well-marked deposit of clay, lying between two sandy formations; the one above came to be known as the “Upper Greensand,” the one below being the “Lower Greensand” (see Greensand). Since the typical clayey Gault is continually taking on a sandy facies as it is traced both horizontally and vertically; and since the fossils of the Upper Greensand and Gault are inseparably related, it has been proposed by A.J. Jukes-Browne that these two series of beds should be regarded as the arenaceous and argillaceous phases of a single formation, to which he has given the name “Selbornian” (from the village of Selborne where the beds are well developed). Lithologically, then, the Selbornian includes the blue and grey clays and marls of the Gault proper; the glauconitic sands of the Upper Greensand, and their local equivalent, the “malm,” “malm rock” or “firestone,” which in places passes into the micaceous sandstone containing sponge spicules and globules of silica, the counterpart of the rock called “gaize” on the same horizon in northern France. In Yorkshire, Lincolnshire and parts of Norfolk the Selbornian is represented by the Red Chalk. The malm is a ferruginous siliceous rock, the silica being mainly in the colloidal condition in the form of globules and sponge spicules; some quartz grains, mica and glauconite are usually present along with from 2 to 25% of calcareous matter. Chert-bands and nodules are common in the Upper Greensand of certain districts; and calcareous concretions, locally recognized as cowstones (Lyme Regis), doggers or buhrstones, are not infrequent.

The principal divisions of the Selbornian stage with their characteristic zonal fossils are as follows:—

Warminster Beds	*Pecten asper* and *Cardiaster fossarius*.
Upper Gault	Devizes Beds or Merstham Beds with *Schloenbachia rostralus*.
Lower Gault	*Hoplites lautus.* *H. interruptus.* *Acanthoceras mammillatum.*

The Gault (with Upper Greensand) crops out all round the Wealden area; it extends beneath the London basin and reappears from beneath the northern scarp of the Chalk along the foot of the Chiltern Hills to near Tring. In the south of England the Gault clay is fairly constant in the lower part, with the Greensand above; the clay, however, passes into sand as it is followed westward and, as already pointed out, the clay and sand appear to pass into a red chalk towards the north-east. The Gault overlaps the Lower Greensand towards the east, where it rests upon the old Paleozoic axis; it also overlaps the same formation towards the west about Frome, and thence passes unconformably across the Portlandian beds, Kimeridge Clay, Corallian beds and Oxford Clay; in south Dorsetshire it rests upon the Wealden Series. The Gault (with Upper Greensand) passes on to the Jurassic and Rhaetic rocks near Axmouth, and oversteps farther westward, in the Haldon Hills, on to the Permian. A large outlier occurs on the Blackdown Hills of Devonshire. Good localities for fossils are Folkestone—where many of the shells are preserved with their original pearly nacre,—Burnham, Merstham, Isle of Wight, the Blackdown and Haldon Hills, Warminster, Hunstanton and Speeton, Black Venn near Lyme Regis, and Devizes (malmstone and gaize). The beds are well developed in the vale of Wardour, and in the Isle of Wight; the Gault forms the so-called “blue slipper” at Ventnor which has been the cause of the landslip or undercliff.

The Gault of north France is very similar to that in the south of England, but the French term *Albien* includes only a portion of the Selbornian formation. The Gault of north-west Germany embraces beds that would be classed as *Albien* and *Aptien* by French authors; it comprises the “Flammenmergel”—a pale siliceous marl shot with flame-shaped darker patches—a clay with *Belemnites minimus*, and the “Gargasmergel” (Aptian). In the Diester and Teutoberger Wald, and in the region of Halberstadt, the clays and marls are replaced by sandstones, the so-called *Gault-Quader*. Continental writers usually place the Gault or Albian at the summit of the Lower Cretaceous; while with English geologists the practice is to commence the Upper Cretaceous with this formation. In addition to the fossils already noticed, the following may be mentioned: *Acanthoceras Desmoceras Beaudanti*, *Hoplites splendens*, *Hamites*, *Scaphites*, *Turrilites*, *Aporrhais retusa*, *Trigonia aliforme*, also *Ichthyosaurus* and *Ornithocheirus* (Pterodactyl). From the clays, bricks and tiles are made at Burham, Barnwell, Dunton Green, Arlesey, Hitchin, &c. The cherts in the Greensand portion are used for road metal, and in the Blackdown Hills, for scythe stones; hearthstone is obtained about Merstham; phosphatic nodules occur at several horizons.

See Cretaceous System; Albian; Aptian; also A.J. Jukes-Browne, “The Gault and Upper Greensand of England.” vol. i., *Cretaceous Rocks of Britain*; *Mem. Geol. Survey*, 1900.

GAUNTLET (a diminutive of the Fr. *gant*, glove), a large form of glove, and especially the steel-plated glove of medieval armour. To “run the gauntlet,” *i.e.* to run between two rows of men who, armed with sticks, rope-ends or other weapons, beat and strike at the person so running, was formerly a punishment for military and naval offences. It was abolished in the Prussian army by Scharnhorst. As a method of torturing prisoners, it was employed among the North American Indians. “Gauntlet” (earlier “gantlet”) in this expression is a corruption of “gantlope,” from a Swedish *gatlope*, from *gata*, lane, and *lopp*, a course (cf. Ger. *gassenlaufen*, to run the gauntlet). According to the *New English Dictionary* the word became familiar in England at the time of the Thirty Years’ War.

GAUR, or Lakhnauti, a ruined city of British India, in Malda district of Eastern Bengal and Assam. The ruins are situated about 8 m. to the south of English Bazar, the civil station of the district of Malda, and on the eastern bank of the Bhagirathi, an old channel of the Ganges. It is said to have been founded by Lakshman, and its most ancient name was Lakshmanavati, corrupted into Lakhnauti. Its known history begins with its conquest in A.D. 1198 by the Mahommedans, who retained it as the chief seat of their power in Bengal for more than three centuries. When the Afghan kings of Bengal established their independence, they transferred their seat of government (about 1350) to

Pandua (*q.v.*), also in Malda district, and to build their new capital they plundered Gaur of every monument that could be removed. When Pandua was in its turn deserted (A.D. 1453), Gaur once more became the capital under the name of Jannatabad; it remained so as long as the Mahommedan kings retained their independence. In A.D. 1564 Sulaiman Kirani, a Pathan adventurer, abandoned it for Tanda, a place somewhat nearer the Ganges. Gaur was sacked by Sher Shah in 1539, and was occupied by Akbar's general in 1575, when Daud Shah, the last of the Afghan dynasty, refused to pay homage to the Mogul emperor. This occupation was followed by an outbreak of the plague, which completed the downfall of the city, and since then it has been little better than a heap of ruins, almost overgrown with jungle.

The city in its prime measured 7½ m. from north to south, with a breadth of 1 to 2 m. With suburbs it covered an area of 20 to 30 sq. m., and in the 16th century the Portuguese historian Faria y Sousa described it as containing 1,200,000 inhabitants. The ramparts of this walled city, which was surrounded by extensive suburbs, still exist; they were works of vast labour, and were on the average about 40 ft. high, and 180 to 200 ft. thick at the base. The facing of masonry and the buildings with which they were covered have now disappeared, and the embankments themselves are overgrown with dense jungle. The western side of the city was washed by the Ganges, and within the space enclosed by these embankments and the river stood the city of Gaur proper, with the fort containing the palace in its south-west corner. Radiating north, south and east from the city, other embankments are to be traced running through the suburbs and extending in certain directions for 30 or 40 m. Surrounding the palace is an inner embankment of similar construction to that which surrounds the city, and even more overgrown with jungle. A deep moat protects it on the outside. To the north of the outer enbankment lies the Sagar Dighi, a great reservoir, 1600 yds. by 800 yds., dating from A.D. 1126.

Fergusson in his *History of Eastern Architecture* thus describes the general architectural style of Gaur:—"It is neither like that of Delhi nor Jaunpore, nor any other style, but one purely local and not without considerable merit in itself; its principal characteristic being heavy short pillars of stone supporting pointed arches and vaults in brick —whereas at Jaunpore, for instance, light pillars carried horizontal architraves and flat ceilings." Owing to the lightness of the small, thin bricks, which were chiefly used in the making of Gaur, its buildings have not well withstood the ravages of time and the weather; while much of its enamelled work has been removed for the ornamentation of the surrounding cities of more modern origin. Moreover, the ruins long served as a quarry for the builders of neighbouring towns and villages, till in 1900 steps were taken for their preservation by the government. The finest ruin in Gaur is that of the Great Golden Mosque, also called Bara Darwaza, or twelve-doored (1526). An arched corridor running along the whole front of the original building is the principal portion now standing. There are eleven arches on either side of the corridor and one at each end of it, from which the mosque probably obtained its name. These arches are surmounted by eleven domes in fair preservation; the mosque had originally thirty-three.

The Small Golden or Eunuch's mosque, in the ancient suburb of Firozpur, has fine carving, and is faced with stone fairly well preserved. The Tantipara mosque (1475-1480) has beautiful moulding in brick, and the Lotan mosque of the same period is unique in retaining its glazed tiles. The citadel, of the Mahommedan period, was strongly fortified with a rampart and entered through a magnificent gateway called the Dakhil Darwaza (? 1459-1474). At the south-east corner was a palace, surrounded by a wall of brick 66 ft. high, of which a part is standing. Near by were the royal tombs. Within the citadel is the Kadam Rasul mosque (1530), which is still used, and close outside is a tall tower called the Firoz Minar (perhaps signifying "tower of victory"). There are a number of Mahommedan buildings on the banks of the Sagar Dighi, including, notably, the tomb of the saint Makhdum Shaikh Akhi Siraj (d. 1357), and in the neighbourhood is a burning ghat, traditionally the only one allowed to the use of the Hindus by their Mahommedan conquerors, and still greatly venerated and frequented by them. Many inscriptions of historical importance have been found in the ruins.

See M. Martin (Buchanan Hamilton), *Eastern India*, vol. iii. (1831); G.H. Ravenshaw, *Gaur* (1878); James Fergusson, *History of Indian and Eastern Architecture* (1876); *Reports of the Archaeological Surveyor, Bengal Circle* (1900-1904).

GAUR, the native name of the wild ox, *Bos* (*Bibos*) *gaurus*, of India, miscalled bison by sportsmen. The gaur, which extends into Burma and the Malay Peninsula, where it is known as seladang, is the typical representative of an Indo-Malay group of wild cattle characterized by the presence of a ridge on the withers, the compressed horns, and the white legs. The gaur, which reaches a height of nearly 6 ft. at the shoulder, is specially characterized by the forward curve and great elevation of the ridge between the horns. The general colour is blackish-grey. Hill-forests are the resort of this species.

GAUSS, KARL FRIEDRICH (1777-1855), German mathematician, was born of humble parents at Brunswick on the 30th of April 1777, and was indebted for a liberal education to the notice which his talents procured him from the reigning duke. His name became widely known by the publication, in his twenty-fifth year (1801), of the *Disquisitiones arithmeticae*. In 1807 he was appointed director of the Göttingen observatory, an office which he retained to his death: it is said that he never slept away from under the roof of his observatory, except on one occasion, when he accepted an invitation from Baron von Humboldt to attend a meeting of natural philosophers at Berlin. In 1809 he published at Hamburg his *Theoria motus corporum coelestium*, a work which gave a powerful impulse to the true methods of astronomical observation; and his astronomical workings, observations, calculations of orbits of planets and comets, &c., are very numerous and valuable. He continued his labours in the theory of numbers and other analytical subjects, and communicated a long series of memoirs to the Royal Society of Sciences (*Königliche Gesellschaft der Wissenschaften*) at Göttingen. His first memoir on the theory of magnetism, *Intensitas vis magneticae terrestris ad mensuram absolutam revocata*, was published in 1833, and he shortly afterwards proceeded, in conjunction with Wilhelm Weber, to invent new apparatus for observing the earth's magnetism and

its changes; the instruments devised by them were the declination instrument and the bifilar magnetometer. With Weber's assistance he erected in 1833 at Göttingen a magnetic observatory free from iron (as Humboldt and F.J.D. Arago had previously done on a smaller scale), where he made magnetic observations, and from this same observatory he sent telegraphic signals to the neighbouring town, thus showing the practicability of an electromagnetic telegraph. He further instituted an association (*Magnetischer Verein*), composed at first almost entirely of Germans, whose continuous observations on fixed term-days extended from Holland to Sicily. The volumes of their publication, *Resultate am den Beobachtungen des magnetischen Vereins*, extend from 1836 to 1839; and in those for 1838 and 1839 are contained the two important memoirs by Gauss, *Allgemeine Theorie des Erdmagnetismus, and the Allgemeine Lehrsätze*—on the theory of forces attracting according to the inverse square of the distance. The instruments and methods thus due to him are substantially those employed in the magnetic observatories throughout the world. He co-operated in the Danish and Hanoverian measurements of an arc and trigonometrical operations (1821-1848), and wrote (1843, 1846) the two memoirs *Über Gegenstände der höheren Geodäsie*. Connected with observations in general we have (1812-1826) the memoir *Theoria combinationis observationum erroribus minimis obnoxia*, with a second part and a supplement. Another memoir of applied mathematics is the *Dioptrische Untersuchungen* (1840). Gauss was well versed in general literature and the chief languages of modern Europe, and was a member of nearly all the leading scientific societies in Europe. He died at Göttingen on the 23rd of February 1855. The centenary of his birth was celebrated (1877) at his native place, Brunswick.

Gauss's collected works were published by the Royal Society of Göttingen, in 7 vols. 4to (Gött., 1863-1871), edited by E.J. Schering—(1) the *Disquisitiones arithmeticae*, (2) *Theory of Numbers*, (3) *Analysis*, (4) *Geometry and Method of Least Squares*, (5) *Mathematical Physics*, (6) *Astronomy*, and (7) the *Theoria motus corporum coelestium*. Additional volumes have since been published, *Fundamente der Geometrie usw*. (1900), and *Geodatische Nachträge zu Band iv*. (1903). They include, besides his various works and memoirs, notices by him of many of these, and of works of other authors in the *Göttingen gelehrte Anzeigen*, and a considerable amount of previously unpublished matter, *Nachlass*. Of the memoirs in pure mathematics, comprised for the most part in vols, ii., iii. and iv. (but to these must be added those on *Attractions* in vol. v.), it may be safely said there is not one which has not signally contributed to the progress of the branch of mathematics to which it belongs, or which would not require to be carefully analysed in a history of the subject. Running through these volumes in order, we have in the second the memoir, *Summatio quarundam serierum singularium*, the memoirs on the theory of biquadratic residues, in which the notion of complex numbers of the form $a + bi$ was first introduced into the theory of numbers; and included in the *Nachlass* are some valuable tables. That for the conversion of a fraction into decimals (giving the complete period for all the prime numbers up to 997) is a specimen of the extraordinary love which Gauss had for long arithmetical calculations; and the amount of work gone through in the construction of the table of the number of the classes of binary quadratic forms must also have been tremendous. In vol. iii. we have memoirs relating to the proof of the theorem that every numerical equation has a real or imaginary root, the memoir on the *Hypergeometric Series*, that on *Interpolation*, and the memoir *Determinatio attractionis*—in which a planetary mass is considered as distributed over its orbit according to the time in which each portion of the orbit is described, and the question (having an implied reference to the theory of secular perturbations) is to find the attraction of such a ring. In the solution the value of an elliptic function is found by means of the *arithmetico-geometrical mean*. The *Nachlass* contains further researches on this subject, and also researches (unfortunately very fragmentary) on the lemniscate-function, &., showing that Gauss was, even before 1800, in possession of many of the discoveries which have made the names of N.H. Abel and K.G.J. Jacobi illustrious. In vol. iv. we have the memoir *Allgemeine Auflösung*, on the graphical representation of one surface upon another, and the *Disquisitiones generales circa superficies curvas*. (An account of the treatment of surfaces which he originated in this paper will be found in the article Surface.) And in vol. v. we have a memoir *On the Attraction of Homogeneous Ellipsoids*, and the already mentioned memoir *Allgemeine Lehrsätze*, on the theory of forces attracting according to the inverse square of the distance.

(A. Ca.)

GAUSSEN, FRANÇOIS SAMUEL ROBERT LOUIS (1790-1863), Swiss Protestant divine, was born at Geneva on the 25th of August 1790. His father, Georg Markus Gaussen, a member of the council of two hundred, was descended from an old Languedoc family which had been scattered at the time of the religious persecutions in France. At the close of his university career at Geneva, Louis was in 1816 appointed pastor of the Swiss Reformed Church at Satigny near Geneva, where he formed intimate relations with J.E. Cellérier, who had preceded him in the pastorate, and also with the members of the dissenting congregation at Bourg-de-Four, which, together with the Église du témoignage, had been formed under the influence of the preaching of James and Robert Haldane in 1817. The Swiss revival was distasteful to the pastors of Geneva (*Vénérable Compagnie des Pasteurs*), and on the 7th of May 1817 they passed an ordinance hostile to it. As a protest against this ordinance, in 1819 Gaussen published in conjunction with Cellérier a French translation of the Second Helvetic Confession, with a preface expounding the views he had reached upon the nature, use and necessity of confessions of faith; and in 1830, for having discarded the official catechism of his church as being insufficiently explicit on the divinity of Christ, original sin and the doctrines of grace, he was censured and suspended by his ecclesiastical superiors. In the following year he took part in the formation of a *Société Évangélique* (*Evangelische Gesellschaft*). When this society contemplated, among other objects, the establishment of a new theological college, he was finally deprived of his charge. After some time devoted to travel in Italy and England, he returned to Geneva and ministered to an independent congregation until 1834, when he joined Merle d'Aubigné as professor of systematic theology in the college which he had helped to found. This post he continued to occupy until 1857, when he retired from the active duties of the chair. He died at Les Grottes, Geneva, on the 18th of June 1863.

His best-known work, entitled *La Théopneustie ou pleine inspiration des saintes écritures*, an elaborate defence of the doctrine of "plenary inspiration," was originally published in Paris in 1840, and rapidly gained a wide popularity in France, as also, through translations, in England and America. It was followed in 1860 by a supplementary treatise on the canon (*Le Canon des saintes écritures au double point de vue de la science et de la foi*), which, though also popular, has hardly been so widely read.

See the article in Herzog-Hauck, *Realencyklopädie* (1899).

GAUTIER, ÉMILE THÉODORE LÉON (1832-1897), French literary historian, was born at Hâvre on the 8th of August 1832. He was educated at the École des Chartes, and became successively keeper of the archives of the department of Haute-Marne and of the imperial archives at Paris under the empire. In 1871 he became professor of palaeography at the École des Chartes. He was elected member of the Academy of Inscriptions in 1887, and became chief of the historical section of the national archives in 1893. Léon Gautier rendered great services to the study of early French literature, the most important of his numerous works on medieval subjects being a critical text (Tours, 1872) with translation and introduction of the *Chanson de Roland*, and *Les Épopées françaises* (3 vols., 1866-1867; 2nd ed., 5 vols., 1878-1897, including a *Bibliographie des chansons de geste*). He died in Paris on the 25th of August 1897.

GAUTIER, THÉOPHILE (1811-1872), French poet and miscellaneous writer, was born at Tarbes on the 31st of August 1811. He was educated at the grammar school of that town, and afterwards at the Collège Charlemagne in Paris, but was almost as much in the studios. He very early devoted himself to the study of the older French literature, especially that of the 16th and the early part of the 17th century. This study qualified him well to take part in the Romantic movement, and enabled him to astonish Sainte-Beuve by the phraseology and style of some literary essays which, when barely eighteen years old, he put into the critic's hands. In consequence of this introduction he at once came under the influence of the great Romantic *cénacle*, to which, as to Victor Hugo in particular, he was also introduced by his gifted but ill-starred schoolmate Gérard de Nerval. With Gérard, Petrus Borel, Corot, and many other less known painters and poets whose personalities he has delightfully sketched in the articles collected under the titles of *Histoire du Romantisme*, &c., he formed a minor romantic clique who were distinguished for a time by the most extravagant eccentricity. A flaming crimson waistcoat and a great mass of waving hair were the outward signs which qualified Gautier for a chief rank among the enthusiastic devotees who attended the rehearsals of *Hernani* with red tickets marked "Hierro," performed mocking dances round the bust of Racine, and were at all times ready to exchange word or blow with the *perruques* and *grisâtres* of the classical party. In Gautier's case these freaks were not inconsistent with real genius and real devotion to sound ideals of literature. He began (like Thackeray, to whom he presents in other ways some striking points of resemblance) as an artist, but soon found that his true powers lay in another direction.

His first considerable poem, *Albertus* (1830), displayed a good deal of the extravagant character which accompanied rather than marked the movement, but also gave evidence of uncommon command both of language and imagery, and in particular of a descriptive power hardly to be excelled. The promise thus given was more than fulfilled in his subsequent poetry, which, in consequence of its small bulk, may well be noticed at once and by anticipation. The *Comédie de la mort*, which appeared soon after (1832), is one of the most remarkable of French poems, and though never widely read has received the suffrage of every competent reader. Minor poems of various dates, published in 1840, display an almost unequalled command over poetical form, an advance even over *Albertus* in vigour, wealth and appropriateness of diction, and abundance of the special poetical essence. All these good gifts reached their climax in the *Émaux et camées*, first published in 1856, and again, with additions, just before the poet's death in 1872. These poems are in their own way such as cannot be surpassed. Gautier's poetical work 537
contains in little an expression of his literary peculiarities. There are, in addition to the peculiarities of style and diction already noticed, an extraordinary feeling and affection for beauty in art and nature, and a strange indifference to anything beyond this range, which has doubtless injured the popularity of his work.

But it was not, after all, as a poet that Gautier was to achieve either profit or fame. For the theatre, he had but little gift, and his dramatic efforts (if we except certain masques or ballets in which his exuberant and graceful fancy came into play) are by far his weakest. It was otherwise with his prose fiction. His first novel of any size, and in many respects his most remarkable work, was *Mademoiselle de Maupin* (1835). Unfortunately this book, while it establishes his literary reputation on an imperishable basis, was unfitted by its subject, and in parts by its treatment, for general perusal, and created, even in France, a prejudice against its author which he was very far from really deserving. During the years from 1833 onwards, his fertility in novels and tales was very great. *Les Jeunes-France* (1833), which may rank as a sort of prose *Albertus* in some ways, displays the follies of the youthful Romantics in a vein of humorous and at the same time half-pathetic satire. *Fortunio* (1838) perhaps belongs to the same class. *Jettatura*, written somewhat later, is less extravagant and more pathetic. A crowd of minor tales display the highest literary qualities, and rank with Mérimée's at the head of all contemporary works of the class. First of all must be mentioned the ghost-story of *La Morte amoureuse*, a gem of the most perfect workmanship. For many years Gautier continued to write novels. *La Belle Jenny* (1864) is a not very successful attempt to draw on his English experience, but the earlier *Militona* (1847) is a most charming picture of Spanish life. In *Spirite* (1866) he endeavoured to enlist the fancy of the day for supernatural manifestations, and a *Roman de la momie* (1856) is a learned study of ancient Egyptian ways. His most remarkable effort in this kind, towards the end of his life, was *Le Capitaine Fracasse* (1863), a novel, partly of the picaresque school, partly of that which Dumas was to make popular, projected nearly thirty years earlier, and before Dumas himself had taken to the style. This book contains some of the finest instances of his literary power.

Yet neither in poems nor in novels did the main occupation of Gautier as a literary man consist. He was early drawn to the more lucrative task of feuilleton-writing, and for more than thirty years he was among the most expert and successful practitioners of this art. Soon after the publication of *Mademoiselle de Maupin*, in which he had not been too polite to journalism, he became irrevocably a journalist. He was actually the editor of *L'Artiste* for a time: but his chief newspaper connexions were with *La Presse* from 1836 to 1854 and with the *Moniteur* later. His work was mainly theatrical and art criticism. The rest of his life was spent either at Paris or in travels of considerable extent to Spain, the Netherlands, Italy, Turkey, England, Algeria and Russia, all undertaken with a more or less definite purpose of book-making. Having absolutely no political opinions, he had no difficulty in accepting the Second Empire, and received from it considerable favours, in return for which, however, he in no way prostituted his pen, but remained a literary man pure and simple. He died on the 23rd of December 1872.

Accounts of his travels, criticisms of the theatrical and literary works of the day, obituary notices of his contemporaries and, above all, art criticism occupied him in turn. It has sometimes been deplored that this engagement in journalism should have diverted Gautier from the performance of more capital work in literature. Perhaps, however, this regret springs from a certain misconception. Gautier's power was literary power pure and

simple, and it is as evident in his slightest sketches and criticisms as in *Émaux et camées or La Morte amoureuse*. On the other hand, his weakness, if he had a weakness, lay in his almost total indifference to the matters which usually supply subjects for art and therefore for literature. He has thus been accused of "lack of ideas" by those who have not cleared their own minds of cant; and in the recent set-back of the critical current against form and in favour of "philosophic" treatment, comment upon him has sometimes been unfavourable. But this injustice will, beyond all question, be redressed again. He was neither immoral, irreligious nor unduly subservient to despotism, but morals, religion and politics (to which we may add science and material progress) were matters of no interest to him. He was to all intents a humanist, as the word was understood in the 15th century. But he was a humorist as well, and this combination, joined to his singularly kindly and genial nature, saved him from some dangers and depravations as well as some absurdities to which the humanist temper is exposed. As time goes on it may be predicted that, though Gautier may not be widely read, yet his writings will never cease to be full of indescribable charm and of very definite instruction to men of letters. Besides those of his works which have been already cited, we may notice *Une Larme du diable* (1839), a charming mixture of humour and tenderness; *Les Grotesques* (1844), a volume of early criticisms on some oddities of 17th-century literature; *Caprices et zigzags* (1845), miscellanies dealing in part with English life; *Voyage en Espagne* (1845), *Constantinople* (1854), *Voyage en Russie* (1866), brilliant volumes of travel; *Ménagerie intime* (1869) and *Tableaux de siège* (1872), his two latest works, which display his incomparable style in its quietest but not least happy form.

There is no complete edition of Gautier's works, and the vicomte Spoelberch de Lovenjoul's *Histoire des œuvres de Théophile Gautier* (1887) shows how formidable such an undertaking would be. But since his death numerous further collections of articles have been made: *Fusains et eaux-fortes* and *Tableaux à la plume* (1880); *L'Orient* (2 vols., 1881); *Les Vacances du lundi* (new ed., 1888); *La Nature chez elle* (new ed., 1891). In 1879 his son-in-law, E. Bergerat, who had married his younger daughter Estelle (the elder, Mme Judith Gautier—herself a writer of distinction—was at one time Mme Catulle Mendès), issued a biography, *Théophile Gautier*, which has been often reprinted. With it should be compared Maxime du Camp's volume in the *Grands Écrivains français* (1890) and the numerous references in the *Journal des Goncourt*. Critical eulogies, from Sainte-Beuve (repeatedly in the *Causeries*) and Baudelaire (two articles in *L'Art romantique*) downwards, are numerous. The chief of the decriers is Émile Faguet in his *Études littéraires sur le XIX^e^ siècle*. In 1902 and 1903 there appeared two respectable academic *éloges* by H. Menai and H. Potez.

(G. Sa.)

GAUTIER D'ARRAS, French *trouvère*, flourished in the second half of the 12th century. Nothing is known of his biography except what may be gleaned from his works. He dedicated his romance of *Éracle* to Theobald V., count of Blois (d. 1191); among his other patrons were Marie, countess of Champagne, daughter of Louis VII. and Eleanor of Guienne and Baldwin IV., count of Hainaut. *Éracle*, the hero of which becomes emperor of Constantinople as Heraclius, is purely a *roman d'aventures* and enjoyed great popularity. His second romance, *Ille et Galeron*, dedicated to Beatrix, the second wife of Frederick Barbarossa, treats of a similar situation to that outlined in the lay of "*Eliduc*" by Marie de France.

See the *Œuvres de Gautier d'Arras*, ed. E. Löseth (2 vols., Paris, 1890); *Hist. litt. de la France*, vol. xxii. (1852); A. Dinaux, *Les Trouvères* (1833-1843), vol. iii.

GAUZE, a light, transparent fabric, originally of silk, and now sometimes made of linen or cotton, woven in an open manner with very fine yarn. It is said to have been originally made at Gaza in Palestine, whence the name. Some of the gauzes from eastern Asia were brocaded with flowers of gold or silver. In the weaving of gauze the warp threads, in addition to being crossed as in plain weaving, are twisted in pairs from left to right and from right to left alternately, after each shot of weft, thereby keeping the weft threads at equal distances apart, and retaining them in their parallel position. The textures are woven either plain, striped or figured; and the material receives many designations, according to its appearance and the purposes to which it is devoted. A thin cotton fabric, woven in the same way, is known as leno, to distinguish it from muslin made by plain weaving. Silk gauze was a prominent and extensive industry in the west of Scotland during the second half of the 18th century, but on the introduction of cotton-weaving it greatly declined. In addition to its use for dress purposes silk gauze is much employed for bolting or sifting flour and other finely ground substances. The term gauze is applied generally to transparent fabrics of whatever fibre made, and to the fine-woven wire-cloth used in safety-lamps, sieves, window-blinds, &c.

GAVARNI, the name by which Sulpice Guillaume Chevalier (1801-1866), French caricaturist, is known. He is said to have taken the *nom de plume* from the place where he made his first published sketch. He was born in Paris of poor parents, and started in life as a workman in an engine-building factory. At the same time he attended the free school of drawing. In his first attempts to turn his abilities to some account he met with many disappointments, but was at last entrusted with the drawing of some illustrations for a journal of fashion. Gavarni was then thirty-four years of age. His sharp and witty pencil gave to these generally commonplace and unartistic figures a life-likeness and an expression which soon won for him a name in fashionable circles. Gradually he gave greater attention to this more congenial work, and finally ceased working as an engineer to become the director of the journal *Les Gens du monde*. His ambition rising in proportion to his success, Gavarni from this time followed the real bent of his inclination, and began a series of lithographed sketches, in which he portrayed the most striking characteristics, foibles and vices of the various classes of French society. The letterpress explanations attached to his drawings were always short, but were forcible and highly humorous, if sometimes trivial, and were admirably adapted to the

particular subjects. The different stages through which Gavarni's talent passed, always elevating and refining itself, are well worth being noted. At first he confined himself to the study of Parisian manners, more especially those of the Parisian youth. To this vein belong *Les Lorettes*, *Les Actrices*, *Les Coulisses*, *Les Fashionables*, *Les Gentilshommes bourgeois*, *Les Artistes*, *Les Débardeurs*, *Clichy*, *Les Étudiants de Paris*, *Les Baliverneries parisiennes*, *Les Plaisirs champêtres*, *Les Bals masqués*, *Le Carnaval*, *Les Souvenirs du carnaval*, *Les Souvenirs du bal Chicard*, *La Vie des jeunes hommes*, *Les Patois de Paris*. He had now ceased to be director of *Les Gens du monde*; but he was engaged as ordinary caricaturist of *Le Charivari*, and, whilst making the fortune of the paper, he made his own. His name was exceedingly popular, and his illustrations for books were eagerly sought for by publishers. *Le Juif errant*, by Eugène Sue (1843, 4 vols. 8vo), the French translation of Hoffman's tales (1843, 8vo), the first collective edition of Balzac's works (Paris, Houssiaux, 1850, 20 vols. 8vo), *Le Diable à Paris* (1844-1846, 2 vols. 4to), *Les Français peints par eux-mêmes* (1840-1843, 9 vols. 8vo), the collection of *Physiologies* published by Aubert in 38 vols. 18mo (1840-1842),—all owed a great part of their success at the time, and are still sought for, on account of the clever and telling sketches contributed by Gavarni. A single frontispiece or vignette was sometimes enough to secure the sale of a new book. Always desiring to enlarge the field of his observations, Gavarni soon abandoned his once favourite topics. He no longer limited himself to such types as the *lorette* and the Parisian student, or to the description of the noisy and popular pleasures of the capital, but turned his mirror to the grotesque sides of family life and of humanity at large. *Les Enfants terribles*, *Les Parents terribles*, *Les Fourberies des femmes*, *La Politique des femmes*, *Les Maris vengés*, *Les Nuances du sentiment*, *Les Rêves*, *Les Petits Jeux de société*, *Les Petits Malheurs du bonheur*, *Les Impressions de menage*, *Les Interjections*, *Les Traductions en langue vulgaire*, *Les Propos de Thomas Vireloque*, &c., were composed at this time, and are his most elevated productions. But whilst showing the same power of irony as his former works, enhanced by a deeper insight into human nature, they generally bear the stamp of a bitter and even sometimes gloomy philosophy. This tendency was still more strengthened by a visit to England in 1849. He returned from London deeply impressed with the scenes of misery and degradation which he had observed among the lower classes of that city. In the midst of the cheerful atmosphere of Paris he had been struck chiefly by the ridiculous aspects of vulgarity and vice, and he had laughed at them. But the debasement of human nature which he saw in London appears to have affected him so forcibly that from that time the cheerful caricaturist never laughed or made others laugh again. What he had witnessed there became the almost exclusive subject of his drawings, as powerful, as impressive as ever, but better calculated to be appreciated by cultivated minds than by the public, which had in former years granted him so wide a popularity. Most of these last compositions appeared in the weekly paper *L'Illustration*. In 1857 he published in one volume the series entitled *Masques et visages* (1 vol. 12mo), and in 1869, about two years after his death, his last artistic work, *Les Douze Mois* (1 vol. fol.), was given to the world. Gavarni was much engaged, during the last period of his life, in scientific pursuits, and this fact must perhaps be connected with the great change which then took place in his manner as an artist. He sent several communications to the Académie des Sciences, and till his death on the 23rd of November 1866 he was eagerly interested in the question of aerial navigation. It is said that he made experiments on a large scale with a view to find the means of directing balloons; but it seems that he was not so successful in this line as his fellow-artist, the caricaturist and photographer, Nadar.

Gavarni's *Œuvres choisies* were edited in 1845 (4 vols. 4to) with letterpress by J. Janin, Th. Gautier and Balzac, followed in 1850 by two other volumes named *Perles et parures*; and some essays in prose and in verse written by him were collected by one of his biographers, Ch. Yriarte, and published in 1869. See also E. and J. de Goncourt, *Gavarni, l'homme et l'œuvre* (1873, 8vo). J. Claretie has also devoted to the great French caricaturist a curious and interesting essay. A catalogue *raisonné* of Gavarni's works was published by J. Armelhault and E. Bocher (Paris, 1873, 8vo).

GAVAZZI, ALESSANDRO (1809-1889), Italian preacher and patriot, was born at Bologna on the 21st of March 1809. He at first became a monk (1825), and attached himself to the Barnabites at Naples, where he afterwards (1829) acted as professor of rhetoric. In 1840, having already expressed liberal views, he was removed to Rome to fill a subordinate position. Leaving his own country after the capture of Rome by the French, he carried on a vigorous campaign against priests and Jesuits in England, Scotland and North America, partly by means of a periodical, the *Gavazzi Free Word*. While in England he gradually went over (1855) to the Evangelical church, and became head and organizer of the Italian Protestants in London. Returning to Italy in 1860, he served as army-chaplain with Garibaldi. In 1870 he became head of the Free Church (*Chiesa libera*) of Italy, united the scattered Congregations into the "Unione delle Chiese libere in Italia," and in 1875 founded in Rome the theological college of the Free Church, in which he himself taught dogmatics, apologetics and polemics. He died in Rome on the 9th of January 1889.

Amongst his publications are *No Union with Rome* (1871); *The Priest in Absolution* (1877); *My Recollections of the Last Four Popes*, &c., in answer to Cardinal Wiseman (1858); *Orations*, 2 decades (1851).

GAVELKIND,[1] a peculiar system of tenure associated chiefly with the county of Kent, but found also in other parts of England. In Kent all land is presumed to be holden by this tenure until the contrary is proved, but some lands have been disgavelled by particular statutes. It is more correctly described as socage tenure, subject to the custom of gavelkind. The chief peculiarities of the custom are the following. (1) A tenant can alienate his lands by feoffment at fifteen years of age. (2) There is no escheat on attainder for felony, or as it is expressed in the old rhyme—

"The father to the bough,
The son to the plough."

(3) Generally the tenant could always dispose of his lands by will. (4) In case of intestacy the estate descends not to

the eldest son but to all the sons (or, in the case of deceased sons, their representatives) in equal shares. “Every son is as great a gentleman as the eldest son is.” It is to this remarkable peculiarity that gavelkind no doubt owes its local popularity. Though females claiming in their own right are postponed to males, yet by representation they may inherit together with them. (5) A wife is dowable of one-half, instead of one-third of the land. (6) A widower may be tenant by courtesy, without having had any issue, of one-half, but only so long as he remains unmarried. An act of 1841, for commuting manorial rights in respect of lands of copyhold and customary tenure, contained a clause specially exempting from the operation of the act “the custom of gavelkind as the same now exists and prevails in the county of Kent.” Gavelkind is one of the most interesting examples of the customary law of England; it was, previous to the Conquest, the general custom of the realm, but was then superseded by the feudal law of primogeniture. Its survival in this instance in one part of the country is regarded as a concession extorted from the Conqueror by the superior bravery of the men of Kent. *Irish gavelkind* was a species of tribal succession, by which the land, instead of being divided at the death of the holder amongst his sons, was thrown again into the common stock, and redivided among the surviving members of the sept. The equal division amongst children of an inheritance in land is of common occurrence outside the United Kingdom and is discussed under Succession.

See Inheritance; Tenure. Also Robinson, *On Gavelkind*; Digby, *History of the Law of Real Property*; Pollock and Maitland, *History of English Law*; Challis, *Real Property*.

1 This word is generally taken to represent in O. Eng. *gafolgecynd*, from *gafol*, payment, tribute, and *gecynd*, species, kind, and originally to have meant tenure by payment of rent or non-military services, cf. gafol-land, and thence to have been applied to the particular custom attached to such tenure in Kent. *Gafol* apparently is derived from the Teutonic root seen in “to give”; the Med. Lat. *gabulum, gablum* gives the Fr. *gabelle*, tax.

GAVESTON, PIERS (d. 1312), earl of Cornwall, favourite of the English king Edward II., was the son of a Gascon knight, and was brought up at the court of Edward I. as companion to his son, the future king. Strong, talented and ambitious, Gaveston gained great influence over young Edward, and early in 1307 he was banished from England by the king; but he returned after the death of Edward I. a few months later, and at once became the chief adviser of Edward II. Made earl of Cornwall, he received both lands and money from the king, and added to his wealth and position by marrying Edward’s niece, Margaret, daughter of Gilbert de Clare, earl of Gloucester (d. 1295). He was regent of the kingdom during the king’s short absence in France in 1308, and took a very prominent part at Edward’s coronation in February of this year. These proceedings aroused the anger and jealousy of the barons, and their wrath was diminished neither by Gaveston’s superior skill at the tournament, nor by his haughty and arrogant behaviour to themselves. They demanded his banishment; and the king, forced to assent, sent his favourite to Ireland as lieutenant, where he remained for about a year. Returning to England in July 1309, Edward persuaded some of the barons to sanction this proceeding; but as Gaveston was more insolent than ever the old jealousies soon broke out afresh. In 1311 the king was forced to agree to the election of the “ordainers,” and the ordinances they drew up provided *inter alia* for the perpetual banishment of his favourite. Gaveston then retired to Flanders, but returned secretly to England at the end of 1311. Soon he was publicly restored by Edward, and the barons had taken up arms. Deserted by the king he surrendered to Aymer de Valence, earl of Pembroke (d. 1324), at Scarborough in May 1312, and was taken to Deddington in Oxfordshire, where he was seized by Guy de Beauchamp, earl of Warwick (d. 1315). Conveyed to Warwick castle he was beheaded on Blacklow Hill near Warwick on the 19th of June 1312. Gaveston, whose body was buried in 1315 at King’s Langley, left an only daughter.

See W. Stubbs, *Constitutional History*, vol. ii. (Oxford, 1896); and *Chronicles of the Reigns of Edward I. and Edward II.*, edited by W. Stubbs. Rolls series (London, 1882-1883).

GAVOTTE (a French word adopted from the Provençal *gavoto*), properly the dance of the Gavots or natives of Gap, a district in the Upper Alps, in the old province of Dauphiné. It is a dance of a brisk and lively character, somewhat resembling the minuet, but quicker and less stately (see Dance); hence also the use of this name for a corresponding form of musical composition.

GAWAIN (Fr. *Walwain* (*Brut*), *Gauvain, Gaugain*; Lat. *Walganus*, *Walwanus*; Dutch, *Walwein*, Welsh, *Gwalchmei*), son of King Loth of Orkney, and nephew to Arthur on his mother’s side, the most famous hero of Arthurian romance. The first mention of his name is in a passage of William of Malmesbury, recording the discovery of his tomb in the province of Ros in Wales. He is there described as “*Walwen qui fuit haud degener Arturis ex sorore nepos*.” Here he is said to have reigned over Galloway; and there is certainly some connexion, the character of which is now not easy to determine, between the two. In the later *Historia* of Geoffrey of Monmouth, and its French translation by Wace, Gawain plays an important and “pseudo-historic” rôle. On the receipt by Arthur of the insulting message of the Roman emperor, demanding tribute, it is he who is despatched as ambassador to the enemy’s camp, where his arrogant and insulting behaviour brings about the outbreak of hostilities. On receipt of the tidings of Mordred’s treachery, Gawain accompanies Arthur to England, and is slain in the battle which ensues on their landing. Wace, however, evidently knew more of Gawain than he has included in his translation, for he speaks of him as

Li quens Walwains
Qui tant fu preudom de ses mains (ll. 9057-58).

and later on says

> Prous fu et de mult grant mesure,
> D'orgoil et de forfait n'ot qure
> Plus vaut faire qu'il ne dist
> Et plus doner qu'il ne pramist (10. 106-109).

The English Arthurian poems regard him as the type and model of chivalrous courtesy, "the fine father of nurture," and as Professor Maynadier has well remarked, "previous to the appearance of Malory's compilation it was Gawain rather than Arthur, who was the typical English hero." It is thus rather surprising to find that in the earliest preserved MSS. of Arthurian romance, *i.e.* in the poems of Chrétien de Troyes, Gawain, though generally placed first in the list of knights, is by no means the hero *par excellence*. The latter part of the *Perceval* is indeed devoted to the recital of his adventures at the *Chastel Merveilleus*, but of none of Chrétien's poems is he the protagonist. The anonymous author of the *Chevalier à l'epée* indeed makes this apparent neglect of Gawain a ground of reproach against Chrétien. At the same time the majority of the short episodic poems connected with the cycle have Gawain for their hero. In the earlier form of the prose romances, *e.g.* in the *Merlin* proper, Gawain is a dominant personality, his feats rivalling in importance those ascribed to Arthur, but in the later forms such as the *Merlin* continuations, the *Tristan*, and the final *Lancelot* compilation, his character and position have undergone a complete change, he is represented as cruel, cowardly and treacherous, and of indifferent moral character. Most unfortunately our English version of the romances, Malory's *Morte Arthur*, being derived from these later forms (though his treatment of Gawain is by no means uniformly consistent), this unfavourable aspect is that under which the hero has become known to the modern reader. Tennyson, who only knew the Arthurian story through the medium of Malory, has, by exaggeration, largely contributed to this misunderstanding. Morris, in *The Defence of Guinevere*, speaks of "gloomy Gawain"; perhaps the most absurdly misleading epithet which could possibly have been applied to the "gay, gratious, and gude" knight of early English tradition.

The truth appears to be that Gawain, the Celtic and mythic origin of whose character was frankly admitted by the late M. Gaston Paris, belongs to the very earliest stage of Arthurian tradition, long antedating the crystallization of such tradition into literary form. He was certainly known in Italy at a very early date; Professor Rajna has found the names of Arthur and Gawain in charters of the early 12th century, the bearers of those names being then grown to manhood; and Gawain is figured in the architrave of the north doorway of Modena cathedral, a 12th-century building. Recent discoveries have made it practically certain that there existed, prior to the extant romances, a collection of short episodic poems, devoted to the glorification of Arthur's famous nephew and his immediate kin (his brother Ghaeris, or Gareth, and his son Guinglain), the authorship of which was attributed to a Welshman, Bleheris; fragments of this collection have been preserved to us alike in the first continuation of Chrétien de Troyes *Perceval*, due to Wauchier de Denain, and in our vernacular *Gawain* poems. Among these "Bleheris" poems was one dealing with Gawain's adventures at the Grail castle, where the Grail is represented as non-Christian, and presents features strongly reminiscent of the ancient Nature mysteries. There is good ground for believing that as Grail quester and winner, Gawain preceded alike Perceval and Galahad, and that the solution of the mysterious Grail problem is to be sought rather in the tales connected with the older hero than in those devoted to the glorification of the younger knights. The explanation of the very perplexing changes which the character of Gawain has undergone appears to lie in a misunderstanding of the original sources of that character. Whether or no Gawain was a sun-hero, and he certainly possessed some of the features—we are constantly told how his strength waxed with the waxing of the sun till noontide, and then gradually decreased; he owned a steed known by a definite name le Gringalet; and a light-giving sword, Escalibur (which, as a rule, is represented as belonging to Gawain, not to Arthur)—all traits of a sun-hero—he certainly has much in common with the primitive Irish hero Cuchullin. The famous head-cutting challenge, so admirably told in *Syr Gawayne and the Grene Knighte*, was originally connected with the Irish champion. Nor was the lady of Gawain's love a mortal maiden, but the queen of the other-world. In Irish tradition the other-world is often represented as an island, inhabited by women only; and it is this "Isle of Maidens" that Gawain visits in *Diu Crone*; returning therefrom dowered with the gift of eternal youth. The Chastel Merveilleus adventure, related at length by Chrétien and Wolfram is undoubtedly such an "other-world" story. It seems probable that it was this connexion which won for Gawain the title of the "Maidens' Knight," a title for which no satisfactory explanation is ever given. When the source of the name was forgotten its meaning was not unnaturally misinterpreted, and gained for Gawain the reputation of a facile morality, which was exaggerated by the pious compilers of the later Grail romances into persistent and aggravated wrong-doing; at the same time it is to be noted that Gawain is never like Tristan and Lancelot, the hero of an illicit connexion maintained under circumstances of falsehood and treachery. Gawain, however, belonged to the pre-Christian stage of Grail tradition, and it is not surprising that writers, bent on spiritual edification, found him somewhat of a stumbling-block. Chaucer, when he spoke of Gawain coming "again out of faërie," spoke better than he knew; the home of that very gallant and courteous knight is indeed Fairy-land, and the true Gawain-tradition is informed with fairy glamour and grace.

See *Syr Gawayne*, the English poems relative to that hero, edited by Sir Frederick Madden for the Bannatyne Club, 1839 (out of print and difficult to procure); *Histoire littéraire de la France*, vol. xxx.; introduction and summary of episodic "Gawain" poems by Gaston Paris; *The Legend of Sir Gawain*, by Jessie L. Weston, Grimm Library, vol. vii.; *The Legend of Sir Perceval*, by Jessie L. Weston, Grimm Library, vol. xvii.; "Sir Gawain and the Green Knight," "Sir Gawain at the Grail Castle" and "Sir Gawain and the Lady of Lys," vols. i., vi and vii. of *Arthurian Romances* (Nutt).

GAWLER, a town of Gawler county, South Australia, on the Para river, 24¾ m. by rail N.E. of Adelaide. It is one of the most thriving places in the colony, being the centre of a large wheat-growing district; it has also engineering works, foundries, flour-mills, breweries and saw-mills, while gold, silver, copper and lead are found in the neighbouring hills. The inhabitants of the town and its extensive suburbs number about 7000; though the population of the town itself in 1901 was 1996.

GAY, JOHN (1685-1732), English poet, was baptized on the 16th of September 1685 at Barnstaple, where his family had long been settled. He was educated at the grammar school of the town under Robert Luck, who had published some Latin and English poems. On leaving school he was apprenticed to a silk mercer in London, but being weary, according to Dr Johnson, “of either the restraint or the servility of his occupation,” he soon returned to Barnstaple, where he spent some time with his uncle, the Rev. John Hanmer, the Nonconformist minister of the town. He then returned to London, and though no details are available for his biography until the publication of *Wine* in 1708, the account he gives in *Rural Sports* (1713), of years wasted in attending on courtiers who were profuse in promises never kept, may account for his occupations. Among his early literary friends were Aaron Hill and Eustace Budgell. In *The Present State of Wit* (1711) Gay attempted to give an account of “all our periodical papers, whether monthly, weekly or diurnal.” He especially praised the *Tatler* and the *Spectator*, and Swift, who knew nothing of the authorship of the pamphlet, suspected it to be inspired by Steele and Addison. To Lintot’s *Miscellany* (1712) Gay contributed “An Epistle to Bernard Lintot,” containing some lines in praise of Pope, and a version of the story of Arachne from the sixth book of the *Metamorphoses* of Ovid. In the same year he was received into the household of the duchess of Monmouth as secretary, a connexion which was, however, broken before June 1714.

The dedication of his *Rural Sports* (1713) to Pope was the beginning of a lasting friendship. Gay could have no pretensions to rivalry with Pope, who seems never to have tired of helping his friend. In 1713 he produced a comedy, *The Wife of Bath*, which was acted only three nights, and *The Fan*, one of his least successful poems; and in 1714 *The Shepherd’s Week*, a series of six pastorals drawn from English rustic life. Pope had urged him to undertake this last task in order to ridicule the Arcadian pastorals of Ambrose Philips, who had been praised by the *Guardian*, to the neglect of Pope’s claims as the first pastoral writer of the age and the true English Theocritus. Gay’s pastorals completely achieved this object, but his ludicrous pictures of the English swains and their loves were found to be abundantly entertaining on their own account. Gay had just been appointed secretary to the British ambassador to the court of Hanover through the influence of Jonathan Swift, when the death of Queen Anne three months later put an end to all his hopes of official employment. In 1715, probably with some help from Pope, he produced *What d’ye call it?* a dramatic skit on contemporary tragedy, with special reference to Otway’s *Venice Preserved*. It left the public so ignorant of its real meaning that Lewis Theobald and Benjamin Griffin (1680-1740) published a *Complete Key to what d’ye call it* by way of explanation. In 1716 appeared his *Trivia, or the Art of Walking the Streets of London*, a poem in three books, for which he acknowledged having received several hints from Swift. It contains graphic and humorous descriptions of the London of that period. In January 1717 he produced the comedy of *Three Hours after Marriage*, which was grossly indecent without being amusing, and was a complete failure. There is no doubt that in this piece he had assistance from Pope and Arbuthnot, but they were glad enough to have it assumed that Gay was the sole author.

Gay had numerous patrons, and in 1720 he published *Poems on Several Occasions* by subscription, realizing £1000 or more. In that year James Craggs, the secretary of state, presented him with some South Sea stock. Gay, disregarding the prudent advice of Pope and other of his friends, invested his all in South Sea stock, and, holding on to the end, he lost everything. The shock is said to have made him dangerously ill. As a matter of fact Gay had always been a spoilt child, who expected everything to be done for him. His friends did not fail him at this juncture. He had patrons in William Pulteney, afterwards earl of Bath, in the third earl of Burlington, who constantly entertained him at Chiswick or at Burlington House, and in the third earl of Queensberry. He was a frequent visitor with Pope, and received unvarying kindness from Congreve and Arbuthnot. In 1724 he produced a tragedy called *The Captives*. In 1727 he wrote for Prince William, afterwards duke of Cumberland, his famous *Fifty-one Fables in Verse*, for which he naturally hoped to gain some preferment, although he has much to say in them of the servility of courtiers and the vanity of court honours. He was offered the situation of gentleman-usher to the Princess Louisa, who was still a child. He refused this offer, which all his friends seem to have regarded, for no very obvious reason, as an indignity. As the *Fables* were written for the amusement of one royal child, there would appear to have been a measure of reason in giving him a sinecure in the service of another. His friends thought him unjustly neglected by the court, but he had already received (1722) a sinecure as lottery commissioner with a salary of £150 a year, and from 1722 to 1729 he had lodgings in the palace at Whitehall. He had never rendered any special services to the court.

He certainly did nothing to conciliate the favour of the government by his next production, the *Beggars’ Opera*, a lyrical drama produced on the 29th of January 1728 by Rich, in which Sir Robert Walpole was caricatured. This famous piece, which was said to have made “Rich gay and Gay rich,” was an innovation in many respects, and for a time it drove Italian opera off the English stage. Under cover of the thieves and highwaymen who figured in it was disguised a satire on society, for Gay made it plain that in describing the moral code of his characters he had in mind the corruptions of the governing class. Part of the success of the *Beggars’ Opera* may have been due to the acting of Lavinia Fenton, afterwards duchess of Bolton, in the part of Polly Peachum. The play ran for sixty-two nights, though the representations, four of which were “benefits” of the author, were not, as has sometimes been stated, consecutive. Swift is said to have suggested the subject, and Pope and Arbuthnot were constantly consulted while the work was in progress, but Gay must be regarded as the sole author. He wrote a sequel, *Polly*, the representation of which was forbidden by the lord chamberlain, no doubt through the influence of Walpole. This act of “oppression” caused no loss to Gay. It proved an excellent advertisement for *Polly*, which was published by subscription in 1729, and brought its author more than £1000. The duchess of Queensberry was dismissed from court for enlisting subscribers in the palace. The duke of Queensberry gave him a home, and the duchess continued her affectionate patronage until Gay’s death, which took place on the 4th of December 1732. He was buried in Westminster Abbey. The epitaph on his tomb is by Pope, and is followed by Gay’s own mocking couplet:—

> “Life is a jest, and all things show it,
> I thought so once, and now I know it.”

Acis and Galatea, an English pastoral opera, the music of which was written by Handel, was produced at the Haymarket in 1732. The profits of his posthumous opera of *Achilles* (1733), and a new volume of *Fables* (1738) went to his two sisters, who inherited from him a fortune of £6000. He left two other pieces, *The Distressed Wife* (1743), a comedy, and *The Rehearsal at Goatham* (1754), a farce. The *Fables*, slight as they may appear, cost him more labour than any of his other works. The narratives are in nearly every case original, and are told in clear and lively verse. The moral which rounds off each little story is never strained. They are masterpieces in their kind, and the very numerous editions of them prove their popularity. They have been translated into Latin, French and Italian, Urdu and Bengali.

See his *Poetical Works* (1893) in the Muses' Library, with an introduction by Mr John Underhill; also Samuel Johnson's *Lives of the Poets*, John Gay's *Singspiele* (1898), edited by G. Sarrazin (*Englische Textbibliothek II.*); and an article by Austin Dobson in vol. 21 of the *Dictionary of National Biography*; *Gay's Chair* (1820), edited by Henry Lee, a fellow-townsman, contained a biographical sketch by his nephew, the Rev. Joseph Baller.

GAY, MARIE FRANÇOISE SOPHIE (1776-1852), French author, was born in Paris on the 1st of July 1776. Madame Gay was the daughter of M. Nichault de la Valette and of Francesca Peretti, an Italian lady. In 1793 she was married to M. Liottier, an exchange broker, but she was divorced from him in 1799, and shortly afterwards was married to M. Gay, receiver-general of the department of the Roër or Ruhr. This union brought her into intimate relations with many distinguished personages; and her salon came to be frequented by all the distinguished littérateurs, musicians, actors and painters of the time, whom she attracted by her beauty, her vivacity and her many amiable qualities. Her first literary production was a letter written in 1802 to the *Journal de Paris*, in defence of Madame de Staël's novel, *Delphine*; and in the same year she published anonymously her first novel *Laure d'Estell. Léonie de Montbreuse*, which appeared in 1813, is considered by Sainte-Beuve her best work; but *Anatole* (1815), the romance of a deaf-mute, has perhaps a higher reputation. Among her other works, *Salons célèbres* (2 vols., 1837) may be especially mentioned. Madame Gay wrote several comedies and opera libretti which met with considerable success. She was also an accomplished musician, and composed both the words and music of a number of songs. She died in Paris on the 5th of March 1852. For an account of her daughter, Delphine Gay, Madame de Girardin, see Girardin.

See her own *Souvenirs d'une vieille femme* (1834); also Théophile Gautier, *Portraits contemporains*; and Sainte-Beuve, *Causeries du lundi*, vol. vi.

GAY, WALTER (1856-), American artist, was born at Hingham, Massachusetts, on the 22nd of January 1856. In 1876 he became a pupil of Léon Bonnat in Paris. He received an honourable mention in the Salon of 1885; a gold medal in 1888, and similar awards at Vienna (1894), Antwerp (1895), Berlin (1896) and Munich (1897). He became an officer of the Legion of Honour and a member of the Society of Secession, Munich. Works by him are in the Luxembourg, the Tate Gallery (London), and the Boston and Metropolitan (New York) Museums of Art. His compositions are mainly figure subjects portraying French peasant life.

GAYA, a city and district of British India, in the Patna division of Bengal. The city is situated 85 m. S. of Patna by rail. Pop. (1901) 71,288. It consists of two distinct parts, adjoining each other; the part containing the residences of the priests is Gaya proper; and the other, which is the business quarter, is called Sahibganj. The civil offices and residences of the European inhabitants are situated here. Gaya derives its sanctity from incidents in the life of Buddha. But a local legend also exists concerning a pagan monster of great sanctity, named Gaya, who by long penance had become holy, so that all who saw or touched him were saved from perdition. Yama, the lord of hell, appealed to the gods, who induced Gaya to lie down in order that his body might be a place of sacrifice; and once down, Yama placed a large stone on him to keep him there. The tricked demon struggled violently, and, in order to pacify him, Vishnu promised that the gods should take up their permanent residence in him, and that any one who made a pilgrimage to the spot where he lay should be delivered from the terrors of the Hindu place of torment. This may possibly be a Brahmanic rendering of Buddha's life and work. There are forty-five sacred spots (of which the temple of Vishnupada is the chief) in and around the city, and these are visited by thousands of pilgrims annually. During the Mutiny the large store of treasure here was conveyed safely to Calcutta by Mr A. Money. The city contains a government high school and an hospital, with a Lady Elgin branch for women.

The District of Gaya comprises an area of 4712 sq. m. Generally speaking, it consists of a level plain, with a ridge of prettily wooded hills along the southern boundary, whence the country falls with a gentle slope towards the Ganges. Rocky hills occasionally occur, either detached or in groups, the loftiest being Maher hill about 12 m. S.E. of Gaya city, with an elevation of 1620 ft. above sea-level. The eastern part of the district is highly cultivated; the portions to the north and west are less fertile; while in the south the country is thinly peopled and consists of hills, the jungles on which are full of wild animals. The principal river is the Son, which marks the boundary between Gaya and Shahabad, navigable by small boats throughout the year, and by craft of 20-tons burden in the rainy season. Other rivers are the Punpun, Phalgu and Jamuna. Two branches of the Son canal system, the eastern main canal and the Patna canal, intersect the district. In 1901 the population was 2,059,933, showing a decrease of 3% in the decade. Among the higher castes there is an unusually large proportion of Brahmans, a circumstance due to the number of sacred places which the district contains. The Gayawals, or priests in charge of the holy places, are held in high esteem by the pilgrims; but they are not pure Brahmans, and are looked down upon by those who are. They live an idle and dissolute life, but are very wealthy, from contributions extorted from the pilgrims. Buddh Gaya, about 6 m. S. of Gaya city, is one of the holiest sites of Buddhism, as containing the tree under which Sakyamuni attained enlightenment. In addition to many ruins and sculptures, there is a temple restored by the government in 1881. Another place of religious interest is a temple of great antiquity, which crowns the highest peak of the Barabar hills, and at which a religious fair is held each September, attended by 10,000 to 20,000 pilgrims. At the foot of the hill are numerous rock caves excavated about 200 B.C. The opium poppy is largely cultivated. There are a number of lac factories. Manufactures consist of common brass utensils, black stone ornaments, pottery, tussur-silk and cotton cloth. Formerly paper-making was an important manufacture in the district, but it has entirely died out. The chief exports are food grains, oil seeds, indigo, crude opium (sent to Patna for manufacture), saltpetre, sugar, blankets, brass utensils, &c. The imports are salt, piece goods, cotton, timber, bamboos, tobacco, lac, iron, spices

and fruits. The district is traversed by four branches of the East Indian railway. In 1901 it suffered severely from the plague.

See *District Gazetteer* (1906); Sir A. Cunningham, *Mahabodhi* (1892).

GAYAL, a domesticated ox allied to the Gaur, but distinguished, among other features, by the more conical and straighter horns, and the straight line between them. Gayal are kept by the natives of the hill-districts of Assam and parts of Tenasserim and Upper Burma. Although it has received a distinct name, *Bos* (*Bibos*) *frontalis*, there can be little doubt that the gayal is merely a domesticated breed of the gaur, many gayal-skulls showing characters approximating to those of the gaur.

GAYANGOS Y ARCE, PASCUAL DE (1809-1897), Spanish scholar and Orientalist, was born at Seville on the 21st of June 1809. At the age of thirteen he was sent to be educated at Pont-le-Voy near Blois, and in 1828 began the study of Arabic under Silvestre de Sacy. After a visit to England, where he married, he obtained a post in the Spanish treasury, and was transferred to the foreign office as translator in 1833. In 1836 he returned to England, wrote extensively in English periodicals, and translated Almakkari's *History of the Mahommedan Dynasties in Spain* (1840-1843) for the Royal Asiatic Society. In England he also made the acquaintance of Ticknor, to whom he was very serviceable. In 1843 he returned to Spain as professor of Arabic at the university of Madrid, which post he held until 1881, when he was made director of public instruction. This office he resigned upon being elected senator for the district of Huelva. His latter years were spent in cataloguing the Spanish manuscripts in the British Museum; he had previously continued Bergenroth's catalogue of the manuscripts relating to England in the Simancas archives. His best-known original work is his dissertation on Spanish romances of chivalry in Rivadeneyra's *Biblioteca de autores españoles*. He died in London on the 4th of October 1897.

GAYARRÉ, CHARLES ÉTIENNE ARTHUR (1805-1895), American historian, was born in New Orleans, Louisiana, on the 9th of January 1805. After studying at the Collège d'Orléans he began, in 1826, to study law in Philadelphia, and three years later was admitted to the bar. In 1830 he was elected a member of the House of Representatives of Louisiana, in 1831 was appointed deputy attorney-general of his state, in 1833 became presiding judge of the city court of New Orleans, and in 1834 was elected as a Jackson Democrat to the United States Senate. On account of ill-health, however, he immediately resigned without taking his seat, and for the next eight years travelled in Europe and collected historical material from the French and the Spanish archives. In 1844-1845 and in 1856-1857 he was again a member of the state House of Representatives, and from 1845 to 1853 was secretary of state of Louisiana. He supported the Southern Confederacy during the Civil War, in which he lost a large fortune, and after its close lived chiefly by his pen. He died in New Orleans on the 11th of February 1895. He is best known as the historian of Louisiana. He wrote *Histoire de la Louisiane* (1847); *Romance of the History of Louisiana* (1848); *Louisiana: its Colonial History and Romance* (1851), reprinted in *A History of Louisiana*; *History of Louisiana: the Spanish Domination* (1854); *Philip II. of Spain* (1866); and *A History of Louisiana* (4 vols., 1866), the last being a republication and continuation of his earlier works in this field, the whole comprehending the history of Louisiana from its earliest discovery to 1861. He wrote also several dramas and romances, the best of the latter being *Fernando de Lemos* (1872).

GAY-LUSSAC, JOSEPH LOUIS (1778-1850), French chemist and physicist, was born at St Léonard, in the department of Haute Vienne, on the 6th of December 1778. He was the elder son of Antoine Gay, *procureur du roi* and judge at Pont-de-Noblac, who assumed the name Lussac from a small property he had in the neighbourhood of St Léonard. Young Gay-Lussac received his early education at home under the direction of the abbé Bourdieux and other masters, and in 1794 was sent to Paris to prepare for the École Polytechnique, into which he was admitted at the end of 1797 after a brilliant examination. Three years later he was transferred to the École des Ponts et Chaussées, and shortly afterwards was assigned to C.L. Berthollet, who wanted an able student to help in his researches. The new assistant scarcely came up to expectations in respect of confirming certain theoretical views of his master's by the experiments set him to that end, and appears to have stated the discrepancy without reserve; but Berthollet nevertheless quickly recognized the ability displayed, and showed his appreciation not only by desiring to be Gay-Lussac's "father in science," but also by making him in 1807 an original member of the Société d'Arcueil. In 1802 he was appointed demonstrator to A.F. Fourcroy at the École Polytechnique, where subsequently (1809) he became professor of chemistry, and from 1808 to 1832 he was professor of physics at the Sorbonne, a post which he only resigned for the chair of chemistry at the Jardin des Plantes. In 1831 he was elected to represent Haute Vienne in the chamber of deputies, and in 1839 he entered the chamber of peers. He died in Paris on the 9th of May 1850.

Gay-Lussac's earlier researches were mostly physical in character and referred mainly to the properties of gases, vapour-tensions, hygrometry, capillarity, &c. In his first memoir (*Ann. de Chimie*, 1802) he showed that different gases are dilated in the same proportion when heated from 0° to 100° C. Apparently he did not know of Dalton's

experiments on the same point, which indeed were far from accurate; but in a note he explained that “le cit. Charles avait remarqué depuis 15 ans la même propriété dans ces gaz; mais n’ayant jamais publié ses résultats, c’est par le plus grand hasard que je les ai connus.” In consequence of his candour in thus rescuing from oblivion the observation which his fellow-citizen did not think worth publishing, his name is sometimes dissociated from this law, which instead is known as that of Charles. In 1804 he had an opportunity of prosecuting his researches on air in somewhat unusual conditions, for the French Academy, desirous of securing some observations on the force of terrestrial magnetism at great elevations above the earth, through Berthollet and J.E. Chaptal obtained the use of the balloon which had been employed in Egypt, and entrusted the task to him and J.B. Biot. In their first ascent from the garden of the Conservatoire des Arts on the 24th of August 1804 an altitude of 4000 metres (about 13,000 ft.) was attained. But this elevation was not considered sufficient by Gay-Lussac, who therefore made a second ascent by himself oh the 16th of September, when the balloon rose 7016 metres (about 23,000 ft.) above sea-level. At this height, with the thermometer marking 9½ degrees below freezing, he remained for a considerable time, making observations not only on magnetism, but also on the temperature and humidity of the air, and collecting several samples of air at different heights. The magnetic observations, though imperfect, led him to the conclusion that the magnetic effect at all attainable elevations above the earth’s surface remains constant; and on analysing the samples of air he could find no difference of composition at different heights. (For an account of both ascents see *Journ. de phys.* for 1804.) On the 1st of October in the same year, in conjunction with Alexander von Humboldt, he read a paper on eudiometric analysis (*Ann. de Chim.*, 1805), which contained the germ of his most important generalization, the authors noting that when oxygen and hydrogen combine together by volume, it is in the proportion of one volume of the former to two volumes of the latter. But his law of combination by volumes was not enunciated in its general form until after his return from a scientific journey through Switzerland, Italy and Germany, on which with Humboldt he started from Paris in March 1805. This journey was interrupted in the spring of 1806 by the news of the death of M.J. Brisson, and Gay-Lussac hurried back to Paris in the hope, which was gratified, that he would be elected to the seat thus vacated in the Academy. In 1807 an account of the magnetic observations made during the tour with Humboldt was published in the first volume of the *Mémoires d’Arcueil*, and the second volume, published in 1809, contained the important memoir on gaseous combination (read to the Société Philomathique on the last day of 1808), in which he pointed out that gases combining with each other in volume do so in the simplest proportions—1 to 1, 1 to 2, 1 to 3—and that the volume of the compound formed bears a simple ratio to that of the constituents.

About this time Gay-Lussac’s work, although he by no means entirely abandoned physical questions, became of a more chemical character; and in three instances it brought him into direct rivalry with Sir Humphry Davy. In the first case Davy’s preparation of potassium and sodium by the electric current spurred on Gay-Lussac and his collaborator L.J. Thénard, who had no battery at their disposal, to search for a chemical method of obtaining those metals, and by the action of red-hot iron on fused potash—a method of which Davy admitted the advantages—they succeeded in 1808 in preparing potassium, going on to make a full study of its properties and to use it, as Davy also did, for the reduction of boron from boracic acid in 1809. The second concerned the nature of “oxymuriatic acid” (chlorine). While admitting the possibility that it was an elementary body, after many experiments they finally declared it to be a compound (*Mém. d’Arcueil*, 1809). Davy, on the other hand, could see no reason to suppose it contained oxygen, as they surmised, and ultimately they had to accept his view of its elementary character. The third case roused most feeling of all. Davy, passing through Paris on his way to Italy at the end of 1813, obtained a few fragments of iodine, which had been discovered by Bernard Courtois (1777-1838) in 1811, and after a brief examination by the aid of his limited portable laboratory perceived its analogy to chlorine and inferred it to be an element. Gay-Lussac, it is said, was nettled at the idea of a foreigner making such a discovery in Paris, and vigorously took up the study of the new substance, the result being the “Mémoire sur l’iode,” which appeared in the *Ann. de chim.* in 1814. He too saw its resemblance to chlorine, and was obliged to agree with Davy’s opinion as to its simple nature, though not without some hesitation, due doubtless to his previous declaration about chlorine. Davy on his side seems to have felt that the French chemist was competing with him, not altogether fairly, in trying to appropriate the honour of discovering the character of the substance and of its compound, hydriodic acid.

In 1810 he published a paper which contains some classic experiments on fermentation, a subject to which he returned in a second paper published in 1815. At the same time he was working with Thénard at the improvement of the methods of organic analysis, and by combustion with oxidizing agents, first potassium chlorate and subsequently copper oxide, he determined the composition of a number of organic substances. But his last great piece of pure research was on prussic acid. In a note published in 1811 he described the physical properties of this acid, but he said nothing about its chemical composition till 1815, when he described cyanogen as a compound radicle, prussic acid as a compound of that radicle with hydrogen alone, and the prussiates (cyanides) as compounds of the radicle with metals. The proof that prussic acid contains hydrogen but no oxygen was a most important support to the hydrogen-acid theory, and completed the downfall of Lavoisier’s oxygen theory; while the isolation of cyanogen was of equal importance for the subsequent era of compound radicles in organic chemistry.

After this research Gay-Lussac’s attention began to be distracted from purely scientific investigation. He had now secured a leading if not the foremost place among the chemists of the French capital, and the demand for his services as adviser in technical problems and matters of practical interest made great inroads on his available time. He had been a member of the consultative committee on arts and manufactures since 1805; he was attached to the “administration des poudres et salpêtres” in 1818, and in 1829 he received the lucrative post of assayer to the mint. In these new fields he displayed the powers so conspicuous in his scientific inquiries, and he was now to introduce and establish scientific accuracy where previously there had been merely practical approximations. His services to industry included his improvements in the processes for the manufacture of sulphuric acid (1818) and oxalic acid (1829); methods of estimating the amount of real alkali in potash and soda by the volume of standard acid required for neutralization, and for estimating the available chlorine in bleaching powder by a solution of arsenious acid; directions for the use of the centesimal alcoholometer published in 1824 and specially commended by the Institute; and the elaboration of a method of assaying silver by a standard solution of common salt, a volume on which was published in 1833. Among his research work of this period may be mentioned the improvements in organic analysis and the investigation of fulminic acid made with the help of Liebig, who gained the privilege of admission to his private laboratory in 1823-1824.

Gay-Lussac was patient, persevering, accurate to punctiliousness, perhaps a little cold and reserved, and not unaware of his great ability. But he was also bold and energetic, not only in his work but also in support and defence of his friends. His early childish adventures, as told by Arago, herald the fearless aeronaut and the undaunted investigator of volcanic eruptions (Vesuvius was in full eruption when he visited it during his tour in 1805); and the endurance he exhibited under the laboratory accidents that befell him shows the power of will with

which he would face the prospect of becoming blind and useless for the prosecution of the science which was his very life, and of which he was one of the most distinguished ornaments. Only at the very end, when the disease from which he was suffering left him no hope, did he complain with some bitterness of the hardship of leaving this world where the many discoveries being made pointed to yet greater discoveries to come.

The most complete list of Gay-Lussac's papers is contained in the Royal Society's *Catalogue of Scientific Papers*, which enumerates 148, exclusive of others written jointly with Humboldt, Thénard, Welter and Liebig. Many of them were published in the *Annales de chimie*, which after it changed its title to *Annales de chimie et physique* he edited, with Arago, up to nearly the end of his life; but some are to be found in the *Mémoires d'Arcueil* and the *Comptes rendus*, and in the *Recherches physiques et chimiques*, published with Thénard in 1811.

GAZA, THEODORUS (*c.* 1400-1475), one of the Greek scholars who were the leaders of the revival of learning in the 15th century, was born at Thessalonica. On the capture of his native city by the Turks in 1430 he fled to Italy. During a three years' residence in Mantua he rapidly acquired a competent knowledge of Latin under the teaching of Vittorino da Feltre, supporting himself meanwhile by giving lessons in Greek, and by copying manuscripts of the ancient classics.[1] In 1447 he became professor of Greek in the newly founded university of Ferrara, to which students in great numbers from all parts of Italy were soon attracted by his fame as a teacher. He had taken some part in the councils which were held in Siena (1423), Ferrara (1438), and Florence (1439), with the object of bringing about a reconciliation between the Greek and Latin Churches; and in 1450, at the invitation of Pope Nicholas V., he went to Rome, where he was for some years employed by his patron in making Latin translations from Aristotle and other Greek authors. After the death of Nicholas (1455), being unable to make a living at Rome, Gaza removed to Naples, where he enjoyed the patronage of Alphonso the Magnanimous for two years (1456-1458). Shortly afterwards he was appointed by Cardinal Bessarion to a benefice in Calabria, where the later years of his life were spent, and where he died about 1475. Gaza stood high in the opinion of most of his learned contemporaries, but still higher in that of the scholars of the succeeding generation. His Greek grammar (in four books), written in Greek, first printed at Venice in 1495, and afterwards partially translated by Erasmus in 1521, although in many respects defective, especially in its syntax, was for a long time the leading text-book. His translations into Latin were very numerous, including the *Problemata*, *De partibus animalium* and *De generatione animalium* of Aristotle; the *Historia plantarum* of Theophrastus; the *Problemata* of Alexander Aphrodisias; the *De instruendis aciebus* of Aelian; the *De compositione verborum* of Dionysius of Halicarnassus; and some of the *Homilies* of John Chrysostom. He also turned into Greek Cicero's *De senectute* and *Somnium Scipionis*—with much success, in the opinion of Erasmus; with more elegance than exactitude, according to the colder judgment of modern scholars. He was the author also of two small treatises entitled *De mensibus* and *De origine Turcarum*.

See G. Voigt, *Die Wiederbelebung des klassischen Altertums* (1893), and article by C.F. Bähr in Ersch and Gruber's *Allgemeine Encyklopädie*. For a complete list of his works, see Fabricius, *Bibliotheca Graeca* (ed. Harles), x.

1 According to Voigt, Gaza came to Italy some ten years later from Constantinople, where he had been a teacher or held some clerical office.

GAZA (or 'Azzah, mod. *Ghuzzeh*), the most southerly of the five princely Philistine cities, situated near the sea, at the point where the old trade routes from Egypt, Arabia and Petra to Syria met. It was always a strong border fortress and a place of commercial importance, in many respects the southern counterpart of Damascus. The earliest notice of it is in the Tell el-Amarna tablets, in a letter from the local governor, who then held it for Egypt, with which country it always stood in close connexion. It never passed for long into Israelite hands, though subject for a while to Hezekiah of Judah; from him it passed to Assyria. In Amos i. 6 the city is denounced for giving up Hebrew slaves to Edom. To Herodotus (iii. 5) the place seemed as important as Sardis. The city withstood Alexander the Great for five months (332 B.C.), and in 96 B.C. was razed to the ground by Alexander Jannaeus. It was rebuilt by Aulus Gabinius, 57 B.C., but on a new site; the old site was remembered and spoken of as "Old" or "Desert Gaza": compare Acts viii. 26. In the 2nd and 3rd centuries Gaza was a thriving Greek city, with good schools and famous temples, especially one to the local god Marna (*i.e.* "Lord" or "Our Lord"). A statue of this god has been found near Gaza; it much resembles the Greek representation of Zeus. The struggle with Christianity here was long and intense. Egyptian monks gradually won over the country folk, and in 402, under the influence of Theodosius and Porphyry the local bishop, the Marneion was destroyed and the cross made politically supreme. In the 5th and 6th centuries Gaza was held in high repute as a place of learning. But after it passed into Moslem hands (635) it gradually lost all save commercial importance, and even the Crusaders did little to revive its old military glory. It finally was captured by the Moslems in 1244. Napoleon captured it in 1799.

The modern town (pop. 16,000) is divided into four quarters, one of which is built on a low hill. A magnificent grove of very ancient olives forms an avenue 4 m. long to the north. There are many lofty minarets in various parts of the town, and a fine mosque built of ancient materials. A 12th century church towards the south side of the hill has also been converted into a mosque. On the east is shown the tomb of Samson (an erroneous tradition dating back to the middle ages). The ancient walls are now covered up beneath green mounds of rubbish. The water-supply is from wells sunk through the sandy soil to the rock; of these there are more than twenty—an unusual number for a Syrian town. The land for the 3 m. between Gaza and the sea consists principally of sand dunes. There is no natural harbour, but traces of ruins near the shore mark the site of the old Maiuma Gazae or Port of Gaza, now called el Mineh, which in the 5th century was a separate town and episcopal see, under the title Constantia or Limena Gaza. Hāshem, an ancestor of Mahomet, lies buried in the town. On the east are remains of a race-course, the corners marked by granite shafts with Greek inscriptions on them. To the south is a remarkable hill, quite isolated and bare, with a small mosque and a graveyard. It is called el Muntār, "the watch tower," and is supposed to be the mountain "before (or facing) Hebron," to which Samson carried the gates of Gaza (Judg. xvi. 3). The

bazaars of Gaza are considered good. An extensive pottery exists in the town, and black earthenware peculiar to the place is manufactured there. The climate is dry and comparatively healthy, but the summer temperature often exceeds 110° Fahr. The surrounding country is partly cornland, partly waste, and is inhabited by wandering Arabs. The prosperity of Ghuzzeh has partially revived through the growing trade in barley, of which the average annual export to Great Britain for 1897-1899 was over 30,000 tons. The dress of the people is Egyptian rather than Syrian. Gaza is an episcopal see both of the Greek and the Armenian church. The Church Missionary Society maintains a mission, with schools for both sexes, and a hospital.

GAZALAND, a district of Portuguese East Africa, extending north from the Komati or Manhissa river, Delagoa Bay, to the Pungwe river. It is a well-watered, fertile country. Gazaland is one of the chief recruiting grounds for negro labour in the Transvaal gold mines. The country derives its name from a Swazi chief named Gaza, a contemporary of Chaka, the Zulu king. Refugees from various clans oppressed by Dingaan (Chaka's successor) were welded into one tribe by Gaza's son Manikusa, who took the name of Sotshangana, his followers being known generally as Matshangana. A section of them was called Maviti or Landeens (*i.e.* couriers), a designation which persists as a tribal name. Between 1833 and 1836 Manikusa made himself master of the country as far north as the Zambezi and captured the Portuguese posts at Delagoa Bay, Inhambane, Sofala and Sena, killing nearly all the inhabitants. The Portuguese reoccupied their posts, but held them with great difficulty, while in the interior the Matshangana continued their ravages unchecked, depopulating large regions. Manikusa died about 1860, and his son Umzila, receiving some help from the Portuguese at Delagoa Bay in a struggle against a brother for the chieftainship, ceded to them the territory south of the Manhissa river. North of that stream as far as the Zambezi and inland to the continental plateau Umzila established himself in independence, a position he maintained till his death (*c.* 1884). His chief rival was a Goanese named Gouveia, who came to Africa about 1850. Having obtained possession of a *prazo* in the Gorongoza district, he ruled there as a feudal lord while acknowledging himself a Portuguese subject. Gouveia recovered from the Matshangana and other troublers of the peace much of the country in the Zambezi valley, and was appointed by the Portuguese captain-general of a large region. From 1868 onward the country began to be better known. Probably the first European to penetrate any distance inland from the Sofala coast since the Portuguese gold-seekers of the 16th century was St Vincent W. Erskine, who explored the region between the Limpopo and Pungwe (1868-1875). Portugal's hold on the coast had been more firmly established at the time of Umzila's death, and Gungunyana, his successor, was claimed as a vassal, while efforts were made to open up the interior. This led in 1890-1891 to collisions on the borderland of the plateau with the newly established British South Africa Company, and to the arrest by the company's agents of Gouveia, who was, however, set at liberty and returned to Mozambique via Cape Town. An offer made by Gungunyana (1891) to come under British protection was not accepted. In 1892 Gouveia was killed in a war with a native chief. Gungunyana maintained his independence until 1895, when he was captured by a Portuguese force and exiled, first to Lisbon and afterwards to Angola, where he died in 1906. With the capture of Gungunyana opposition to Portuguese rule largely ceased.

In flora, fauna and commerce Gazaland resembles the neighbouring regions of Portuguese East Africa. (*q.v.*).

See G. McCall Theal, *History of South Africa since 1795*, vol. v. (London, 1908).

GAZEBO (usually explained as a comic Latinism, for "I will gaze"; the *New English Dictionary* suggests a possible oriental origin now lost), a term used in the 18th century for a structure on the outer wall of a garden, having an upper storey with windows on each side so as to overlook the road. Similar buildings are found in Holland on the borders of the canals, which in some cases form very picturesque features.

GAZETTE, a name given to news-sheets or newspapers having an abstract of current events (see Newspapers). The *London Gazette* is the title of the English official organ for announcements by the government, and is published every Tuesday and Friday. It contains all proclamations, orders of council, promotions and appointments to commissions in the army and navy, all appointments to offices of state, and such other orders, rules and regulations as are directed by act of parliament to be published therein. It also contains notices of proceedings in bankruptcy, dissolutions of partnership, &c. By the Documentary Evidence Act 1868 the production of a copy of the *Gazette* is prima facie evidence of royal proclamations and government orders and regulations. Similar gazettes are also published in Edinburgh and Dublin. Most countries (the United States excepted) have official journals containing information more or less similar to that of the *London Gazette*, as the French *Journal officiel*, the German *Deutscher Reichs-und Kgl. Preuss. Staats-Anzeiger*, &c. The word "gazetteer" was originally applied to one who wrote for "gazettes," but is now only used for a geographical dictionary arranged on an alphabetical plan.

GEAR (connected with "garb," properly elegance, fashion, especially of dress, and with "gar," to cause to do, only found in Scottish and northern dialects; the root of the word is seen in the Old Teut. *garwjan*, to make ready), an outfit, applied to the wearing apparel of a person, or to the harness and trappings of a horse or any draft animal, as riding-gear, hunting-gear, &c.; also to household goods or stuff. The phrase "out of gear," though now connected

with the mechanical application of the word, was originally used to signify “out of harness” or condition, not ready to work, not fit. The word is also used of apparatus generally, and especially of the parts collectively in a machine by which motion is transmitted from one part to another by a series of cog-wheels, continuous bands, &c. It is used in a special sense in reference to a bicycle, meaning the diameter of an imaginary wheel, the circumference of which is equal to the distance accomplished by one revolution of the pedals (see Bicycle).

GEBER. The name Geber has long been used to designate the author of a number of Latin treatises on alchemy, entitled *Summa perfectionis magisterii, De investigatione perfectionis, De inventione veritatis, Liber fornacum, Testamentum Geberi Regis Indiae and Alchemia Geberi*, and these writings were generally regarded as translations from the Arabic originals of Abu Abdallah Jaber ben Hayyam (Haiyan) ben Abdallah al-Kufi, who is supposed to have lived in the 8th or 9th century of the Christian era. About him, however, there is considerable uncertainty. According to the *Kitāb-al-Fihrist* (10th century), which gives his name as above, the authorities disagree, some asserting him to have been a writer on philosophy and rhetoric, and others claiming for him the first place among the adepts of his time in the art of making gold and silver. The writer of the *Kitāb-al-Fihrist* says he had been assured that Jaber only wrote one book and even that he never existed at all, but these statements he scouts as ridiculous, and expressing the conviction that Jaber really did exist, and that his works were numerous and important, goes on to quote the titles of some 500 treatises attributed to him. He is said to have resided most frequently at Kufa, where he prepared the “elixir,” but, according to others, he never spent long in one place, having reason to keep his whereabouts unknown. His patron or master is variously given as Ja’far ben Yahya, and as Ja’far es-Sadiq; in the Arabic *Book of Royalty*, professedly written by him, he addresses the last-named as his master. In addition to these details the Fihrist mentions a tradition that he originally came from Khorasan. Another story given by d’Herbelot (*Bibliothèque orientale*, s.v. “Giaber”) makes him a native of Harran in Mesopotamia and a Sabaean. Leo Africanus, who in 1526 gave an account of the Alchemists of Fez in Africa (see the English translation of his *Africae descriptio* by John Pory, *A Geographical History of Africa*, London, 1600, p. 155), states that their principal authority was Geber, a Greek who had apostatized to Mahommedanism and lived a century after Mahomet. In Albertus Magnus the name Geber occurs only once and then with the epithet “of Seville”; doubtless the reference is to the Arabian Jabir ben Aflah, who lived in that city in the 11th century, and wrote an astronomy in 9 books which is of importance in the history of trigonometry.

The great puzzle connected with the name Geber lies in the character of the writings attributed to him, their style and matter differentiating them strongly from those of even the best authors of the later alchemical period, and making it difficult to account for their existence at all. The researches of M.P.E. Berthelot threw a great deal of light on this question. Taking the six treatises enumerated above he concluded, after critical examination, that the two last may be disregarded as of later date than the others, and that the *De investigatione perfectionis*, the *De inventione* and the *Liber fornacum* are merely extracts from or summaries of the *Summa perfectionis* with later additions. The *Summa* he therefore regarded as representative of the work of the Latin Geber, and study of it convinced him that it contains no indication of an Arabic origin, either in its method, which is conspicuous for clearness of reasoning and logical co-ordination of material, or in its facts, or in the words and persons quoted. Without going so far as to deny that some words and phrases may be taken from the writings of the Arabian Jaber, he was disposed to hold that it is the original work of some unknown Latin author, who wrote it in the second half of the 13th century and put it under the patronage of the venerated name of Geber. The MS. of this work in the Bibliothèque Nationale at Paris dates from about the year 1300. Berthelot further investigated Arabic MSS. existing in the Paris library and in the university of Leiden, and containing works attributed to Jaber, and had translations made of six treatises—two, of which he gives the titles as *Livre de la royauté* and *Petit Livre de la miséricorde*,—from Paris, and four—*Livre des balances, Livre de la miséricorde, Livre de la concentration* and *Livre de la mercure orientale*—from Leiden. Berthelot was not prepared to assert that these treatises were actually written by Jaber, but he held it certain that they are works written in Arabic between the 9th and 12th centuries, at a period anterior to the relations of the Latins with the Arabs. In style these treatises are entirely different from the *Summa* of Geber. Their language is vague and allegorical, full of allusions and pious Mussulman invocations; the author continually announces that he is about to speak without mystery or reserve, but all the same never gives any precise details of the secrets he professes to reveal. He holds the doctrine that everything endowed with an apparent quality possesses an opposite occult quality in much the same terms as it is found in Latin writers of the middle ages, but he makes no allusion to the theory of the generation of the metals by sulphur and mercury, a theory generally attributed to Geber, who also added arsenic to the list. Again he fully accepts the influence of the stars on the production of the metals, whereas the Latin Geber disputes it, and in general the chemical knowledge of the two is on a different plane. Here again the inference is that the Latin treatises printed from the 15th century onwards as the work of Geber are not authentic, regarded as translations of the Arabic author Jaber, always supposing that the Arabic MSS. transcribed and translated for Berthelot are really, as they profess to be, the work of Jaber, and as representative of his opinions and attainments.

But while Berthelot thus deprived the world of what were long regarded as genuine Latin versions of Jaber’s works, he also gave it something in their place, for among the Paris MSS. he found a mutilated treatise, hitherto unpublished, entitled *Liber de Septuaginta (Johannis), translatus a Magistro Renaldo Cremonensi*, which he considered the only known Latin work that can be regarded as a translation from the Arabic Jaber. The latter states in the Arabic works referred to above that under that title he collected 70 of the 500 little treatises or tracts of which he was the author, and the titles of those tracts enumerated in the *Kitāb-al-Fihrist* as forming the chapters of the *Liber de Septuaginta* correspond in general with those of the Latin work, which further is written in a style similar to that of the Arabic Jaber and contains the same doctrines. Hence Berthelot felt justified in assigning it to Jaber, although no Arabic original is known.

The evidence collected by Berthelot has an important bearing on the history of chemistry. Most of the chemical knowledge attributed to the Arabs has been attributed to them on the strength of the reputed Latin writings of Geber. If, therefore, these are original works rather than translations, and contain facts and doctrines which are not to be found in the Arabian Jaber, it follows that, on the one hand, the chemical knowledge of the Arabs has been overestimated and, on the other, that more progress was made in the middle ages than has generally been supposed.

See M.P.E. Berthelot's works on the history of alchemy and especially his *Chimie au moyen âge* (3 vols., Paris, 1893), the third volume of which contains a French translation of Jaber's works together with the Arabic text.

GEBHARD TRUCHSESS VON WALDBURG (1547-1601), elector and archbishop of Cologne, was the second son of William, count of Waldburg, and nephew of Otto, cardinal bishop of Augsburg (1514-1573). Belonging thus to an old and distinguished Swabian family, he was born on the 10th of November 1547, and after studying at the universities of Ingolstadt, Perugia, Louvain and elsewhere began his ecclesiastical career at Augsburg. Subsequently he held other positions at Strassburg, Cologne and Augsburg, and in December 1577 was chosen elector of Cologne after a spirited contest. Gebhard is chiefly noted for his conversion to the reformed doctrines, and for his marriage with Agnes, countess of Mansfeld, which was connected with this step. After living in concubinage with Agnes he decided, perhaps under compulsion, to marry her, doubtless intending at the same time to resign his see. Other counsels, however, prevailed. Instigated by some Protestant supporters he declared he would retain the electorate, and in December 1582 he formally announced his conversion to the reformed faith. The marriage with Agnes was celebrated in the following February, and Gebhard remained in possession of the see. This affair created a great stir in Germany, and the clause concerning ecclesiastical reservation in the religious peace of Augsburg was interpreted in one way by his friends, and in another way by his foes; the former holding that he could retain his office, the latter that he must resign. Anticipating events Gebhard had collected some troops, and had taken measures to convert his subjects to Protestantism. In April 1583 he was deposed and excommunicated by Pope Gregory XIII.; a Bavarian prince, Ernest, bishop of Liége, Freising and Hildesheim, was chosen elector, and war broke out between the rivals. The cautious Lutheran princes of Germany, especially Augustus I., elector of Saxony, were not enthusiastic in support of Gebhard, whose friendly relations with the Calvinists were not to their liking; and although Henry of Navarre, afterwards Henry IV. of France, tried to form a coalition to aid the deposed elector, the only assistance which he obtained came from John Casimir, administrator of the Palatinate of the Rhine. The inhabitants of the electorate were about equally divided on the question, and Ernest, supported by Spanish troops, was too strong for Gebhard. John Casimir, who acted as commander-in-chief, returned to the Palatinate in October 1583, and early in the following year Gebhard was driven from Bonn and took refuge in the Netherlands. The electorate was soon completely in the possession of Ernest, and the defeat of Gebhard was a serious blow to Protestantism, and marks a stage in the history of the Reformation. Living in the Netherlands he became very intimate with Elizabeth's envoy, Robert Dudley, earl of Leicester, but he failed to get assistance for renewing the war either from the English queen or in any other quarter. In 1589 Gebhard took up his residence at Strassburg, where he had held the office of dean of the cathedral since 1574. Before his arrival some trouble had arisen in the chapter owing to the fact that three excommunicated canons persisted in retaining their offices. He joined this party, which was strongly supported in the city, took part in a double election to the bishopric in 1592, and in spite of some opposition retained his office until his death at Strassburg on the 31st of May 1601. Gebhard was a drunken and licentious man, who owes his prominence rather to his surroundings than to his abilities.

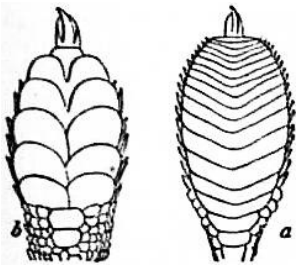
See M. Lossen, *Der kölnische Krieg* (Gotha, 1882), and the article on Gebhard in band viii. of the *Allgemeine deutsche Biographie* (Leipzig, 1878); J.H. Hennes, *Der Kampf um das Erzstift Köln* (Cologne, 1878); L. Ennen, *Geschichte der Stadt Köln* (Cologne, 1863-1880); and *Nuntiaturberichte aus Deutschland. Der Kampf um Köln*, edited by J. Hansen (Berlin, 1892).

GEBWEILER (Fr. *Guebwiller*), a town of Germany in the imperial province of Alsace-Lorraine, at the foot of the Vosges, on the Lauch, 13 m. S. of Colmar, on the railway Bollweiler-Lautenbach. Pop. (1905) 13,259. Among the principal buildings are the Roman Catholic church of St Leodgar, dating from the 12th century, the Evangelical church, the synagogue, the town-house, and the old Dominican convent now used as a market and concert hall. The chief industries are spinning and dyeing, and the manufacture of cloth and of machinery; quarrying is carried on and the town is celebrated for its white wines.

Gebweiler is mentioned as early as 774. It belonged to the religious foundation of Murbach, and in 1759 the abbots chose it for their residence. In 1789, at the outbreak of the Revolution, the monastic buildings were laid in ruins, and, though the archives were rescued and removed to Colmar, the library perished.

GECKO,[1] the common name applied to all the species of the *Geckones*, one of the three sub-orders of the *Lacertilia*. The geckoes are small creatures, seldom exceeding 8 in. in length including the tail. With the head considerably flattened, the body short and thick, the legs not high enough to prevent the body dragging somewhat on the ground, the eyes large and almost destitute of eyelids, and the tail short and in some cases nearly as thick as the body, the geckoes altogether lack the litheness and grace characteristic of most lizards. Their colours also are dull, and to the weird and forbidding aspect thus produced the general prejudice against those creatures in the countries where they occur, which has led to their being classed with toads and snakes, is no doubt to be attributed. Their bite was supposed to be venomous, and their saliva to produce painful cutaneous eruptions; even their touch was thought sufficient to convey a dangerous taint. It is needless to say that in this instance the popular mind was misled by appearances. The geckoes are not only harmless, but are exceedingly useful creatures, feeding on insects, which, owing to the great width of their oesophagus, they are enabled to swallow whole, and in pursuit of which they do not hesitate to enter human dwellings, where they are often killed on suspicion. The structure of the toes in these lizards forms one of their most characteristic anatomical features.

Leaf-tailed Gecko (*Gymnodactylus platurus*) of Australia.



Lower Surface of the Toe of (*a*) *Gecko*, (*b*) *Hemidactylus*—enlarged.

Most geckoes have adhesive digits and toes, by means of which they are enabled not only to climb absolutely smooth and vertical surfaces, for instance a window-pane, but to run along a white-washed ceiling, back downwards. The adhesion is not produced by sticky matter but by numerous transverse lamellae, each of which is further beset with tiny hair-like excrescences. The arrangement of the lamellae and pads differs much in the various genera and is used for classificatory purposes. Those which live on sandy ground have narrow digits without the adhesive apparatus. Most species have sharp, curved claws, often retractile between some of the lamellae or into a special sheath. The tail is very brittle and can be quickly regenerated; it varies much in size and shape; the most extraordinary is that of the leaf-tailed gecko. *Ptychozoon homalocephalon* of the Malay countries has membranous expansions on the sides of the head, body, limbs and tail, which look like parachutes, but more probably they aid in concealing the creature when it is closely pressed to the similarly coloured bark of a tree. Most geckoes are dull coloured, yellow to brown, and they soon change colour from lighter to dark tints. They are insectivorous and chiefly nocturnal, but are fond of basking in the sun, motionless on the bark of a tree, or on a rock the colour of which is then imitated to a nicety. Some species are more or less transparent.

Geckoes, of which about 270 species are known, subdivided into about 50 genera, are cosmopolitan within the warmer zones, including New Zealand, and even the remotest volcanic islands. This wide distribution is due partly to the great age of the suborder (although fossils are unknown), partly to their being able to exist for several months without food so that, concealed in hollow trunks of trees, they may float about for a very long time. Ships, also, act as distributors. In south Europe occur only *Hemidactylus turcicus*, *Tarentola mauritanica (Platydactylus facetanus)* and *Phyllodactylus europaeus*.

1 The Malay name *gē-koq* imitates the animal’s cry.

GED, WILLIAM (1690-1749), the inventor of stereotyping, was born at Edinburgh in 1690. In 1725 he patented his invention, developed from the simple process of soldering together loose types of Van der Mey. Ged, although he succeeded in obtaining a cast in similar metal, of a type page, could not persuade Edinburgh printers to take up his invention, and finally entered into partnership with a London stationer named Jenner and Thomas James, a typefounder. The partnership, however, turned out very ill; and Ged, broken-hearted at his want of success due to trade jealousy and the compositors’ dislike of the innovation, died in poverty on the 19th of October 1749. Two prayer-books for the university of Cambridge and an edition of Sallust were printed from his stereotype plates. In his time the best type was imported from Holland, and Ged’s daughter reports that he had repeated offers from the Dutch which, from patriotic motives, he refused. His sons tried to carry out his patent, and it was eventually perfected by Andrew Wilson.

GEDDES, ALEXANDER (1737-1802), Scottish Roman Catholic theologian, was born in Rathven, Banffshire, on the 14th of September 1737. He was trained at the Roman Catholic seminary at Scalan and at the Scottish College in Paris, where he studied biblical philology, school divinity and modern languages. In 1764 he officiated as a priest in Dundee, but in May 1765 accepted an invitation to live with the earl of Traquair; where, with abundance of leisure and the free use of an adequate library, he made further progress in his favourite biblical studies. After a second visit to Paris, which was employed by him in reading and making extracts from rare books and manuscripts, he was appointed in 1769 priest of Auchinhalrig and Preshome in his native county. The freedom with which he fraternized with his Protestant neighbours called forth the rebuke of his bishop (George Hay), and ultimately, for hunting and for occasionally attending the parish church of Cullen, where one of his friends was minister, he was deprived of his charge and forbidden the exercise of ecclesiastical functions within the diocese. This happened in 1779; and in 1780 he went with his friend Lord Traquair to London, where he spent the rest of his life. Before leaving Scotland he had received the honorary degree of LL.D. from the university of Aberdeen, and had been made an honorary member of the Society of Antiquaries, in the institution of which he had taken a very active part. In London Geddes soon received an appointment in connexion with the chapel of the imperial ambassador, and was also helped by Lord Petre in his scheme for a new Catholic version of the Bible. In 1786, supported also by such scholars as Benjamin Kennicott and Robert Lowth, Geddes published a *Prospectus of a new Translation of the Holy Bible*, a considerable quarto volume, in which the defects of previous translations were fully pointed out, and the

means indicated by which these might be removed. It was well received, and led to the publication in 1788 of *Proposals for Printing*, with a specimen, and in 1790 of a *General Answer to Queries, Counsels and Criticisms*. The first volume of the translation itself, which was entitled *The Holy Bible ... faithfully translated from corrected Texts of the Originals, with various Readings, explanatory Notes and critical Remarks*, appeared in 1792, and was the signal for a storm of hostility on the part of both Catholics and Protestants. It was obvious enough—no small offence in the eyes of some—that as a critic Geddes had identified himself with C.F. Houbigant (1686-1783), Kennicott and J.D. Michaelis, but others did not hesitate to stigmatize him as the would-be "corrector of the Holy Ghost." Three of the vicars-apostolic almost immediately warned all the faithful against the "use and reception" of his translation, on the ostensible ground that it had not been examined and approved by due ecclesiastical authority; and by his own bishop (Douglas) he was in 1793 suspended from the exercise of his orders in the London district. The second volume of the translation, completing the historical books, published in 1797, found no more friendly reception; but this circumstance did not discourage him from giving forth in 1800 the volume of *Critical Remarks on the Hebrew Scriptures*, which presented in a somewhat brusque manner the then novel and startling views of Eichhorn and his school on the primitive history and early records of mankind.

Geddes was engaged on a critical translation of the Psalms (published in 1807) when he was seized with an illness of which he died on the 26th of February 1802. Although under ecclesiastical censures, he had never swerved from a consistent profession of faith as a Catholic; and on his death-bed he duly received the last rites of his communion.

Besides pamphlets on the Catholic and slavery questions, as well as several fugitive *jeux d'esprit*, and a number of unsigned articles in the *Analytical Review*, Geddes also published a free metrical version of *Select Satires of Horace* (1779), and a verbal rendering of the *First Book of the Iliad of Homer* (1792). The *Memoirs* of his life and writings by his friend John Mason Good appeared in 1803.

GEDDES, ANDREW (1783-1844), British painter, was born at Edinburgh. After receiving a good education in the high school and in the university of that city, he was for five years in the excise office, in which his father held the post of deputy auditor. After the death of his father, who had opposed his desire to become an artist, he came to London and entered the Royal Academy schools. His first contribution to the exhibitions of the Royal Academy, a "St John in the Wilderness," appeared at Somerset House in 1806, and from that year onwards Geddes was a fairly constant exhibitor of figure-subjects and portraits. His well-known portrait of Wilkie, with whom he was on terms of intimacy, was at the Royal Academy in 1816. He alternated for some years between London and Edinburgh, with some excursions on the Continent, but in 1831 settled in London, and was elected associate of the Royal Academy in 1832; and he died in London of consumption in 1844. A very able executant, a good colourist, and a close student of character, he made his chief success as a portrait-painter, but he produced occasional figure subjects and landscapes, and executed some admirable copies of the old masters as well. He was also a good etcher. His portrait of his mother, and a portrait study, called "Summer," are in the National Gallery of Scotland, and his portrait of Sir Walter Scott is in the Scottish National Portrait Gallery.

See *Art in Scotland: its Origin and Progress*, by Robert Brydall (1889); *The Scottish School of Painting*, by William D. McKay, R.S.A. (1906).

GEDDES, JAMES LORRAINE (1827-1887), American soldier and writer, was born in Edinburgh, Scotland, on the 19th of March 1827. In his boyhood he was taken to Canada, but in 1843 he returned to Scotland; then studied at Calcutta in the military academy, entered the army, and after distinguishing himself in the Punjab campaign, returned to Canada, whence in 1857 he removed to Vinton, Iowa. In the American Civil War he served in the Federal army first as lieutenant-colonel and after February 1862 as colonel of volunteers, taking part in the fighting at Shiloh, Vicksburg and Corinth. He was captured at Shiloh and was imprisoned for a time at Madison, Ga., and in Libby prison, Richmond, Va., and in 1865 was brevetted brigadier-general of volunteers. He was principal of the College for the Blind at Vinton after the war, and until his death was connected with the Iowa College of Agriculture at Ames, being military instructor and cashier in 1870-1882, acting president in 1876-1877, librarian in 1877-1875, vice-president and professor of military tactics in 1880-1882, and treasurer in 1884-1887. He died at Ames on the 21st of February 1887. He wrote a number of war songs, including "The Soldiers' Battle Prayer" and "The Stars and Stripes."

GEDDES, SIR WILLIAM DUGUID (1828-1900), Scottish scholar and educationist, was born in Aberdeenshire. He was educated at Elgin academy and university and King's College, Aberdeen, and after having held various scholastic posts he was appointed in 1860 professor of Greek and in 1885 principal of the (united) university of Aberdeen. He was knighted in 1892. He died in Aberdeen on the 9th of February 1900. It is chiefly as a teacher that Geddes will be remembered, and in his enthusiastic and successful efforts to raise the standard of Greek at the Scottish universities he has been compared with the humanists of the Renaissance. Amongst other works he was the author of *A Greek Grammar* (1855; 17th edition, 1883; new and revised edition, 1893); a meritorious edition of the *Phaedo* of Plato (2nd ed., 1885); and *The Problem of the Homeric Poems* (1878), in which, while supporting Grote's view that the *Iliad* consisted of an original Achilleïs with insertions or additions by later hands, he maintains that these insertions are due to the author of the *Odyssey*.

GEDYMIN (d. 1342), grand-duke of Lithuania, was supposed by the earlier chroniclers to have been the servant of Witen, prince of Lithuania, but more probably he was Witen's younger brother and the son of Lutuwer, another Lithuanian prince. Gedymin inherited a vast domain, comprising Lithuania proper, Samogitia, Red Russia, Polotsk and Minsk; but these possessions were environed by powerful and greedy foes, the most dangerous of them being the Teutonic Knights and the Livonian knights of the Sword. The systematic raiding of Lithuania by the knights under the pretext of converting it had long since united all the Lithuanian tribes against the common enemy; but Gedymin aimed at establishing a dynasty which should make Lithuania not merely secure but mighty, and for this purpose he entered into direct diplomatic negotiations with the Holy See. At the end of 1322 he sent letters to Pope John XXII. soliciting his protection against the persecution of the knights, informing him of the privileges already granted to the Dominicans and the Franciscans in Lithuania for the preaching of God's Word, and desiring that legates should be sent to receive him also into the bosom of the church. On receiving a favourable reply from the Holy See, Gedymin issued circular letters, dated 25th of January 1325, to the principal Hanse towns, offering a free access into his domains to men of every order and profession from nobles and knights to tillers of the soil. The immigrants were to choose their own settlements and be governed by their own laws. Priests and monks were also invited to come and build churches at Vilna and Novogrodek. Similar letters were sent to the Wendish or Baltic cities, and to the bishops and landowners of Livonia and Esthonia. In short Gedymin, recognizing the superiority of western civilization, anticipated Ivan the Terrible and Peter the Great by throwing open the semi-savage Russian lands to influences of culture.

In October 1323 representatives of the archbishop of Riga, the bishop of Dorpat, the king of Denmark, the Dominican and Franciscan orders, and the Grand Master of the Teutonic Order assembled at Vilna, when Gedymin confirmed his promises and undertook to be baptized as soon as the papal legates arrived. A compact was then signed at Vilna, "in the name of the whole Christian World," between Gedymin and the delegates, confirming the promised privileges. But the christianizing of Lithuania was by no means to the liking of the Teutonic Knights, and they used every effort to nullify Gedymin's far-reaching design. This, unfortunately, it was easy to do. Gedymin's chief object was to save Lithuania from destruction at the hands of the Germans. But he was still a pagan reigning over semi-pagan lands; he was equally bound to his pagan kinsmen in Samogitia, to his orthodox subjects in Red Russia, and to his Catholic allies in Masovia. His policy, therefore, was necessarily tentative and ambiguous, and might very readily be misinterpreted. Thus his raid upon Dobrzyn, the latest acquisition of the knights on Polish soil, speedily gave them a ready weapon against him. The Prussian bishops, who were devoted to the knights, at a synod at Elbing questioned the authority of Gedymin's letters and denounced him as an enemy of the faith; his orthodox subjects reproached him with leaning towards the Latin heresy; while the pagan Lithuanians accused him of abandoning the ancient gods. Gedymin disentangled himself from his difficulties by repudiating his former promises; by refusing to receive the papal legates who arrived at Riga in September 1323; and by dismissing the Franciscans from his territories. These apparently retrogressive measures simply amounted to a statesmanlike recognition of the fact that the pagan element was still the strongest force in Lithuania, and could not yet be dispensed with in the coming struggle for nationality. At the same time Gedymin through his ambassadors privately informed the papal legates at Riga that his difficult position compelled him for a time to postpone his steadfast resolve of being baptized, and the legates showed their confidence in him by forbidding the neighbouring states to war against Lithuania for the next four years, besides ratifying the treaty made between Gedymin and the archbishop of Riga. Nevertheless in 1325 the Order, disregarding the censures of the church, resumed the war with Gedymin, who had in the meantime improved his position by an alliance with Wladislaus Lokietek, king of Poland, whose son Casimir now married Gedymin's daughter Aldona.

While on his guard against his northern foes, Gedymin from 1316 to 1340 was aggrandizing himself at the expense of the numerous Russian principalities in the south and east, whose incessant conflicts with each other wrought the ruin of them all. Here Gedymin's triumphal progress was irresistible; but the various stages of it are impossible to follow, the sources of its history being few and conflicting, and the date of every salient event exceedingly doubtful. One of his most important territorial accretions, the principality of Halicz-Vladimir, was obtained by the marriage of his son Lubart with the daughter of the Haliczian prince; the other, Kiev, apparently by conquest. Gedymin also secured an alliance with the grand-duchy of Muscovy by marrying his daughter, Anastasia, to the grand-duke Simeon. But he was strong enough to counterpoise the influence of Muscovy in northern Russia, and assisted the republic of Pskov, which acknowledged his overlordship, to break away from Great Novgorod. His internal administration bears all the marks of a wise ruler. He protected the Catholic as well as the orthodox clergy, encouraging them both to civilize his subjects; he raised the Lithuanian army to the highest state of efficiency then attainable; defended his borders with a chain of strong fortresses; and built numerous towns including Vilna, the capital (*c.* 1321). Gedymin died in the winter of 1342 of a wound received at the siege of Wielowa. He was married three times, and left seven sons and six daughters.

See Teodor Narbutt, *History of the Lithuanian nation* (Pol.) (Vilna, 1835); Antoni Prochaska, *On the Genuineness of the Letters of Gedymin* (Pol.) (Cracow, 1895); Vladimir Bonifatovich Antonovich, *Monograph concerning the History of Western and South-western Russia* (Rus.) (Kiev, 1885).

(R. N. B.)

GEE, THOMAS (1815-1898), Welsh Nonconformist preacher and journalist, was born at Denbigh on the 24th of January 1815. At the age of fourteen he went into his father's printing office, but continued to attend the grammar school in the afternoons. In 1837 he went to London to improve his knowledge of printing, and on his return to Wales in the following year ardently threw himself into literary, educational and religious work. Among his publications were the well-known quarterly magazine *Y Traethodydd* ("The Essayist"), *Gwyddoniadur Cymreig* ("Encyclopaedia Cambrensis"), and Dr Silvan Evans's *English-Welsh Dictionary* (1868), but his greatest achievement in this field was the newspaper *Baner Cymru* ("The Banner of Wales"), founded in 1857 and amalgamated with *Yr Amserau* ("The Times") two years later. This paper soon became an oracle in Wales, and played a great part in stirring up the nationalist movement in the principality. In educational matters he waged a long and successful struggle on behalf of undenominational schools and for the establishment of the intermediate school system. He was an enthusiastic advocate of church disestablishment, and had a historic newspaper duel with Dr John Owen (afterwards bishop of St David's) on this question. The Eisteddfod found in him a thorough friend and a wise counsellor. His commanding presence, mastery of diction, and resonant voice made him an effective platform

speaker. He was ordained to the Calvinistic Methodist ministry at Bala in 1847, and gave his time and talents ungrudgingly to Sunday school and temperance work. Throughout his life he believed in the itinerant unpaid ministry rather than in the settled pastorate. He died on the 28th of September 1898, and his funeral was the most imposing ever seen in North Wales.

GEEL, JACOB (1789-1862), Dutch scholar and critic, was born at Amsterdam on the 12th of November 1789. In 1823 he was appointed sub-librarian, and in 1833 chief librarian and honorary professor at Leiden, where he died on the 11th of November 1862. Geel materially contributed to the development of classical studies in Holland. He was the author of editions of Theocritus (1820), of the Vatican fragments of Polybius (1829), of the Ὀλυμπιακός of Dio Chrysostom (1840) and of numerous essays in the *Rheinisches Museum* and *Bibliotheca critica nova*, of which he was one of the founders. He also compiled a valuable catalogue of the MSS. in the Leiden library, wrote a history of the Greek sophists, and translated various German works into Dutch.

GEELONG, a seaport of Grant county, Victoria, Australia, situated on an extensive land-locked arm of Port Phillip known as Corio Bay, 45 m. by rail S.W. of Melbourne. Pop. of the city proper (1901) 12,399; with the adjacent boroughs of Geelong West, and Newton-and-Chilwell, 23,311. Geelong slopes to the bay on the north and to the Barwon river on the south, and its position in this respect, as well as the shelter it obtains from the Bellarine hills, renders it one of the healthiest towns in Victoria. As a manufacturing centre it is of considerable importance. The first woollen mill in the colony was established here, and the tweeds, cloths and other woollen fabrics of the town are noted throughout Australia. There are extensive tanneries, flour-mills and salt works, while at Fyansford, 3 m. distant, there are important cement works and paper-mills. The extensive vineyards in the neighbourhood of the town were destroyed under the Phylloxera Act, but replanting subsequently revived this industry. Corio Bay, a safe and commodious harbour, is entered by two channels across its bar, one of which has a depth of 23½ ft. There is extensive quayage, and the largest wool ships are able to load alongside the wharves, which are connected by rail with all parts of the colony. The facilities given for shipping wool direct to England from this port have caused a very extensive wool-broking trade to grow up in the town. The country surrounding Geelong is agricultural, but there are large limestone quarries east of the town, and in the Otway Forest, 23 m. distant, coal is worked. Geelong was incorporated in 1849.

GEESTEMÜNDE, a seaport town of Germany, in the Prussian province of Hanover, on the right bank of the Weser, at the mouth of the Geeste, which separates it from Bremerhaven, 32 m. N. from Bremen by rail. Pop. (1905) 23,625. The interest of the place is purely naval and commercial, its origin dating no farther back than 1857, when the construction of the harbour was begun. The great basin, which can accommodate large sea-going vessels, was completed in 1863, the petroleum basin was opened in 1874, and additional wharves have been constructed for the reception of vessels engaged in the fishing industry. The fish market of Geestemünde is the most important in Germany, and the auction hall practically determines the price of fish throughout the empire. The whole port is protected by powerful fortifications. Among the industrial establishments of the town are shipbuilding yards, foundries, engineering works and saw-mills.

GEFFCKEN, FRIEDRICH HEINRICH (1830-1896), German diplomatist and jurist, was born on the 9th of December 1830 at Hamburg, of which city his father was senator. After studying law at Bonn, Göttingen and Berlin, he was attached in 1854 to the Prussian legation at Paris. For ten years (1856-1866) he was the diplomatic representative of Hamburg in Berlin, first as chargé d'affaires, and afterwards as minister-resident, being afterwards transferred in a like capacity to London. Appointed in 1872 professor of constitutional history and public law in the reorganized university of Strassburg, Geffcken became in 1880 a member of the council of state of Alsace-Lorraine. Of too nervous a temperament to withstand the strain of the responsibilities of his position, he retired from public service in 1882, and lived henceforth mostly at Munich, where he died, suffocated by an accidental escape of gas into his bedchamber, on the 1st of May 1896. Geffcken was a man of great erudition and wide knowledge and of remarkable legal acumen, and from these qualities proceeded the personal influence he possessed. He was moreover a clear writer and made his mark as an essayist. He was one of the most trusted advisers of the Prussian crown prince, Frederick William (afterwards the emperor Frederick), and it was he (it is said, at Bismarck's suggestion) who drew up the draft of the New German federal constitution, which was submitted to the crown prince's headquarters at Versailles during the war of 1870-71. It was also Geffcken who assisted in framing the famous document which the emperor Frederick, on his accession to the throne in 1888, addressed to the chancellor. This memorandum gave umbrage, and on the publication by Geffcken in the *Deutsche Rundschau* (Oct. 1888) of extracts from the emperor Frederick's private diary during the war of 1870-71, he was, at Bismarck's instance, prosecuted for high treason. The Reichsgericht (supreme court), however, quashed the indictment, and Geffcken was liberated after being under arrest for three months. Publications of various kinds proceeded from his pen. Among these are *Zur Geschichte des orientalischen Krieges 1853-1856* (Berlin, 1881); *Frankreich, Russland und der Dreibund* (Berlin, 1894); and *Staat und Kirche* (1875), English translation by E.F.

Fairfax (1877). His writings on English history have been translated by S.J. Macmullan and published as *The British Empire, with essays on Prince Albert, Palmerston, Beaconsfield, Gladstone, and reform of the House of Lords* (1889).

GEFFROY, MATHIEU AUGUSTE (1820-1895), French historian, was born in Paris. After studying at the École Normale Supérieure he held history professorships at various lycées. His French thesis for the doctorate of letters, *Étude sur les pamphlets politiques et religieux de Milton* (1848), showed that he was attracted towards foreign history, a study for which he soon qualified himself by mastering the Germanic and Scandinavian languages. In 1851 he published a *Histoire des états scandinaves*, which is especially valuable for clear arrangement and for the trustworthiness of its facts. Later, a long stay in Sweden furnished him with valuable documents for a political and social history of Sweden and France at the end of the 18th century. In 1864 and 1865 he published in the *Revue des deux mondes* a series of articles on Gustavus III. and the French court, which were republished in book form in 1867. To the second volume he appended a critical study on *Marie Antoinette et Louis XVI apocryphes*, in which he proved, by evidence drawn from documents in the private archives of the emperor of Austria, that the letters published by Feuillet de Conches (*Louis XVI, Marie Antoinette et Madame Elisabeth*, 1864-1873) and Hunolstein (*Corresp. inédite de Marie Antoinette*, 1864) are forgeries. With the collaboration of Alfred von Arneth, director of the imperial archives at Vienna, he edited the *Correspondance secrète entre Marie-Thérèse et le comte de Mercy-Argenteau* (3 vols., 1874), the first account based on trustworthy documents of Marie Antoinette's character, private conduct and policy. The Franco-German War drew Geffroy's attention to the origins of Germany, and his *Rome et les Barbares: étude sur la Germanie de Tacite* (1874) set forth some of the results of German scholarship. He was then appointed to superintend the opening of the French school of archaeology at Rome, and drew up two useful reports (1877 and 1884) on its origin and early work. But his personal tastes always led him back to the study of modern history. When the Paris archives of foreign affairs were thrown open to students, it was decided to publish a collection of the instructions given to French ambassadors since 1648 (*Recueil des instructions données aux ambassadeurs et ministres de France depuis le traité de Westphalie*), and Geffroy was commissioned to edit the volumes dealing with Sweden (vol. ii., 1885) and Denmark (vol. xiii., 1895). In the interval he wrote *Madame de Maintenon d'après sa correspondance authentique* (2 vols., 1887), in which he displayed his penetrating critical faculty in discriminating between authentic documents and the additions and corrections of arrangers like La Beaumelle and Lavallée. His last works were an *Essai sur la formation des collections d'antiques de la Suède* and *Des institutions et des mœurs du paganisme scandinave: l'Islande avant le Christianisme*, both published posthumously. He died at Bièvre on the 16th of August 1895.

GEFLE, a seaport of Sweden on an inlet of the Gulf of Bothnia, chief town of the district (*län*) of Gefleborg, 112 m. N.N.W. of Stockholm by rail. Pop. (1900) 29,522. It is the chief port of the district of Kopparberg, with its iron and other mines and forests. The exports consist principally of timber and wood-pulp, iron and steel. The harbour, which has two entrances about 20 ft. deep, is usually ice-bound in mid-winter. Large vessels generally load in the roads at Gråberg, 6 m. distant. There are slips and shipbuilding yards, and a manufacture of sail-cloth. The town is an important industrial centre, having tobacco and leather factories, electrical and other mechanical works, and breweries. At Skutskär at the mouth of the Dal river are wood-pulp and saw mills, dealing with the large quantities of timber floated down the river; and there are large wood-yards in the suburb of Bomhus. Gefle was almost destroyed by fire in 1869, but was rebuilt in good style, and has the advantage of a beautiful situation. The principal buildings are a castle, founded by King John III. (1568-1592), but rebuilt later, a council-house erected by Gustavus III., who held a diet here in 1792, an exchange, and schools of commerce and navigation.

GEGENBAUR, CARL (1826-1903), German anatomist, was born on the 21st of August 1826 at Würzburg, the university of which he entered as a student in 1845. After taking his degree in 1851 he spent some time in travelling in Italy and Sicily, before returning to Würzburg as *Privatdocent* in 1854. In 1855 he was appointed extraordinary professor of anatomy at Jena, where after 1865 his fellow-worker, Ernst Haeckel, was professor of zoology, and in 1858 he became the ordinary professor. In 1873 he was appointed to Heidelberg, where he was professor of anatomy and director of the Anatomical Institute until his retirement in 1901. He died at Heidelberg on the 14th of June 1903. The work by which perhaps he is best known is his *Grundriss der vergleichenden Anatomie* (Leipzig, 1874; 2nd edition, 1878). This was translated into English by W.F. Jeffrey Bell (*Elements of Comparative Anatomy*, 1878), with additions by E. Ray Lankester. While recognizing the importance of comparative embryology in the study of descent, Gegenbaur laid stress on the higher value of comparative anatomy as the basis of the study of homologies, *i.e.* of the relations between corresponding parts in different animals, as, for example, the arm of man, the foreleg of the horse and the wing of a fowl. A distinctive piece of work was effected by him in 1871 in supplementing the evidence adduced by Huxley in refutation of the theory of the origin of the skull from expanded vertebrae, which, formulated independently by Goethe and Oken, had been championed by Owen. Huxley demonstrated that the skull is built up of cartilaginous pieces; Gegenbaur showed that "in the lowest (gristly) fishes, where hints of the original vertebrae might be most expected, the skull is an unsegmented gristly brain-box, and that in higher forms the vertebral nature of the skull cannot be maintained, since many of the bones, notably those along the top of the skull, arise in the skin." Other publications by Gegenbaur include a *Text-book of Human Anatomy* (Leipzig, 1883, new ed. 1903), the *Epiglottis* (1892) and *Comparative Anatomy of the Vertebrates in relation to the Invertebrates* (Leipzig, 2 vols., 1898-1901). In 1875 he founded the *Morphologisches Jahrbuch*, which he edited for many years. In 1901 he published a short autobiography under the title *Erlebtes und*

Erstrebtes.

See Fürbringer in *Heidelberger Professoren aus dem 19ten Jahrhundert* (Heidelberg, 1903).

GEGENSCHEIN (Ger. *gegen*, opposite, and *schein*, shine), an extremely faint luminescence of the sky, seen opposite the direction of the sun. Germany was the country in which it was first discovered and described. The English rendering "counterglow" is also given to it. Its faintness is such that it can be seen only by a practised eye under favourable conditions. It is invisible during the greater part of June, July, December and January, owing to its being then blotted out by the superior light of the Milky Way. It is also invisible during moonlight and near the horizon, and the neighbourhood of a bright star or planet may interfere with its recognition. When none of these unfavourable conditions supervene it may be seen at nearly any time when the air is clear and the depression of the sun below the horizon more than 20°. (See Zodiacal Light.)

GEIBEL, EMANUEL (1815-1884), German poet, was born at Lübeck on the 17th of October 1815, the son of a pastor in the city. He was originally intended for his father's profession, and studied at Bonn and Berlin, but his real interests lay not in theology but in classical and romance philology. In 1838 he accepted a tutorship at Athens, where he remained until 1840. In the same year he brought out, in conjunction with his friend Ernst Curtius, a volume of translations from the Greek. His first poems, *Zeitstimmen*, appeared in 1841; a tragedy, *König Roderich*, followed in 1843. In the same year he received a pension from the king of Prussia, which he retained until his invitation to Munich by the king of Bavaria in 1851 as honorary professor at the university. In the interim he had produced *König Sigurds Brautfahrt* (1846), an epic, and *Juniuslieder* (1848, 33rd ed. 1901), lyrics in a more spirited and manlier style than his early poems. A volume of *Neue Gedichte*, published at Munich in 1857, and principally consisting of poems on classical subjects, denoted a further considerable advance in objectivity, and the series was worthily closed by the *Spätherbstblätter*, published in 1877. He had quitted Munich in 1869 and returned to Lübeck, where he died on the 6th of April 1884. His works further include two tragedies, *Brunhild* (1858, 5th ed. 1890), and *Sophonisbe* (1869), and translations of French and Spanish popular poetry. Beginning as a member of the group of political poets who heralded the revolution of 1848, Geibel was also the chief poet to welcome the establishment of the Empire in 1871. His strength lay not, however, in his political songs but in his purely lyric poetry, such as the fine cycle *Ada* and his still popular love-songs. He may be regarded as the leading representative of German lyric poetry between 1848 and 1870.

Geibel's *Gesammelte Werke* were published in 8 vols. (1883, 4th ed. 1906); his *Gedichte* have gone through about 130 editions. An excellent selection in one volume appeared in 1904. For biography and criticism, see K. Goedeke, *E. Geibel* (1869); W. Scherer's address on Geibel (1884); K.T. Gaedertz, *Geibel-Denkwurdigkeiten* (1886); C.C.T. Litzmann, *E. Geibel, aus Erinnerungen, Briefen und Tagebüchern* (1887), and biographies by C. Leimbach (2nd ed., 1894), and K.T. Gaedertz (1897).

GEIGE (O. Fr. *gigue*, *gige*; O. Ital. and Span. *giga*; Prov. *gigua*; O. Dutch *ghighe*), in modern German the violin; in medieval German the name applied to the first stringed instruments played with a bow, in contradistinction to those whose strings were plucked by fingers or plectrum such as the cithara, rotta and fidula, the first of these terms having been very generally used to designate various instruments whose strings were plucked. The name *gîge* in Germany, of which the origin is uncertain,[1] and its derivatives in other languages, were in the middle ages applied to rebecs having fingerboards. As the first bowed instruments in Europe were, as far as we know, those of the rebab type, both boat-shaped and pear-shaped, it seems probable that the name clung to them long after the bow had been applied to other stringed instruments derived from the cithara, such as the fiddle (videl) or vielle. In the romances of the 12th and 13th centuries the *gîge* is frequently mentioned, and generally associated with the rotta. Early in the 16th century we find definite information concerning the Geige in the works of Sebastian Virdung (1511), Hans Judenkünig (1523), Martin Agricola (1532), Hans Gerle (1533); and from the instruments depicted, of two distinct types and many varieties, it would appear that the principal idea attached to the name was still that of the bow used to vibrate the strings. Virdung qualifies the word *Geige* with *Klein* (small) and *Gross* (large), which do not represent two sizes of the same instrument but widely different types, also recognized by Agricola, who names three or four sizes of each, discant, alto, tenor and bass. Virdung's *Klein Geige* is none other than the rebec with two C-shaped soundholes and a raised fingerboard cut in one piece with the vaulted back and having a separate flat soundboard glued over it, a change rendered necessary by the arched bridge. Agricola's *Klein Geige* with three strings was of a totally different construction, having ribs and wide incurvations but no bridge; there was a rose soundhole near the tailpiece and two C-shaped holes in the shoulders. Agricola (*Musica instrumentalis*) distinctly mentions three kinds of *Geigen* with three, four and five strings. From him we learn that only one position was as yet used on these instruments, one or two higher notes being occasionally obtained by sliding the little finger along. A century later Agricola's *Geige* was regarded as antiquated by Praetorius, who reproduces one of the bridgeless ones with five strings, a rose and two C-shaped soundholes, and calls it an old fiddle; under *Geige* he gives the violins.

(K. S.)

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1 The words *gîge*, *gîgen*, *geic* appear suddenly in the M. H. German of the 12th century, and thence passed apparently into the Romance languages, though some would reverse the process (*e.g.* Weigand, *Deutsches Wörterbuch*). An elaborate argument in the *Deutsches Wörterbuch* of J. and W. Grimm (Leipzig, 1897) connects the word with an ancient common Teut. root *gag*—meaning to sway to and fro, as preserved in numerous forms: *e.g.* M.H.G *gagen*, *gugen*, "to sway to and fro"

(*gugen*, *gagen*, the rocking of a cradle), the Swabian *gigen*, *gagen*, in the same sense, the Tirolese *gaiggern*, to sway, doubt, or the old Norse *geiga*, to go astray or crooked. The reference is to the swaying motion of the violin bow. The English "jig" is derived from *gîge* through the O. Fr. *gigue* (in the sense of a stringed instrument); the modern French gigue (a dance) is the English "jig" re-imported (Hatzfeld and Darmesteter, *Dictionnaire*). This opens up another possibility, of the origin of the name of the instrument in the dance which it accompanied.

(W. A. P.)

GEIGER, ABRAHAM (1810-1874), Jewish theologian and orientalist, was born at Frankfort-on-Main on the 24th of May 1810, and educated at the universities of Heidelberg and Bonn. As a student he distinguished himself in philosophy and in philology, and at the close of his course wrote on the relations of Judaism and Mahommedanism a prize essay which was afterwards published in 1833 under the title *Was hat Mohammed aus dem Judentum aufgenommen?* (English trans. *Judaism and Islam*, Madras, 1898). In November 1832 he went to Wiesbaden as rabbi of the synagogue, and became in 1835 one of the most active promoters of the *Zeitschrift für jüdische Theologie* (1835-1839 and 1842-1847). From 1838 to 1863 he lived in Breslau, where he organized the reform movement in Judaism and wrote some of his most important works, including *Lehr- und Lesebuch zur Sprache der Mischna* (1845), *Studien* from Maimonides (1850), translation into German of the poems of Juda ha-Levi (1851), and *Urschrift und Übersetzungen der Bibel in ihrer Abhängigkeit von der innern Entwickelung des Judentums* (1857). The last-named work attracted little attention at the time, but now enjoys a great reputation as a new departure in the methods of studying the records of Judaism. The *Urschrift* has moreover been recognized as one of the most original contributions to biblical science. In 1863 Geiger became head of the synagogue of his native town, and in 1870 he removed to Berlin, where, in addition to his duties as chief rabbi, he took the principal charge of the newly established seminary for Jewish science. The *Urschrift* was followed by a more exhaustive handling of one of its topics in *Die Sadducäer und Pharisäer* (1863), and by a more thorough application of its leading principles in an elaborate history of Judaism (*Das Judentum und seine Geschichte*) in 1865-1871. Geiger also contributed frequently on Hebrew, Samaritan and Syriac subjects to the *Zeitschrift der deutschen morgenländischen Gesellschaft*, and from 1862 until his death (on the 23rd of October 1874) he was editor of a periodical entitled *Jüdische Zeitschrift für Wissenschaft und Leben*. He also published a Jewish prayerbook (*Israëlitisches Gebetbuch*) and a variety of minor monographs on historical and literary subjects connected with the fortunes of his people.

(I. A.)

An *Allgemeine Einleitung* and five volumes of *Nachgelassene Schriften* were edited in 1875 by his son Ludwig Geiger (b. 1848), who in 1880 became extraordinary professor in the university of Berlin. Ludwig Geiger published a large number of biographical and literary works and made a special study of German humanism. He edited the *Goethe-Jahrbuch* from 1880, *Vierteljahrsschrift für Kultur und Litteratur der Renaissance* (1885-1886), *Zeitschr. für die Gesch. der Juden im Deutschland* (1886-1891), *Zeitschr. für vergleichende Litteraturgeschichte und Renaissance-Litteratur* (1887-1891). Among his works are *Johann Reuchlin, sein Leben und seine Werke* (Leipzig, 1871); and *Johann Reuchlin's Briefwechsel* (Tübingen, 1875); *Renaissance und Humanismus in Italien und Deutschland* (1882, 2nd ed. 1901); *Gesch. des geistigen Lebens der preussischen Hauptstadt* (1892-1894); *Berlin's geistiges Leben* (1894-1896).

See also J. Derenbourg in *Jüd. Zeitschrift*, xi. 299-308; E. Schrieber, *Abraham Geiger als Reformator des Judentums* (1880), art. (with portrait) in *Jewish Encyclopedia*.

Abraham Geiger's nephew Lazarus Geiger (1829-1870), philosopher and philologist, born at Frankfort-on-Main, was destined to commerce, but soon gave himself up to scholarship and studied at Marburg, Bonn and Heidelberg. From 1861 till his sudden death in 1870 he was professor in the Jewish high school at Frankfort. His chief aim was to prove that the evolution of human reason is closely bound up with that of language. He further maintained that the origin of the Indo-Germanic language is to be sought not in Asia but in central Germany. He was a convinced opponent of rationalism in religion. His chief work was his *Ursprung und Entwickelung der menschlichen Sprache und Vernunft* (vol. i., Stuttgart, 1868), the principal results of which appeared in a more popular form as *Der Ursprung der Sprache* (Stuttgart, 1869 and 1878). The second volume of the former was published in an incomplete form (1872, 2nd ed. 1899) after his death by his brother Alfred Geiger, who also published a number of his scattered papers as *Zur Entwickelung der Menschheit* (1871, 2nd ed. 1878; Eng. trans. D. Asher, *Hist. of the Development of the Human Race*, Lond., 1880).

See L.A. Rosenthal, *Laz. Geiger: seine Lehre vom Ursprung d. Sprache und Vernunft und sein Leben* (Stuttgart, 1883); E. Peschier, *L. Geiger, sein Leben und Denken* (1871); J. Keller, *L. Geiger und d. Kritik d. Vernunft* (Wertheim, 1883) and *Der Ursprung d. Vernunft* (Heidelberg, 1884).

GEIJER, ERIK GUSTAF (1783-1847), Swedish historian, was born at Ransäter in Värmland, on the 12th of January 1783, of a family that had immigrated from Austria in the 17th century. He was educated at the university of Upsala, where in 1803 he carried off the Swedish Academy's great prize for his *Äreminne öfver Sten Sture den äldre*. He graduated in 1806, and in 1810 returned from a year's residence in England to become *docent* in his university. Soon afterwards he accepted a post in the public record office at Stockholm, where, with some friends, he founded the "Gothic Society," to whose organ *Iduna* he contributed a number of prose essays and the songs *Manhem*, *Vikingen*, *Den siste kämpen*, *Den siste skalden*, *Odalbonden*, *Kolargossen*, which he set to music. About the same time he issued a volume of hymns, of which several are inserted in the Swedish Psalter.

Geijer's lyric muse was soon after silenced by his call to be assistant to Erik Michael Fant, professor of history at Upsala, whom he succeeded in 1817. In 1824 he was elected a member of the Swedish Academy. A single volume of a great projected work, *Svea Rikes Häfder*, itself a masterly critical examination of the sources of Sweden's legendary history, appeared in 1825. Geijer's researches in its preparation had severely strained his health, and he went the same year on a tour through Denmark and part of Germany, his impressions from which are recorded in his *Minnen*. In 1832-1836 he published three volumes of his *Svenska folkets historia* (Eng. trans. by J.H. Turner,

1845), a clear view of the political and social development of Sweden down to 1654. The acute critical insight, just thought, and finished historical art of these incomplete works of Geijer entitle him to the first place among Swedish historians. His chief other historical and political writings are his *Teckning af Sveriges tillsånd* 1718-1772 (Stockholm, 1838), and *Feodalism och republikanism, ett bidrag till Samhällsförfattningens historia* (1844), which led to a controversy with the historian Anders Fryxell regarding the part played in history by the Swedish aristocracy. Geijer also edited, with the aid of J.H. Schröder, a continuation of Fant's *Scriptores rerum svecicarum medii aevi* (1818-1828), and, by himself, Thomas Thorild's *Samlade skrifter* (1819-1825), and *Konung Gustaf III.*'s *efterlemnade Papper* (4 vols., 1843-1846). Geijer's academic lectures, of which the last three, published in 1845 under the title *Om vår tids inre samhällsforhållanden, i synnerhet med afseende på Fäderneslandet*, involved him in another controversy with Fryxell, but exercised a great influence over his students, who especially testified to their attachment after the failure of a prosecution against him for heresy. A number of his extempore lectures, recovered from notes, were published in 1856. He also wrote a life of Charles XIV. (Stockholm, 1844). Failing health forced Geijer to resign his chair in 1846, after which he removed to Stockholm for the purpose of completing his *Svenska folkets historia*, and died there on the 23rd of April 1847. His *Samlade skrifter* (13 vols., 1840-1855; new ed., 1873-1877) include a large number of philosophical and political essays contributed to reviews, particularly to *Litteraturbladet* (1838-1839), a periodical edited by himself, which attracted great attention in its day by its pronounced liberal views on public questions, a striking contrast to those he had defended in 1828-1830, when, as again in 1840-1841, he represented Upsala University in the Swedish diet. His poems were collected and published as *Skaldestycken* (Upsala, 1835 and 1878).

Geijer's style is strong and manly. His genius bursts out in sudden flashes that light up the dark corners of history. A few strokes, and a personality stands before us instinct with life. His language is at once the scholar's and the poet's; with his profoundest thought there beats in unison the warmest, the noblest, the most patriotic heart. Geijer came to the writing of history fresh from researches in the whole field of Scandinavian antiquity, researches whose first-fruits are garnered in numerous articles in *Iduna*, and his masterly treatise *Om den gamla nordiska folkvisan*, prefixed to the collection of Svenska folkvisor which he edited with A.A. Afzelius (3 vols., 1814-1816). The development of freedom is the idea that gives unity to all his historical writings.

For Geijer's biography, see his own *Minnen* (1834), which contains copious extracts from his letters and diaries; B.E. Malmström, *Minnestal öfver E.G. Geijer*, addressed to the Upsala students (June 6, 1848), and printed among his *Tal och esthetiska afhandlingar* (1868), and *Grunddragen af Svenska vitterhetens häfder* (1866-1868); and S.A. Hollander, *Minne af E.G. Geijer* (Örebro, 1869). See also lives of Geijer by J. Hellstenius (Stockholm, 1876) and J. Niekson (Odense, 1902).

GEIKIE, SIR ARCHIBALD (1835-), Scottish geologist, was born at Edinburgh on the 28th of December 1835. He was educated at the high school and university of Edinburgh, and in 1855 was appointed an assistant on the Geological Survey. Wielding the pen with no less facility than the hammer, he inaugurated his long list of works with *The Story of a Boulder; or, Gleanings from the Note-Book of a Geologist* (1858). His ability at once attracted the notice of his chief, Sir Roderick Murchison, with whom he formed a lifelong friendship, and whose biographer he subsequently became. With Murchison some of his earliest work was done on the complicated regions of the Highland schists; and the small geological map of Scotland published in 1862 was their joint work: a larger map was issued by Geikie in 1892. In 1863 he published an important essay "On the Phenomena of the Glacial Drift of Scotland," *Trans. Geol. Soc. Glasgow*, in which the effects of ice action in that country were for the first time clearly and connectedly delineated. In 1865 appeared Geikie's *Scenery of Scotland* (3rd edition, 1901), which was, he claimed, "the first attempt to elucidate in some detail the history of the topography of a country." In the same year he was elected F.R.S. At this time the Edinburgh school of geologists—prominent among them Sir Andrew Ramsay, with his *Physical Geology and Geography of Great Britain*—were maintaining the supreme importance of denudation in the configuration of land-surfaces, and particularly the erosion of valleys by the action of running water. Geikie's book, based on extensive personal knowledge of the country, was an able contribution to the doctrines of the Edinburgh school, of which he himself soon began to rank as one of the leaders.

In 1867, when a separate branch of the Geological Survey was established for Scotland, he was appointed director. On the foundation of the Murchison professorship of geology and mineralogy at the university of Edinburgh in 1871, he became the first occupant of the chair. These two appointments he continued to hold till 1881, when he succeeded Sir Andrew Ramsay in the joint offices of director-general of the Geological Survey of the United Kingdom and director of the museum of practical geology, London, from which he retired in February 1901. A feature of his tenure of office was the impetus given to microscopic petrography, a branch of geology to which he had devoted special study, by a splendid collection of sections of British rocks. Later he wrote two important and interesting Survey Memoirs, *The Geology of Central and Western Fife and Kinross* (1900), and *The Geology of Eastern Fife* (1902).

From the outset of his career, when he started to investigate the geology of Skye and other of the Western Isles, he took a keen interest in volcanic geology, and in 1871 he brought before the Geological Society of London an outline of the Tertiary volcanic history of Britain. Many difficult problems, however, remained to be solved. Here he was greatly aided by his extensive travels, not only throughout Europe, but in western America. While the canyons of the Colorado confirmed his long-standing views on erosion, the eruptive regions of Wyoming, Montana and Utah supplied him with valuable data in explanation of volcanic phenomena. The results of his further researches were given in an elaborate and charmingly written essay on "The History of Volcanic Action during the Tertiary Period in the British Isles," *Trans. Roy. Soc. Edin.*, (1888). His mature views on volcanic geology were given to the world in his presidential addresses to the Geological Society in 1891 and 1892, and afterwards embodied in his great work on *The Ancient Volcanoes of Great Britain* (1897). Other results of his travels are collected in his *Geological Sketches at Home and Abroad* (1882).

His experience as a field geologist resulted in an admirable text-book, *Outlines of Field Geology* (5th edition, 1900). After editing and practically re-writing Jukes's *Student's Manual of Geology* in 1872, he published in 1882 a *Text-Book* and in 1886 a *Class-Book* of geology, which have taken rank as standard works of their kind. A fourth edition of his *Text-Book*, in two vols., was issued in 1903. His writings are marked in a high degree by charm of style and power of vivid description. His literary ability has given him peculiar qualifications as a writer of scientific

biography, and the *Memoir of Edward Forbes* (with G. Wilson), and those of his old chiefs, Sir R.I. Murchison (2 vols., 1875) and Sir Andrew Crombie Ramsay (1895), are models of what such works should be. His *Founders of Geology* consists of the inaugural course of Lectures (founded by Mrs G.H. Williams) at Johns Hopkins University, Baltimore, delivered in 1897. In 1897 he issued an admirable *Geological Map of England and Wales, with Descriptive Notes*. In 1898 he delivered the Romanes Lectures, and his address was published under the title of *Types of Scenery and their Influence on Literature*. The study of geography owes its improved position in Great Britain largely to his efforts. Among his works on this subject is *The Teaching of Geography* (1887). His *Scottish Reminiscences* (1904) and *Landscape in History and other Essays* (1905) are charmingly written and full of instruction. He was foreign secretary of the Royal Society from 1890 to 1894, joint secretary from 1903 to 1908, president in 1909, president of the Geological Society in 1891 and 1892, and president of the British Association, 1892. He received the honour of knighthood in 1891.

GEIKIE, JAMES (1839-), Scottish geologist, younger brother of Sir Archibald Geikie, was born at Edinburgh on the 23rd of August 1839. He was educated at the high school and university of Edinburgh. He served on the Geological Survey from 1861 until 1882, when he succeeded his brother as Murchison professor of geology and mineralogy at the university of Edinburgh. He took as his special subject of investigation the origin of surface-features, and the part played in their formation by glacial action. His views are embodied in his chief work, *The Great Ice Age and its Relation to the Antiquity of Man* (1874; 3rd ed., 1894). He was elected F.R.S. in 1875. James Geikie became the leader of the school that upholds the all-important action of land-ice, as against those geologists who assign chief importance to the work of pack-ice and icebergs. Continuing this line of investigation in his *Prehistoric Europe* (1881), he maintained the hypothesis of five inter-Glacial periods in Great Britain, and argued that the palaeolithic deposits of the Pleistocene period were not post- but inter- or pre-Glacial. His *Fragments of Earth Lore: Sketches and Addresses, Geological and Geographical* (1893) and *Earth Sculpture* (1898) are mainly concerned with the same subject. His *Outlines of Geology* (1886), a standard text-book of its subject, reached its third edition in 1896; and in 1905 he published an important manual on *Structural and Field Geology*. In 1887 he displayed another side of his activity in a volume of *Songs and Lyrics by H. Heine and other German Poets, done into English Verse*. From 1888 he was honorary editor of the *Scottish Geographical Magazine*.

GEIKIE, WALTER (1795-1837), Scottish painter, was born at Edinburgh on the 9th of November 1795. In his second year he was attacked by a nervous fever by which he permanently lost the faculty of hearing, but through the careful attention of his father he was enabled to obtain a good education. Before he had the advantage of the instruction of a master he had attained considerable proficiency in sketching both figures and landscapes from nature, and in 1812 he was admitted into the drawing academy of the board of Scottish manufactures. He first exhibited in 1815, and was elected an associate of the Royal Scottish Academy in 1831, and a fellow in 1834. He died on the 1st of August 1837, and was interred in the Greyfriars churchyard, Edinburgh. Owing to his want of feeling for colour, Geikie was not a successful painter in oils, but he sketched in India ink with great truth and humour the scenes and characters of Scottish lower-class life in his native city. A series of etchings which exhibit very high excellence were published by him in 1829-1831, and a collection of eighty-one of these was republished posthumously in 1841, with a biographical introduction by Sir Thomas Dick Lauder, Bart.

GEILER (or GEYLER) **VON KAISERSBERG, JOHANN** (1445-1510), "the German Savonarola," one of the greatest of the popular preachers of the 15th century, was born at Schaffhausen on the 16th of March 1445, but from 1448 passed his childhood and youth at Kaisersberg in Upper Alsace, from which place his current designation is derived. In 1460 he entered the university of Freiburg in Baden, where, after graduation, he lectured for some time on the *Sententiae* of Peter Lombard, the commentaries of Alexander of Hales, and several of the works of Aristotle. A living interest in theological subjects, awakened by the study of John Gerson, led him in 1471 to the university of Basel, a centre of attraction to some of the most earnest spirits of the time. Made a doctor of theology in 1475, he received a professorship at Freiburg in the following year; but his tastes, no less than the spirit of the age, began to incline him more strongly to the vocation of a preacher, while his fervour and eloquence soon led to his receiving numerous invitations to the larger towns. Ultimately he accepted in 1478 a call to the cathedral of Strassburg, where he continued to work with few interruptions until within a short time of his death on the 10th of March 1510. The beautiful pulpit erected for him in 1481 in the nave of the cathedral, when the chapel of St Lawrence had proved too small, still bears witness to the popularity he enjoyed as a preacher in the immediate sphere of his labours, and the testimonies of Sebastian Brant, Beatus Rhenanus, Johann Reuchlin, Melanchthon and others show how great had been the influence of his personal character. His sermons—bold, incisive, denunciatory, abounding in quaint illustrations and based on texts by no means confined to the Bible,—taken down as he spoke them, and circulated (sometimes without his knowledge or consent) by his friends, told perceptibly on the German thought as well as on the German speech of his time.

Among the many volumes published under his name only two appear to have had the benefit of his revision, namely, *Der Seelen Paradies von waren und volkomnen Tugenden*, and that entitled *Das irrig Schaf*. Of the rest, probably the best-known is a series of lectures on his friend Seb. Brant's work, *Das Narrenschiff* or the *Navicula* or *Speculum fatuorum*, of which an edition was published at Strassburg in 1511 under the following title:—*Navicula sive speculum fatuorum praestantissimi sacrarum literarum doctoris Joannis Geiler Keysersbergii*.

See F.W. von Ammon, *Geyler's Leben, Lehren und Predigten* (1826); L. Dacheux, *Un Réformateur catholique à la fin du XV^e siècle*, J.G. de K. (Paris, 1876); R. Cruel, *Gesch. der deutschen Predigt*, pp. 538-576 (1879); P. de Lorenzi,

Geiler's ausgewählte Schriften (4. vols., 1881); T.M. Lindsay, *History of the Reformation*, i. 118 (1906); and G. Kawerau in Herzog-Hauck, *Realencyklopädie*, vi. 427.

GEINITZ, HANS BRUNO (1814-1900), German geologist, was born at Altenburg, the capital of the duchy of Saxe-Altenburg, on the 16th of October 1814. He was educated at the universities of Berlin and Jena, and gained the foundations of his geological knowledge under F.A. Quenstedt. In 1837 he took the degree of Ph.D. with a thesis on the Muschelkalk of Thuringia. In 1850 he became professor of geology and mineralogy in the Royal Polytechnic School at Dresden, and in 1857 he was made director of the Royal Mineralogical and Geological Museum; he held these posts until 1894. He was distinguished for his researches on the Carboniferous and Cretaceous rocks and fossils of Saxony, and in particular for those relating to the fauna and flora of the Permian or Dyas formation. He described also the graptolites of the local Silurian strata; and the flora of the Coal-formation of Altai and Nebraska. From 1863 to 1878 he was one of the editors of the *Neues Jahrbuch*. He was awarded the Murchison medal by the Geological Society of London in 1878. He died at Dresden on the 28th of January 1900. His son Franz Eugene Geinitz (b. 1854), professor of geology in the university of Rostock, became distinguished for researches on the geology of Saxony, Mecklenburg, &c.

H.B. Geinitz's publications were *Das Quadersandsteingebirge oder Kreidegebirge in Deutschland* (1849-1850); *Die Versteinerungen der Steinkohlenformation in Sachsen* (1855); *Dyas, oder die Zechsteinformation und das Rothliegende* (1861-1862); *Das Elbthalgebirge in Sachsen* (1871-1875).

GEISHA (a Chino-Japanese word meaning "person of pleasing accomplishments"), strictly the name of the professional dancing and singing girls of Japan. The word is, however, often loosely used for the girls and women inhabiting Shin Yoshiwara, the prostitutes' quarter of Tokyo. The training of the true Geisha or singing girl, which includes lessons in dancing, begins often as early as her seventh year. Her apprenticeship over, she contracts with her employer for a number of years, and is seldom able to reach independence except by marriage. There is a capitation fee of two *yen* per month on the actual singing girls, and of one *yen* on the apprentices.

See Jukichi Inouye, *Sketches of Tokyo Life*.

GEISLINGEN, a town of Germany in the kingdom of Württemberg, on the Thierbach, 38 m. by rail E.S.E. of Stuttgart. Pop. (1905) 7050. It has shops for the carving and turning of bone, ivory, wood and horn, besides iron-works, machinery factories, glass-works, brewing and bleaching works, &c. The church of St Mary contains wood-carving by Jörg Syrlin the Younger. Above the town lie the ruins of the castle of Helfenstein, which was destroyed in 1552. Having been for a few years in the possession of Bavaria, the town passed to Württemberg in 1810.

See Weitbrecht, *Wanderungen durch Geislingen und seine Umgebung* (Stuttgart, 1896).

GEISSLER, HEINRICH (1814-1879), German physicist, was born at the village of Igelshieb in Saxe-Meiningen on the 26th of May 1814 and was educated as a glass-blower. In 1854 he settled at Bonn, where he speedily gained a high reputation for his skill and ingenuity of conception in the fabrication of chemical and physical apparatus. With Julius Plücker, in 1852, he ascertained the maximum density of water to be at 3.8° C. He also determined the coefficient of expansion for ice between −24° and −7°, and for water freezing at 0°. In 1869, in conjunction with H.P.J. Vogelsang, he proved the existence of liquid carbon dioxide in cavities in quartz and topaz, and later he obtained amorphous from ordinary phosphorus by means of the electric current. He is best known as the inventor of the sealed glass tubes which bear his name, by means of which are exhibited the phenomena accompanying the discharge of electricity through highly rarefied vapours and gases. Among other apparatus contrived by him were a vaporimeter, mercury air-pump, balances, normal thermometer, and areometer. From the university of Bonn, on the occasion of its jubilee in 1868, he received the honorary degree of doctor of philosophy. He died at Bonn on the 24th of January 1879.

See A.W. Hofmann, *Ber. d. deut. chem. Ges.* p. 148 (1879).

GELA, a city of Sicily, generally and almost certainly identified with the modern Terranova (*q.v.*). It was founded by Cretan and Rhodian colonists in 688 B.C., and itself founded Acragas (see Agrigentum) in 582 B.C. It also had a treasure-house at Olympia. The town took its name from the river to the east (Thucydides vi. 2), which in turn was so called from its winter frost (γέλα in the Sicel dialect; cf. Lat. *gelidus*). The Rhodian settlers called it Lindioi (see Lindus). Gela enjoyed its greatest prosperity under Hippocrates (498-491 B.C.), whose dominion extended over a

considerable part of the island. Gelon, who seized the tyranny on his death, became master of Syracuse in 485 B.C., and transferred his capital thither with half the inhabitants of Gela, leaving his brother Hiero to rule over the rest. Its prosperity returned, however, after the expulsion of Thrasybulus in 466 B.C.,[1] but in 405 it was besieged by the Carthaginians and abandoned by Dionysius' order, after his failure (perhaps due to treachery) to drive the besiegers away (E.A. Freeman, *Hist. of Sic.* iii. 562 seq.). The inhabitants later returned and rebuilt the town, but it never regained its position. In 311 B.C. Agathocles put to death 5000 of its inhabitants; and finally, after its destruction by the Mamertines about 281 B.C., Phintias of Agrigentum transferred the remainder to the new town of Phintias (now Licata, *q.v.*). It seems that in Roman times they still kept the name of Gelenses or Geloi in their new abode (Th. Mommsen in *C.I.L.* x., Berlin, 1883, p. 737).

(T. As.)

1 Aeschylus died there in 456 B.C.

GELADA, the Abyssinian name of a large species of baboon, differing from the members of the genus *Papio* (see Baboon) by the nostrils being situated some distance above the extremity of the muzzle, and hence made the type of a separate genus, under the name of *Theropithecus gelada*. In the heavy mantle of long brown hair covering the fore-quarters of the old males, with the exception of the bare chest, which is reddish flesh-colour, the gelada recalls the Arabian baboon (*Papio hamadryas*), and from this common feature it has been proposed to place the two species in the same genus. The gelada inhabits the mountains of Abyssinia, where, like other baboons, it descends in droves to pillage cultivated lands. A second species, or race, *Theropithecus obscurus*, distinguished by its darker hairs and the presence of a bare flesh-coloured ring round each eye, inhabits the eastern confines of Abyssinia.

(R. L.*)

GELASIUS, the name of two popes.

Gelasius I., pope from 492 to 496, was the successor of Felix III. He confirmed the estrangement between the Eastern and Western churches by insisting on the removal of the name of Acacius, bishop of Constantinople, from the diptychs. He is the author of *De duabus in Christo naturis adversus Eutychen et Nestorium*. A great number of his letters has also come down to us. His name has been attached to a *Liber Sacramentorum* anterior to that of St Gregory, but he can have composed only certain parts of it. As to the so-called *Decretum Gelasii de libris recipiendis et non recipiendis*, it also is a compilation of documents anterior to Gelasius, and it is difficult to determine Gelasius's contributions to it. At all events, as we know it, it is of Roman origin, and 6th-century or later.

(L. D.*)

Gelasius II. (Giovanni Coniulo), pope from the 24th of January 1118 to the 29th of January 1119, was born at Gaeta of an illustrious family. He became a monk of Monte Cassino, was taken to Rome by Urban II., and made chancellor and cardinal-deacon of Sta Maria in Cosmedin. Shortly after his unanimous election to succeed Paschal II. he was seized by Cencius Frangipane, a partisan of the emperor Henry V., but freed by a general uprising of the Romans in his behalf. The emperor drove Gelasius from Rome in March, pronounced his election null and void, and set up Burdinus, archbishop of Braga, as antipope under the name of Gregory VIII. Gelasius fled to Gaeta, where he was ordained priest on the 9th of March and on the following day received episcopal consecration. He at once excommunicated Henry and the antipope and, under Norman protection, was able to return to Rome in July; but the disturbances of the imperialist party, especially of the Frangipani, who attacked the pope while celebrating mass in the church of St Prassede, compelled Gelasius to go once more into exile. He set out for France, consecrating the cathedral of Pisa on the way, and arrived at Marseilles in October. He was received with great enthusiasm at Avignon, Montpellier and other cities, held a synod at Vienne in January 1119, and was planning to hold a general council to settle the investiture contest when he died at Cluny. His successor was Calixtus II.

His letters are in J.P. Migne, *Patrol. Lat.* vol. 163. The original life by Pandulf is in J.M. Watterich, *Pontif. Roman. vitae* (Leipzig, 1862), and there is an important digest of his bulls and official acts in Jaffé-Wattenbach, *Regesta pontif. Roman.* (1885-1888).

See J. Langen, *Geschichte der römischen Kirche von Gregor VII. bis Innocenz III.* (Bonn, 1893); F. Gregorovius, *Rome in the Middle Ages*, vol. 4, trans. by Mrs G.W. Hamilton (London, 1896); A. Wagner, *Die unteritalischen Normannen und das Papsttum, 1086-1150* (Breslau, 1885); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit*, Bd. iii. (Brunswick, 1890); G. Richter, *Annalen der deutschen Geschichte im Mittelalter*, iii. (Halle, 1898); H.H. Milman, *Latin Christianity*, vol. 4 (London, 1899).

(C. H. Ha.)

GELATI, a Georgian monastery in Russian Transcaucasia, in the government of Kutais, 11 m. E. of the town of Kutais, standing on a rocky spur (705 ft. above sea-level) in the valley of the Rion. It was founded in 1109 by the Georgian king David the Renovator. The principal church, a sandstone cathedral, dates from the end of the preceding century, and contains the royal crown of the former Georgian kingdom of Imeretia, besides ancient MSS., ecclesiological furniture, and fresco portraits of the kings of Imeretia. Here also, in a separate chapel, is the tomb of David the Renovator (1089-1125) and part of the iron gate of the town of Ganja (now Elisavetpol), which that monarch brought away as a trophy of his capture of the place.

GELATIN, or Gelatine, the substance which passes into solution when "collagen," the ground substance of bone, cartilage and white fibrous tissue, is treated with boiling water or dilute acids. It is especially characterized by its property of forming a jelly at ordinary temperature, becoming liquid when heated, and resolidifying to a jelly on cooling. The word is derived from the Fr. *gélatine*, and Ital. *gelatina*, from the Lat. *gelata*, that which is frozen, congealed or stiff. It is, therefore, in origin cognate with "jelly," which came through the Fr. *gélee* from the same Latin original.

The "collagen," obtained from tendons and connective tissues, also occurs in the cornea and sclerotic coat of the eye, and in fish scales. Cartilage was considered to be composed of a substance chondrigen, which gave chondrin or cartilage-glue on boiling with water. Recent researches make it probable that cartilage contains (1) chondromucoid, (2) chondroitin-sulphuric acid, (3) collagen, (4) an albumoid present in old but not in young cartilage; whilst chondrin is a mixture of gelatin and mucin. "Bone collagen," or "ossein," constitutes, with calcium salts, the ground substance of bones. Gelatin consists of two substances, glutin and chondrin; the former is the main constituent of skin-gelatin, the latter of bone-gelatin.

True gelatigenous tissue occurs in all mature vertebrates, with the single exception, according to E.F.I. Hoppe-Seyler, of the *Amphioxus lanceolatus*. Gelatigenous tissue was discovered by Hoppe-Seyler in the cephalopods *Octopus* and *Sepiola*, but in an extension of his experiments to other invertebrates, as cockchafers and *Anodon* and *Unio*, no such tissue could be detected. Neither glutin nor chondrin occurs ready formed in the animal kingdom, but they separate when the tissues are boiled with water. A similar substance, vegetable gelatin, is obtained from certain mosses.

Pure gelatin is an amorphous, brittle, nearly transparent substance, faintly yellow, tasteless and inodorous, neutral in reaction and unaltered by exposure to dry air. Its composition is in round numbers C = 50, H = 7, N = 18, O = 25%; sulphur is also present in an amount varying from 0.25 to 0.7%.

> Nothing is known with any certainty as to its chemical constitution, or of the mode in which it is formed from albuminoids. It exhibits in a general way a connexion with that large and important class of animal substances called *proteids*, being, like them, amorphous, soluble in acids and alkalis, and giving in solution a left-handed rotation of the plane of polarization. Nevertheless, the ordinary well-recognized reactions for proteids are but faintly observed in the case of gelatin, and the only substances which at once and freely precipitate it from solution are mercuric chloride, strong alcohol and tannic acid.
>
> Although gelatin in a dry state is unalterable by exposure to air, its solution exhibits, like all the proteids, a remarkable tendency to putrefaction; but a characteristic feature of this process in the case of gelatin is that the solution assumes a transient acid reaction. The ultimate products of this decomposition are the same as are produced by prolonged boiling with acid. It has been found that oxalic acid, over and above the action common to all dilute acids of preventing the solidification of gelatin solutions, has the further property of preventing in a large measure this tendency to putrefy when the gelatin is treated with hot solutions of this acid, and then freed from adhering acid by means of calcium carbonate. Gelatin so treated has been called *metagelatin*.
>
> In spite of the marked tendency of gelatin solutions to develop ferment-organisms and undergo putrefaction, the stability of the substance in the dry state is such that it has even been used, and with some success, as a means of preserving perishable foods. The process, invented by Dr Campbell Morfit, consists in impregnating the foods with gelatin, and then drying them till about 10% or less of water is present. Milk gelatinized in this way is superior in several respects to the products of the ordinary condensation process, more especially in the retention of a much larger proportion of albuminoids.
>
> Gelatin has a marked affinity for water, abstracting it from admixture with alcohol, for example. Solid gelatin steeped for some hours in water absorbs a certain amount and swells up, in which condition a gentle heat serves to convert it into a liquid; or this may be readily produced by the addition of a trace of alkali or mineral acid, or by strong acetic acid. In the last case, however, or if we use the mineral acids in a more concentrated form, the solution obtained has lost its power of solidifying, though not that of acting as a glue. This property is utilized in the preparation of liquid glue (see Glue). By prolonged boiling of strong aqueous solutions at a high, or of weak solutions at a lower temperature, the characteristic properties of gelatin are impaired and ultimately destroyed. After this treatment it acts less powerfully as a glue, loses its tendency to solidify, and becomes increasingly soluble in cold water; nevertheless the solutions yield on precipitation with alcohol a substance identical in composition with gelatin.
>
> By prolonged boiling in contact with hydrolytic agents, such as sulphuric acid or caustic alkali, it yields quantities of leucin and glycocoll (so-called "sugar of gelatin," this being the method by which glycocoll was first prepared), but no tyrosin. In this last respect it differs from the great body of proteids, the characteristic solid products of the decomposition of which are leucin and tyrosin.

Gelatin occurs in commerce in varying degrees of purity; the purer form obtained from skins and bones (to which this article is restricted) is named gelatin; a preparation of great purity is "patent isinglass," while isinglass (*q.v.*) itself is a fish-gelatin; less pure forms constitute glue (*q.v.*), while a dilute aqueous solution appears in commerce as size (*q.v.*). The manufacture follows much the same lines as that of glue; but it is essential that the raw materials must be carefully selected, and in view of the consumption of most of the gelatin in the kitchen—for soups, jellies, &c.—great care must be taken to ensure purity and cleanliness.

> In the manufacture of bone-gelatin the sorted bones are degreased as in the case of glue manufacture, and then transferred to vats containing a dilute hydrochloric acid, by which means most of the mineral matter is dissolved out, and the bones become flexible. Instead of hydrochloric acid some French makers use phosphoric acid. After being well washed with water to remove all traces of hydrochloric acid, the bones are bleached by leading in sulphur dioxide. They are now transferred to the extractors, and heated by steam, care being taken that the temperature does not exceed 85° C. The digestion is repeated, and the runnings are clarified, concentrated, re-bleached and jellied as with glue. Skin-gelatin is manufactured in the same way as skin-glue. After steeping in lime pits the selected skins are digested three times; the first and second runnings are worked up for gelatin, while the third are filtered for "size."
>
> Vegetable gelatin is manufactured from a seaweed, genus *Laminaria*; from the tengusa, an American seaweed, and from Irish moss. The *Laminaria* is first extracted with water, and the residue with sodium carbonate; the filtrate is acidified with hydrochloric acid and the precipitated alginic acid washed and bleached. It is then dissolved in an alkali, the solution concentrated, and cooled down by running over horizontal glass plates. Flexible colourless sheets resembling animal gelatin are thus obtained. In America the weed is simply boiled with water, the solution filtered, and cooled to a thick jelly. Irish moss is treated in the same way. Both tengusa and Irish moss yield a gelatin suitable for most purposes; tengusa gelatin clarifies liquids in the same way as isinglass, and forms a harder

and firmer jelly than ordinary gelatin.

Applications of Gelatin.—First and foremost is the use of gelatin as a food-stuff—in jellies, soups, &c. Referring to the articles Glue, Isinglass and Size for the special applications of these forms of gelatin, we here enumerate the more important uses of ordinary gelatin. In photography it is employed in carbon-processes, its use depending on the fact that when treated with potassium bichromate and exposed to light, it is oxidized to insoluble compounds; it plays a part in many other processes. A solution of gelatin containing readily crystallized salts—alum, nitre, &c.—solidifies with the formation of pretty designs; this is the basis of the so-called "crystalline glass" used for purposes of ornamentation. It is also used for coating pills to prevent them adhering together and to make them tasteless. Compounded with various mineral salts, the carbonates and phosphates of calcium, magnesium and aluminium, it yields a valuable ivory substitute. It also plays a part in the manufacture of artificial leather, of India inks, and of artificial silk (the Vanduara Company processes).

GELDERLAND, Gelders, or Guelders, formerly a duchy of the Empire, on the lower Rhine and the Yssel, bounded by Friesland, Westphalia, Brabant, Holland and the Zuider Zee; part of which has become the province of Holland, dealt with separately below. The territory of the later duchy of Gelderland was inhabited at the beginning of the Christian era by the Teutonic tribes of the Sicambri and the Batavi, and later, during the period of the decline of the Roman empire, by the Chamavi and other Frank peoples. It formed part of the Caroling kingdom of Austrasia, and was divided into *pagi* or *gauen*, ruled by official counts (*comites-graven*). In 843, by the treaty of Verdun, it became part of Lotharingia (Lorraine), and in 879 was annexed to the kingdom of East Francia (Germany) by the treaty of Meerssen. The nucleus of the later county and duchy was the *gau* or district surrounding the town of Gelder or Gelre, lying between the Meuse and the Niers, and since 1715 included in Rhenish Prussia.

The early history is involved in much obscurity. There were in the 11th century a number of counts ruling in various parts of what was afterwards known as Gelderland. Towards the close of that century Gerard of Wassenburg, who besides the county of Gelre ruled over portions of Hamalant and Teisterbant, acquired a dominant position amongst his neighbours. He is generally reckoned as the first hereditary count of Gelderland (d. 1117/8). His son, Gerard II.—the Long—(d. 1131), married Irmingardis, daughter and heiress of Otto, count of Zutphen, and their son, Henry I. (d. 1182), inherited both countships. His successors Otto I. (1182-1207) and Gerard III. (1207-1229) were lovers of peace and strong supporters of the Hohenstaufen emperors, through whose favour they were able to increase their territories by acquisitions in the districts of Veluwe and Betuwe. He acted as guardian to his nephew Floris IV. of Holland during his minority. Otto II., the Lame (1220-1271), fortified several towns and bestowed privileges upon them for the purpose of encouraging trade. He became a person of so much importance that he was urged to be a candidate for the dignity of emperor. He preferred to support the claims of his cousin, William II. of Holland. In return for the loan of a considerable sum of money William gave to him the city of Nijmwegen in pledge. His son Reinald I. (d. 1326) married Irmingardis, heiress of Limburg, and in right of his wife laid claim to the duchy against Adolf of Berg, who had sold his rights to John I. of Brabant. War followed, and on the 5th of June 1288 Reinald, who meantime had also sold his rights to the count of Luxemburg, was defeated and taken prisoner at the battle of Woeringen. In this battle the count of Luxemburg was slain, and Reinald had to surrender his claims as the price of his defeat to John of Brabant. In 1310, in return for his support, Reinald received from the emperor Henry VII. for all his territories *privilegium de non evocando*, *i.e.* the exemption of his subjects from the liability to be sued before any court outside his jurisdiction. In 1317 he was made a prince of the Empire. A wound received at the battle of Woeringen had affected his brain, and an insurrection against him was in 1316 headed by his son Reinald, who assumed the government under the title of "Son of the Count." Reinald I. was finally in 1320 immured in prison, where he died in 1326.

Reinald II., the Black (1326-1343), was one of the foremost princes in the Netherlands of his day. He married (1) Sophia, heiress of Mechlin, and (2) in 1331 Eleanor, sister of Edward III. of England. By purchase or conquest he added considerably to his territories. He did much to improve the condition of the country, to foster trade, to promote the prosperity of the towns, and to maintain order and security in his lands by wise laws and firm administration. In 1338 the title of duke was bestowed upon him by the emperor Louis the Bavarian, who at the same time granted to him the fief of East Friesland. He died in 1343, leaving three daughters by his first marriage, and two sons, Reinald and Edward, both minors, by Eleanor of England. His elder son was ten years of age, and succeeded to the duchy under the guardianship of his mother Eleanor. Declared of age two years later, the youthful Reinald III. found himself involved in many difficulties through the struggles between the rival factions named after the two noble families of Bronkhorst and Hekeren. What was the quarrel between them, and what the causes they represented, cannot now be ascertained with certainty. There is good reason, however, to believe that they were the counterparts of the contemporary Cod and Hook parties in Holland, and of the Schieringers and Vetkoopers in Friesland. In Gelderland the quarrel between them was converted into a dynastic struggle, the Hekeren recognizing Duke Reinald, while the Bronkhorsten set up his younger brother Edward. At the battle of Tiel (1361) Reinald was defeated and taken prisoner, and Edward held the duchy till 1371. He was a good and successful ruler, and his death by an arrow wound, after a brilliant victory over the duke of Brabant near Baesweller (August 1371), was a loss to his country. He was in his thirty-fifth year and left no heirs. Reinald was now taken from the prison in which he had been confined to reign once more, but his health was broken and he died childless three years afterwards. The war of factions again broke out, the half-sisters of Reinald III. and Edward both claiming the inheritance; the elder, Matilda (Machteld), in her own right, the younger Maria on behalf of her seven-year-old boy William of Jülich, as the only male representative of the family. The Hekeren supported Matilda, the Bronkhorsten William of Jülich. The war of succession lasted till 1379, and ended in William's favour, the emperor Wenceslas (Wenzel) recognizing him as duke four years later.

Duke William was able, restless and adventurous, an ideal knight of the palmy days of chivalry. He took part in no less than five crusades with the Teutonic order against the heathen Lithuanians and Prussians. In 1393 he inherited the duchy of Jülich, and died in 1402. He was succeeded by his brother, Reinald IV. (d. 1423), in the united sovereignty of Gelderland, Zutphen and Jülich, who, in accordance with a promise made before his accession, ceded the town of Emmerich to Duke Adolf of Cleves. He took the part of his brother-in-law, John of Arkel, against William VI. of Holland, and in a war of several years' duration was not successful in preventing the Arkel territory being incorporated in Holland. On his death without legitimate issue, Gelderland passed to the young Arnold of Egmont, grandson of his sister Johanna, who had married John, lord of Arkel, their daughter Maria (d. 1415) being the wife

of John, count of Egmont (d. 1451). Arnold was recognized as duke in 1424 by the emperor Sigismund, but in the following year the emperor revoked his decision and bestowed the duchy upon Adolf of Berg. Arnold in retaliation laid claim to the duchy of Jülich, which had likewise been granted to Adolf by Sigismund, and a war followed in which the cities and nobles of Gelderland stood by Arnold; it ended in Arnold retaining Gelderland and Zutphen, and Gerard, the son of Adolf (d. 1437), being acknowledged as duke of Jülich. To gain the support of the estates of Gelderland in this war of succession, Arnold had been compelled to make many concessions limiting the ducal prerogatives, and granting large powers to a council consisting of representatives of the nobles and the four chief cities, and his extravagance and exactions led to continual conflicts, in which the prince was compelled to yield to the demands of his subjects. In his later years a conspiracy was formed against him, headed by his wife, the violent and ambitious Catherine of Cleves, and his son Adolf. Arnold was at first successful and Adolf had to go into exile; but he returned, and in 1465, having taken his father prisoner by treachery, interned him in the castle of Buren. Charles the Bold of Burgundy now seized the opportunity to intervene. In 1471 he forced Adolf to release his father, who sold the reversion of the duchy to the duke of Burgundy for 92,000 golden gulden. On the 23rd of February 1473 Arnold died, and Charles of Burgundy became duke of Gelderland. His succession was not unopposed. Nijmwegen offered an heroic resistance and only fell after a long siege. After Charles's death in 1477 Adolf was released from the captivity in which he had been held, and placed himself at the head of a party in the powerful city of Ghent, which sought to settle the disputed succession by forcing a match between him and Mary, the heiress of Burgundy. On the 29th of June 1477, however, he was killed at the siege of Tournai; and Mary gave her hand to Maximilian of Austria, afterwards emperor. Catherine, Adolf's sister, made an attempt to assert the rights of his son Charles to the duchy, but by 1483 Maximilian had crushed all opposition and established himself as duke of Gelderland.

Charles of Egmont, however, did not surrender his claims, but with the aid of the French collected an army, and in the course of 1492 and 1493 succeeded in reconquering his inheritance. The efforts of Maximilian to recover the country were vain, and the successive governors of the Netherlands, Philip the Fair and his sister Margaret, fared no better. In 1507 Charles of Egmont invaded Holland and Brabant, captured Harderwijk and Bommel in 1511, threatened Amsterdam in 1512, and took Groningen. It was, undoubtedly, a great and heroic achievement for the ruler of a petty state like Gelderland thus to assert and maintain his independence for a long period against the overwhelming power of the house of Austria. It was not till 1528 that the emperor Charles V. could force him to accept the compromise of the treaty of Gorichen, by which he received Gelderland and Zutphen for life as fiefs of the Empire. In 1534 the duke, who was childless, attempted to transfer the reversion of Gelderland to France, but this project was violently resisted by the estates of the duchy, and Charles was compelled by them in 1538 to appoint as his successor William V.—the Rich—of Cleves (d. 1592). Charles died the same year, and William, with the aid of the French, succeeded in maintaining his position in Gelderland for several years. The Habsburg power was, however, in the end too great for him, and he was forced to cede the duchy to Charles V. by the treaty of Venloo, signed on the 7th of September 1543.

Gelderland was now definitely amalgamated with the Habsburg dominions in the Netherlands, until the revolt of the Low Countries led to its partition. In 1579 the northern and greater part, comprising the three "quarters" of Nijmwegen, Arnhem and Zutphen, joined the Union of Utrecht and became the province of Gelderland in the Dutch republic. Only the quarter of Roermonde remained subject to the crown of Spain, and was called Spanish Gelderland. By the treaty of Utrecht (1715) this was ceded to Prussia with the exception of Venloo, which fell to the United Provinces, and Roermonde, which, with the remaining Spanish Netherlands, passed to Austria. Of this, part was ceded to France at the peace of Basel in 1795, and the whole by the treaty of Lunéville in 1801, when it received the name of the department of the Roer. By the peace of Paris of 1814 the bulk of Gelderland was incorporated in the United Netherlands, the remainder falling to Prussia, where it forms the circle of Düsseldorf.

The rise of the towns in Gelderland began in the 13th century, river commerce and markets being the chief cause of their prosperity, but they never attained to the importance of the larger cities in Holland and Utrecht, much less to that of the great Flemish municipalities. They differed also from the Flemish cities in the nature of their privileges and immunities, as they did not possess the rights of communes, but only those of "free cities" of the Rhenish type. The power of the feudal lord over them was much greater. The states of Gelderland first became a considerable power in the land during the reign of Arnold of Egmont (1423-1473). Their claim to large privileges and a considerable share in the government of the county were formulated in a document drawn up at Nijmwegen in April 1436. These the duke had to concede, and to agree further to the appointment of a council to assist him in his administration. From this time the absolute authority of the sovereign in Gelderland was broken. The states consisted of two members—the nobility and the towns. The towns were divided into four separate districts or "quarters" named after the chief town in each—Nijmwegen, Arnhem, Zutphen and Roermonde. In the time of the republic, as has been stated above, the province of Gelderland comprised the three first-named "quarters" only. The three quarters had each of them peculiar rights and customs, and their representatives met together in a separate assembly before taking part in the diet (*landdag*) of the states. The nobility possessed great influence in Gelderland and retained it in the time of the republic.

(G. E.)

GELDERLAND (*Guelders*), a province of Holland, bounded S. by Rhenish Prussia and North Brabant, W. by Utrecht and South Holland, N. by the Zuider Zee, N.E. by Overysel, and S.E. by the Prussian province of Westphalia. It has an area of 1906 sq. m. and a pop. (1900) of 566,549. Historically it was part of the duchy of Gelderland, which is treated separately above.

The main portion of Gelderland north of the Rhine and the Old Ysel forms as it were an extension of the province of Overysel, being composed of diluvial sand and gravel, covered with sombre heaths and patches of fen. South of this line, however, the soil consists of fertile river-clay. The northern portion is divided by the New (or Gelders) Ysel into two distinct regions, namely, the Veluwe ("bad land") on the west, and the former countship of Zutphen on the east. In this last division the ground slopes downwards from south-east to north-west (131 to 26 ft.) and is intersected by several fertilizing streams which flow in the same direction to join the Ysel. The extreme eastern corner is occupied by older Tertiary loam, which is used for making bricks, and upon this and the river-banks are the most fertile spots, woods, cultivated land, pastures, towns and villages. The highlands of the Veluwe lying west of the Ysel really extend as far as the Crooked Rhine and the Vecht in the province of Utrecht, but are slightly

detached from the Utrecht hills by the so-called Gelders valley, which forms the boundary between the two provinces. This valley extends from the Rhine along the Grift, the Luntersche Beek, and the Eem to the Zuider Zee, and would still offer an outlet in this direction to the Rhine at high water if it were not for the river dikes. The two main ridges of the Veluwe hills (164 and 360 ft.) extend from the neighbourhood of Arnhem north to Harderwyk and north-east to Hattem. In the south they stretch themselves along the banks of the Rhine, forming a strip of picturesque river scenery made up of the varied elements of sandhills and trees, clay-lands and pastures. A large number of country-houses and villas are to be found here, and the riverside villages of Dieren, Velp and Renkum. All over the Veluwe are heaths, scantily cultivated, with fields of rye and buckwheat, cattle of inferior quality, and sheep, and a sparse population. There is also a considerable cultivation of wood, especially of fir and copse, while tobacco plantations are found at Nykerk and Wageningen.

The southern division of the province presents a very different aspect, and contains many old towns and villages. It is watered by the three large rivers, the Rhine, the Waal and the Maas, and has a level clay soil, varied only by isolated hills and a sandy, wooded stretch between Nijmwegen and the southern border. The region enclosed between the Rhine and the Waal and watered by the Linge is called the Betuwe (“good land”), and gave its name to the Germanic tribe of Batavians, who are sometimes wrongly regarded as the parent stock of the Dutch people. There is here a denser population, occupied in the cultivation of wheat, beetroot and fruit, the breeding of excellent cattle, shipping and industrial pursuits. The principal centres of population, such as Zutphen, Arnhem (the chief town of the province), Nijmwegen and Tiel, lie along the large rivers. Smaller, but of equal antiquity, are the riverside towns of Doesburg, which is strongly fortified; Wageningen, with the State agricultural schools; Doetinchem, with a bridge over the Old Ysel which is mentioned as early as the 14th century; Zalt-Bommel, with an old church (1304), and a railway bridge over the Waal; and Kuilenburg, with a fine railway bridge (1863-1868) over the Rhine. Five m. S. of Zalt-Bommel, on the Maas, is the medieval castle of Ammerzode or Ammersooi, also called Amelroy during the French occupation in 1674. It is in an excellent state of preservation and has been restored in modern times. The first authentic record of the castle is its possession by John de Herlar of the noble family of Loo at the end of the 13th century. In 1480 it passed by marriage to the powerful lords van Arkel, and was partly destroyed by fire at the end of the 16th century. The chapel dates from the 15th century, and the keep from 1564. Among the family portraits are works by Albert Dürer. Zetten, on the railway between Nijmwegen and Tiel, is famous for the charitable institutions founded here by the preacher Otto Gerhard Heldring (d. 1876). They comprise a penitentiary (1849) for women; an educational home (1858) for girls; a theological training college (1864); and a Magdalen hospital. Nykerk, Harderwyk and Elburg are fishing towns on the Zuider Zee. Apeldoorn is situated on the edge of the sand-grounds. Heerenberg on the south-eastern border is remarkable for its ancient castle near the seat of the powerful lords van den Bergh. Other ancient and historical towns bordering on the Prussian frontier are Zevenaar, which was for long the cause of dispute between the houses of Cleves and Gelder and was finally attached to the kingdom of the Netherlands in 1816; Breedevoort, once the seat of a lordship of the same name belonging to the counts van Loon or Lohn, who built a castle here in the beginning of the 13th century which was destroyed in 1646—the lordship was presented to Prince William III. in 1697; Winterswyk, now an important railway junction, and of growing industrial importance; and Borkeloo, or Borkulo, the seat of an ancient lordship dating from the first half of the 12th century, which finally came into the possession of Prince William V. of Orange Nassau in 1777. The castle was formerly of importance.

Gelderland is intersected by the main railway lines, which are largely supplemented by steam-tram railways. Steam-tramways connect Arnhem and Zutphen, Wageningen, Nijmwegen, Velp, Doetinchem (by way of Dieren and Doesburg), whence there are various lines to Emmerich and Gendringen on the Prussian borders. Groenlo and Lichtenvorde, Borkulo and Deventer are also connected.

GELDERN, a town of Germany, in Rhenish Prussia, on the Niers, 28 m. N. W. of Düsseldorf, at the junction of railways to Wesel and Cologne. Pop. (1905) 6551. It has an Evangelical and two Roman Catholic churches and a town hall with a fine council chamber. Its industries include the manufacture of buttons, shoes, cigars and soap. The town dates from about 1100 and was early an important fortified place; until 1371 it was the residence of the counts and dukes of Gelderland. Having passed to Spain, its fortifications were strengthened by Philip II., but they were razed by Frederick the Great, the town having been in the possession of Prussia since 1703.

See Nettesheim, *Geschichte der Stadt und des Amtes Geldern* (Crefeld, 1863); Henrichs, *Beiträge zur innern Geschichte der Stadt Geldern* (Geldern, 1893); and Real, *Chronik der Stadt und Umgegend von Geldern* (Geldern, 1897).

GELL, SIR WILLIAM (1777-1836), English classical archaeologist, was born at Hopton in Derbyshire. He was educated at Jesus College, Cambridge, and subsequently elected a fellow of Emmanuel College (B.A. 1798, M.A. 1804). About 1800 he was sent on a diplomatic mission to the Ionian islands, and on his return in 1803 he was knighted. He went with Princess (afterwards Queen) Caroline to Italy in 1814 as one of her chamberlains, and gave evidence in her favour at the trial in 1820 (see G.P. Clerici, *A Queen of Indiscretions*, Eng. trans., London, 1907). He died at Naples on the 4th of February 1836. His numerous drawings of classical ruins and localities, executed with great detail and exactness, are preserved in the British Museum. Gell was a thorough dilettante, fond of society and possessed of little real scholarship. None the less his topographical works became recognized text-books at a time when Greece and even Italy were but superficially known to English travellers. He was a fellow of the Royal Society and the Society of Antiquaries, and a member of the Institute of France and the Berlin Academy.

His best-known work is *Pompeiana; the Topography, Edifices and Ornaments of Pompeii* (1817-1832), in the first part of which he was assisted by J.P. Gandy. It was followed in 1834 by the *Topography of Rome and its Vicinity* (new ed. by E.H. Bunbury, 1896). He wrote also *Topography of Troy and its Vicinity* (1804); *Geography and Antiquities of Ithaca* (1807); *Itinerary of Greece, with a Commentary on Pausanias and Strabo* (1810, enlarged ed. 1827); *Itinerary of the Morea* (1816; republished as *Narrative of a Journey in the Morea*, 1823). All these works

have been superseded by later publications.

GELLERT, CHRISTIAN FÜRCHTEGOTT (1715-1769), German poet, was born at Hainichen in the Saxon Erzgebirge on the 4th of July 1715. After attending the famous school of St Afra in Meissen, he entered Leipzig University in 1734 as a student of theology, and on completing his studies in 1739 was for two years a private tutor. Returning to Leipzig in 1741 he contributed to the *Bremer Beiträge*, a periodical founded by former disciples of Johann Christoph Gottsched, who had revolted from the pedantry of his school. Owing to shyness and weak health Gellert gave up all idea of entering the ministry, and, establishing himself in 1745 as *privatdocent* in philosophy at the university of Leipzig, lectured on poetry, rhetoric and literary style with much success. In 1751 he was appointed extraordinary professor of philosophy, a post which he held until his death at Leipzig on the 13th of December 1769.

The esteem and veneration in which Gellert was held by the students, and indeed by persons in all classes of society, was unbounded, and yet due perhaps less to his unrivalled popularity as a lecturer and writer than to his personal character. He was the noblest and most amiable of men, generous, tender-hearted and of unaffected piety and humility. He wrote in order to raise the religious and moral character of the people, and to this end employed language which, though at times prolix, was always correct and clear. He thus became one of the most popular German authors, and some of his poems enjoyed a celebrity out of proportion to their literary value. This is more particularly true of his *Fabeln und Erzählungen* (1746-1748) and of his *Geistliche Oden und Lieder* (1757). The fables, for which he took La Fontaine as his model, are simple and didactic. The “spiritual songs,” though in force and dignity they cannot compare with the older church hymns, were received by Catholics and Protestants with equal favour. Some of them were set to music by Beethoven. Gellert wrote a few comedies: *Die Betschwester* (1745), *Die kranke Frau* (1748), *Das Los in der Lotterie* (1748), and *Die zärtlichen Schwestern* (1748), the last of which was much admired. His novel *Die schwedische Gräfin von G.* (1746), a weak imitation of Richardson’s *Pamela*, is remarkable as being the first German attempt at a psychological novel. Gellert’s *Briefe* (letters) were regarded at the time as models of good style.

See Gellert’s *Sämtliche Schriften* (first edition, 10 vols., Leipzig, 1769-1774; last edition, Berlin, 1867). *Sämtliche Fabeln und Erzählungen* have been often published separately, the latest edition in 1896. A selection of Gellert’s poetry (with an excellent introduction) will be found in F. Muncker, *Die Bremer Beiträge* (Stuttgart, 1899). A translation by J.A. Murke, *Gellert’s Fables and other Poems* (London, 1851). For a further account of Gellert’s life and work see lives by J.A. Cramer (Leipzig, 1774), H. Döring (Greiz, 1833), and H.O. Nietschmann (2nd ed., Halle, 1901); also *Gellerts Tagebuch aus dem Jahre 1761* (2nd ed., Leipzig, 1863) and *Gellerts Briefwechsel mit Demoiselle Lucius* (Leipzig, 1823).

GELLERT, or Killhart, in Welsh traditional history, the dog of Llewellyn, prince of Wales. The dog, a greyhound, was left to guard the cradle in which the infant heir slept. A wolf enters, and is about to attack the child, when Gellert flies at him. In the struggle the cradle is upset and the infant falls underneath. Gellert kills the wolf, but when Prince Llewellyn arrives and sees the empty cradle and blood all around, he does not for the moment notice the wolf, but thinks Gellert has killed the baby. He at once stabs him, but almost instantly finds his son safe under the cradle and realizes the dog’s bravery. Gellert is supposed to have been buried near the village of Beddgelert (“grave of Gellert”), Snowdon, where his tomb is still pointed out to visitors. The date of the incident is traditionally given as 1205. The incident has given rise to a Welsh proverb, “I repent as much as the man who slew his greyhound.” The whole story is, however, only the Welsh version of a tale long before current in Europe, which is traced to the Indian Panchatantra and perhaps as far back as 200 B.C.

See W.A. Clouston, *Popular Tales and Fictions* (1887); D.E. Jenkins, *Beddgelert, its Facts, Fairies and Folklore* (Portmadoc, 1899).

GELLIUS, AULUS (*c.* A.D. 130-180), Latin author and grammarian, probably born at Rome. He studied grammar and rhetoric at Rome and philosophy at Athens, after which he returned to Rome, where he held a judicial office. His teachers and friends included many distinguished men—Sulpicius Apollinaris, Herodes Atticus and Fronto. His only work, the *Noctes Atticae*, takes its name from having been begun during the long nights of a winter which he spent in Attica. He afterwards continued it at Rome. It is compiled out of an Adversaria, or commonplace book, in which he had jotted down everything of unusual interest that he heard in conversation or read in books, and it comprises notes on grammar, geometry, philosophy, history and almost every other branch of knowledge. The work, which is utterly devoid of sequence or arrangement, is divided into twenty books. All these have come down to us except the eighth, of which nothing remains but the index. The *Noctes Atticae* is valuable for the insight it affords into the nature of the society and pursuits of those times, and for the numerous excerpts it contains from the works of lost ancient authors.

Editio princeps (Rome, 1469); the best editions are those of Gronovius (1706) and M. Hertz (1883-1885; editio minor, 1886, revised by C. Hosius, 1903, with bibliography). There is a translation in English by W. Beloe (1795), and in French by various hands (1896). See Sandys, *Hist. Class. Schol.* i. (1906), 210.

GELLIVARA [Gellivare], a mining town of Sweden in the district (*län*) of Norrbotten, 815 m. N. by E. of Stockholm by rail. It lies in the well-nigh uninhabited region of Swedish Lapland, 43 m. N. of the Arctic Circle. It owes its importance to the iron mines in the mountain Malmberget 4½ m. to the north, rising to 2024 ft. above sea-level (830 ft. above Gellivara town). During the dark winter months work proceeds by the aid of electric light. In 1864 the mines were acquired by an English company, but abandoned in 1867. In 1884 another English company took them up and completed a provisional railway from Malmberget to Luleå at the head of the Gulf of Bothnia (127 m. S.S.E.), besides executing a considerable portion of the preliminary works for the continuation of the line on the Norwegian side from Ofoten Fjord upwards (see Narvik). But this company, after extracting some 150,000 tons of ore in 1888-1889, went into liquidation in the latter year. Two years later the mines passed into the hands of a Swedish company, and the railway was acquired by the Swedish Government. The output of ore was insignificant until 1892, when it stood at 178,000 tons; but in 1902 it amounted to 1,074,000 tons. Three miles S.W. rises the hill Gellivara Dundret (2700 ft.), from which the sun is visible at midnight from June 5 to July 11. The population of the parish (about 6500 sq. m.) in 1900 was 11,745; the greater part of the population being congregated at the town of Gellivara and at Malmberget.

GELNHAUSEN, a town of Germany, in the Prussian province of Hesse-Nassau, on the Kinzig, 27 m. E.N.E. of Frankfort-on-Main, on the railway to Bebra. Pop. 4500. It is romantically situated on the slope of a vine-clad hill, and is still surrounded by ancient walls and towers. On an island in the river are the ivy-covered ruins of the imperial palace which Frederick I. (Barbarossa) built before 1170, and which was destroyed by the Swedes during the Thirty Years' War. It has an interesting and beautiful church (the Marien Kirche), with four spires (of which that on the transept is curiously crooked), built in the 13th century, and restored in 1876-1879; also several other ancient buildings, notably the town-hall, the Fürstenhof (now administrative offices), and the Hexenthurm. India-rubber goods are manufactured, and wine is made. Gelnhausen became an imperial town in 1169, and diets of the Empire were frequently held within its walls. In 1634 and 1635 it suffered severely from the Swedes. In 1803 the town became the property of Hesse-Cassel, and in 1866 passed to Prussia.

GELO, son of Deinomenes, tyrant of Gela and Syracuse. On the death of Hippocrates, tyrant of Gela (491 B.C.), Gelo, who had been his commander of cavalry, succeeded him; and in 485, his aid having been invoked by the Gamori (the oligarchical landed proprietors) of Syracuse who had been driven out by the populace, he seized the opportunity of making himself despot. From this time Gelo paid little attention to Gela, and devoted himself to the aggrandizement of Syracuse, which attained extraordinary wealth and influence. When the Greeks solicited his aid against Xerxes, he refused it, since they would not give him command of the allied forces (Herodotus vii. 171). In the same year the Carthaginians invaded Sicily, but were totally defeated at Himera, the result of the victory being that Gelo became lord of all Sicily. After he had thus established his power, he made a show of resigning it; but his proposal was rejected by the multitude, and he reigned without opposition till his death (478). He was honoured as a hero, and his memory was held in such respect that when all the brazen statues of tyrants were condemned to be sold in the time of Timoleon (150 years later) an exemption was made in favour of the statue of Gelo.

Herodotus vii.; Diod. Sic. xi. 20-38; see also Sicily: *History*, and Syracuse; for his coins see Numismatics: *Sicily*.

GELSEMIUM, a drug consisting of the root of *Gelsemium nitidum*, a clinging shrub of the natural order Loganiaceae, having a milky juice, opposite, lanceolate shining leaves, and axillary clusters of from one to five large, funnel-shaped, very fragrant yellow flowers, whose perfume has been compared with that of the wallflower. The fruit is composed of two separable jointed pods, containing numerous flat-winged seeds. The stem often runs underground for a considerable distance, and indiscriminately with the root it is used in medicine. The plant is a native of the United States, growing on rich clay soil by the side of streams near the coast, from Virginia to the south of Florida. In the United States it is commonly known as the wild, yellow or Carolina jessamine, although in no way related to the true jessamines, which belong to the order Oleaceae. It was first described in 1640 by John Parkinson, who grew it in his garden from seed sent by Tradescant from Virginia; at the present time it is but rarely seen, even in botanical gardens, in Great Britain.

The drug contains a volatile oil and two potent alkaloids, gelseminine and gelsemine. Gelseminine is a yellowish, bitter substance, readily soluble in ether and alcohol. It is not employed therapeutically. Gelsemine has the formula $C_{11}H_{19}NO_2$, and is a colourless, odourless, intensely bitter solid, which is insoluble in water, but readily forms a soluble hydrochloride.

The dose of this salt is from $\frac{1}{60}$th to $\frac{1}{20}$th of a grain. The British Pharmacopoeia contains a tincture of gelsemium, the dose of which is from five to fifteen minims.

Gelsemium nitidum, half natural size; flower, nat. size.

The drug is essentially a nerve poison. It has no action on the skin and no marked action on the alimentary or circulatory systems. Its action on the cerebrum is slight, consciousness being retained even after toxic doses, but there may be headache and giddiness. The drug rapidly causes failure of vision, diplopia, ptosis or falling of the upper eyelid, dilatation of the pupil, and a lowering of the intra-ocular tension. This last action is doubtful. The symptoms appear to be due to a paralysis of the motor cells that control the internal and external ocular muscles. The most marked action of the drug is upon the anterior cornua of grey matter in the spinal cord. It can be shown by a process of experimental exclusion that to an arrest of function of these cells is due the paralysis of all the voluntary muscles of the body that follows the administration of gelsemium or gelsemine. Just before death the sensory part of the spinal cord is also paralysed, general anaesthesia resulting. The drug kills by its action on the respiratory centre in the medulla oblongata. Shortly after the administration of even a moderate dose the respiration is slowed and is ultimately arrested, this being the cause of death. In cases of poisoning the essential treatment is artificial respiration, which may be aided by the subcutaneous exhibition of strychnine.

Though the drug is still widely used, the rational indications for its employment are singularly rare and uncertain. The conditions in which it is most frequently employed are convulsions, bronchitis, severe and purposeless coughing, myalgia or muscular pain, neuralgia and various vague forms of pain.

GELSENKIRCHEN, a town of Germany in the Prussian province of Westphalia, 27 m. W. of Dortmund on the railway Duisburg-Hamm. Pop. (1905) 147,037. It has coal mines, iron furnaces, steel and boiler works, and soap, glass and chemical factories. In 1903 various neighbouring industrial townships were incorporated with the town.

GEM (Lat. *gemma*, a bud,—from the root *gen*, meaning "to produce,"—or precious stone; in the latter sense the Greek term is ψῆφος), a word applied in a wide sense to certain minerals which, by reason of their brilliancy, hardness and rarity, are valued for personal decoration; it is extended to include pearl. In a restricted sense the term is applied only to precious stones after they have been cut and polished as jewels, whilst in their raw state the minerals are conveniently called "gem-stones." Sometimes, again, the term "gem" is used in a yet narrower sense, being restricted to engraved stones, like seals and cameos.

The subject is treated here in two sections: (1) Mineralogy and general properties; (2) Gems in Art, *i.e.* engraved gems, such as seals and cameos. The artificial products which simulate natural gem-stones in properties and chemical composition are treated in the separate article Gem, Artificial.

1. Mineralogy and General Properties

The gem-stones form a small conventional group of minerals, including principally the diamond, ruby, sapphire, emerald and opal. Other stones of less value—such as topaz, spinel, chrysoberyl, chrysolite, zircon and tourmaline—are sometimes called "fancy stones." Many minerals still less prized, yet often used as ornamental stones,—like moonstone, rock-crystal and agate,—occasionally pass under the name of "semi-precious stones," but this is rather a vague term and may include the stones of the preceding group. The classification of gem-stones is, indeed, to some extent a matter of fashion.

Descriptions of the several gem-stones will be found under their respective headings, and the present article gives only a brief review of the general characters of the group.

Hardness.

A high degree of hardness is an essential property of a gem-stone, for however beautiful and brilliant a mineral may be it is useless to the jeweller if it lack sufficient hardness to withstand the abrasion to which articles of personal decoration are necessarily subjected. Even if not definitely scratched, the polished stone becomes dull by wear. Imitations in paste may be extremely brilliant, but being comparatively soft

they soon lose lustre when rubbed. In the article Mineralogy it is explained that the varying degrees of hardness are registered on a definite scale. The exceptional hardness of the diamond gives it a supreme position in this scale, and to it the arbitrary value of 10 has been assigned. The corundum gem-stones (ruby and sapphire), though greatly inferior in hardness to the diamond, come next, with the value of 9; and it is notable that the sapphire is usually rather harder than ruby. Then follows the topaz, which, with spinel and chrysoberyl, has a hardness of 8; whilst quartz falls a degree lower. Most gem-stones are harder than quartz, though precious opal, turquoise, moonstone and sphene are inferior to it in hardness. Those stones which are softer than quartz have been called by jewellers *demi-dures*. To test the hardness of a cut stone, one of its sharp edges may be drawn, with firm pressure, across the smooth surface of a piece of quartz; if it leave a scratch its hardness must be above 7. The stone is then applied in like manner to a fragment of topaz, preferably a cleavage-piece, and if it fail to leave a distinct scratch its hardness is between 7 and 8, whereas if the topaz be scratched it is above 8. An expert may obtain a fair idea of hardness by gently passing the stone over a fine steel file, and observing the feel of the stone and the grating sound which it emits. If a stone be scratched by a steel knife its hardness is below 6. The degree of hardness of a precious stone is soon ascertained by the lapidary when cutting it.

Gem-stones differ markedly among themselves in density or specific weight; and although this is a character which does not directly affect their value for ornamental purposes, it furnishes by its constancy an important means of distinguishing one stone from another. Moreover, it is a character very easily determined and can be applied to cut stones without injury. The relative weightiness of a stone is called its specific gravity, and is often abbreviated as S.G. The number given in the description of a mineral as S.G. shows how many times the stone is heavier than an equal bulk of the standard with which it is compared, the standard being distilled water at 4° C. If, for example, the S.G. of diamond is said to be 3.5 it means that a diamond weighs 3½ times as much as a mass of water of the same bulk. The various methods of determining specific gravity are described under Density. The readiest method of testing precious stones, especially when cut, is to use dense liquids. Suppose it be required to determine whether a yellow stone be true topaz or false topaz (quartz), it is merely necessary to drop the stone into a liquid made up to the specific gravity of about 3; and since topaz has S.G. of 3.5 it sinks in this medium, but as quartz has S.G. of only 2.65 it floats. The densest gem-stone is zircon, which may have S.G. as high as 4.7, whilst the lowest is opal with S.G. 2.2. Amber, it is true, is lighter still, being scarcely denser than water, but this substance can hardly be called a gem.

Specific gravity.

Although the great majority of precious stones occur crystallized, the characteristic form is destroyed in cutting. The crystal-forms of the several stones are noticed under their respective headings, and the subject is discussed fully under Crystallography. A few substances used as ornamental stones—like opal, turquoise, obsidian and amber—are amorphous or without crystalline form; whilst others, like the various stones of the chalcedony-group, display no obvious crystal-characters, but are seen under the microscope to possess a crystalline structure. Gem-stones are frequently found in gravels or other detrital deposits, where they occur as rolled crystals or fragments of crystals, and in many cases have been reduced to the form of pebbles. By the disintegration of the rock which formed the original matrix, its constituent minerals were set free, and whilst many of them were worn away by long-continued attrition, the gem-stones survived by virtue of their superior hardness.

Crystalline form and cleavage.

Many crystallized gem-stones exhibit cleavage, or a tendency to split in definite directions. The lapidary recognizes a “grain” in the stone. When the cleavage is perfect, as in topaz, it may render the working of the stone difficult, and produce incipient cracks in the cut gem. Flaws due to the cleavage planes are called “feathers.” The octahedral cleavage of the diamond is taken advantage of in dressing the stone before cutting it. The cutting of gem-stones is explained under Lapidary.

The beauty and consequent value of gems depend mainly on their colour. Some stones, it is true, are valued for entire absence of colour, as diamonds of pure “water.” Certain kinds of sapphire and topaz, too, are “water clear,” as also is pure rock-crystal; but in most stones colour is a prime element of attraction. The colour, however, is not generally an essential property of the mineral, but is due to the presence of foreign pigmentary matter, often in very small proportion and in some cases eluding determination. Thus, corundum when pure is colourless, but the presence of traces of certain mineral substances imparts to it not only the red of ruby and the blue of sapphire, but almost every other colour. The tinctorial matter may be distributed either uniformly throughout the stone or in regular zones, or in quite irregular patches. A tourmaline, for instance, may be red at one end of a prismatic crystal and green at the other extremity, or the colour may be so disposed that in transverse section the centre will be red and the outer zone green. A beryl may be yellow and green in the same crystal. Sapphire, again, is often parti-coloured, one portion of the stone being blue and other portions white or yellow; and the skilful lapidary, in cutting the stone, will take advantage of the blue portion. The character of the pigment is in many cases not definitely known. It by no means follows that the material capable of imparting a certain tint to glass is identical with that which naturally colours a stone of the same tint; thus a glass of sapphire-blue may be obtained by the use of cobalt, yet cobalt has not been detected in the sapphire. Probably the most common mineral pigments are compounds of iron, manganese, copper and chromium. If the colour of the stone be discharged by heat, an organic pigment is presumably present. Some ornamental stones change their colour, or even lose it, on exposure to sunlight and air: such is the case with rose-quartz, chrysoprase and certain kinds of topaz and turquoise. Exposure to heat alters the colour of some stones so readily that the change is taken advantage of commercially; thus, sherry-yellow topaz may be rendered pink, smoky and amethystine quartz may become yellow, and coloured zircons may be decolorized, so as to resemble diamonds.

Colour.

The colours of some gem-stones are greatly affected by radioactivity, and Prof. F. Bordas has found this to be particularly the case with sapphire. From his experiments he believes that yellow corundum, or oriental topaz, may have been formed from blue corundum under the influence of radioactive substances present in the soil in which the sapphire was embedded. Different shades of colour may be presented by different stones of the same species; and it was formerly the custom of lapidaries to regard the darker stones as masculine and the paler as feminine, a full blue sapphire, for instance, being called a “male sapphire” and a delicate blue stone a “female sapphire.” It is notable that some stones appear to change colour by candle-light and by most other artificial means of illumination; some amethysts thus become inky, and certain sapphires acquire a murky tint, whilst others become amethystine. For an example of a remarkable change of this character, see Alexandrite.

As the optical properties of minerals are fully explained under Crystallography, little need be said here on this subject. The brilliancy of a cut stone depends on the amount of light reflected from its faces; and in the form known as the “brilliant” the gem is so cut that much of the incident light, after entering the stone and suffering refraction, is totally reflected from the facets at the back. The amount of light which is

Refraction.

thus returned to the eye of the observer will be greater as the angle of total reflection, or critical angle, is smaller, but this angle will be small if the refractive power of the stone is great, so that the brilliancy directly depends on the refractivity. The diamond has the highest refractive index of any gem-stone (2.42). Jargoon, or zircon, has also a high index (mean 1.95), and sphene, which is occasionally cut as a gem, is likewise very notable in this respect. The index of refraction generally bears a relation to the specific gravity of the stone, the heaviest gems having the highest indices, though a few minerals offer exceptions. The refractive index, which is thus a very important character in the scientific discrimination of gem-stones, may be conveniently determined, within certain limits, by means of the refractometer devised by Dr G.F. Herbert Smith. This instrument is an improved form of the total reflectometer, in which the refractive power of a given substance is determined by the method of total reflection. It may be used for indices ranging from 1.300 to 1.775, and may be applied to faceted stones without removal from their settings.

Dispersion.

The play of prismatic colours exhibited by a cut stone, often known as its "fire," is due to the decomposition of the white light which enters the stone, and is returned, by internal reflection, after resolution in to its coloured components. This decomposition depends on the dispersive power of the substance. The exceptional beauty of the fiery flashes in the diamond is due to its high dispersion, in other words, to the difference between the refractive indices for the red rays and the violet rays at the extremities of the spectrum. The peculiar lustre exhibited by the diamond is called adamantine, and is shared to some extent by certain other stones which have a high refractive index and high dispersion, such as zircon.

Spectroscopic characters.

The use of the spectroscope may be valuable in discriminating between certain precious stones. It was shown by Sir A.H. Church that almandine garnet and zircon when simply viewed through this instrument give, under proper conditions, characteristic absorption spectra, due to the light reflected from the stone having penetrated to some extent into the substance of the mineral and suffered absorption. It is sometimes useful to examine the behaviour of a stone under the action of the Röntgen rays.

Dichroism.

A very useful means of discriminating between certain stones is found in their dichroism, or, to use a more general term, pleochroism. Neither amorphous minerals, like opal, nor minerals crystallizing in the cubic system, like spinel and garnet, possess this property; but coloured minerals which are doubly refracting may show different colours, when properly examined, in different directions. Occasionally this is so marked as to be detected by the naked eye, as in iolite or dichroite, but usually the stone needs to be examined with such an instrument as Haidinger's dichroscope (see Crystallography). It must be remembered that in the direction of an optic axis the two images will be of the same colour in all positions of the instrument, and it is therefore necessary before reaching a definite conclusion to turn the stone about and examine it in various directions. The use of the dichroscope is so simple that it can be applied by any one to the examination of a cut stone, but there are other means of determining the nature of a stone by its optical properties available to the mineralogist and more suitably discussed under Crystallography.

Chemical composition.

In chemical composition the gem-stones present great variety. Diamond is composed of only a single element; ruby, sapphire and the quartz-group are oxides; spinel and chrysoberyl may be regarded as aluminates; turquoise and beryllonite are phosphates; and a great number of ornamental stones are silicates of greater or less complexity, such as emerald, topaz, chrysolite, garnet, zircon, tourmaline, kunzite, sphene and benitoite. In the examination of a cut stone chemical tests are not available, since they usually involve the partial destruction of the mineral. The artificial production of certain gems by chemical processes which yield products identical in composition and physical properties with the natural stones, is described in the article Gem, Artificial.

Doublets and triplets are composite stone, sometimes prepared for fraudulent purposes. In a doublet a slab of real gem-stone covers the face of a paste, whilst in a triplet the paste is both faced and backed by a slice of genuine stone. By the action of a suitable solvent, such as chloroform or in some cases even hot water, the cement uniting the pieces gives way and the compound character of the structure is detected.

Before the chemical composition of gem-stones was understood, their classification remained vague and unscientific. As the ancients depended almost entirely on the eye, the colour of the stone naturally became the chief factor in classification. A variety of stones agreeing roughly in colour would be grouped together under a common name, widely as they might differ in other respects. Thus the emerald, the peridot, green fluorspar, malachite, and certain kinds of quartz and jade seem to have been united under the general name of σμάραγδος whilst the ruby, red spinel and garnet were probably grouped together as *carbunculus*. In this way minerals radically different were associated on the ground of what is generally a superficial and accidental character, and rarely of any classificatory value. On the other hand, a grouping based only on colour led to several names being in some cases applied to the same mineral species. Thus the ruby and sapphire are essentially identical in chemical composition and in all physical characters, save colour.

Superstitions.

Descriptions of precious stones by ancient writers generally are too vague for exact diagnosis. The principal classical authorities are Theophrastus and the elder Pliny. Stones were formerly held in esteem not only for their beauty and rarity but for the medicinal and magical powers with which they were reputed to be endowed. Up to comparatively recent years the toadstone, for example, was worn not for beauty but for sake of occult virtue; and even at the present day certain stones, like jade, are valued for a similar reason. Prof. W. Ridgeway has suggested that jewelry took its origin not, as often supposed, in an innate love of personal decoration, but rather in the belief that the objects used possessed magical virtue. Small stones peculiar in colour or shape, especially those with natural perforations, are usually valued by uncivilized peoples as amulets. The Orphic poem Λιθικά, reputed to be of very early though unknown date, is rich in allusions to the virtues of many of the gem-stones. Many of the medical and other virtues of precious stones were evidently attributed to them on the well-known doctrine of signatures. Thus, the blood-red colour of a fine jasper suggested that the stone would be useful in haemorrhage; a green jasper would bring fertility to the soil; and the purple wine-colour of amethyst pointed to its value as a preventive of intoxication. Many of the superstitions came down to modern times, and even at the present day the belief in "lucky stones" is by no means extinct.

Bibliography.—The most comprehensive work on gem-stones is Professor Max Bauer's *Edelsteinkunde* (1896), translated, with additions, by L.J. Spencer under the title *Precious Stones* (1904). Less detailed are Professor P. Groth's *Grundriss der Edelsteinkunde* (1887) and Professor C. Doelter's *Edelsteinkunde* (1893). Sir A. H. Church's *Precious Stones* (1905), intended as a guide to the collections in the Victoria and Albert Museum, is a convenient introduction: and Professor H.A. Miers's Cantor Lectures at the Society of Arts on *Precious Stones* (1896) may be studied with advantage. For American stones, the valuable work of Dr G.F. Kunz, *The Gems and Precious Stones of N. America*, is a standard authority; and the Annual Reports of this writer and others, published by the Geological

Survey of the United States in the *Mineral Resources*, form a repertory of valuable information on precious stones in general. The articles in *The Mineral Industry* (founded by R.P. Rothwell) should also be consulted. See likewise O.C. Farrington, *Gems and Gem Minerals* (Chicago, 1903). For optical characters reference should be made to G.F.H. Smith, *The Herbert Smith Refractometer* (London, 1907); L. Claremont, *The Gem-Cutter's Craft* (London, 1906); W. Goodchild, *Precious Stones* (London, 1908).

(F. W. R.*)

2. Gems in Art

In art, the word Gem is the general term for precious stones when engraved with designs, whether adapted for sealing (σφραγίς, *sigillum*, *intaglio*), or mainly for artistic effect (*imagines ectypae*, *cameo*). They exist in a very large number of undoubtedly genuine old examples, extending from the mists of Babylonian antiquity to the decline of Roman civilization, and again starting with a new, but less original impulse on the revival of art. Apart from workmanship they possess the charms of colour deep, rich, and varied, of material unequalled for its endurance, and of scarcity, which in many instances has been enhanced by the remoteness of the lands whence they came or the fortuity of their occurrence. These qualities united within the small compass of a gem were precisely such as were required in a seal as a thing of constant use, so inalienable in its possession as to become naturally a personal ornament and an attractive medium of artistic skill, no less than the centre of traditions or of religious and legendary associations. As regards the nations of classical antiquity, all seals are classed as gems, though in many cases the material is not such as would strictly come under that heading, and precious stones in the modern sense are hardly known to occur. On the other hand it must not be supposed that gems engraved in intaglio were necessarily employed as seals. At all periods many intaglios are found which could not have been so employed without great difficulty. In Greece and Rome, within historic times, gems were worn engraved with designs to show that the bearer was an adherent of a particular worship, the follower of a certain philosopher, or the attached subject of an emperor. However, speaking generally, the intaglio engraving is a means to an end, namely, a seal-impression, while an engraving in relief is complete in itself.

Methods of Engraving (see also under Lapidary).—In gem-engraving the principal modern implement is a wheel or minute copper disk, driven in the manner of a lathe, and moistened with olive oil mixed with emery or diamond dust. There is no clear proof of the use among the ancients of a wheel mounted lathewise, but we have abundant indications of drilling with a revolving tool, which might be either a tubular drill making a ring-like depression, a pointed tool making a cup-like sinking, or a small wheel with a cutting edge, making a boat-shaped depression.

We have one sepulchral monument from Philadelphia showing the tool of an intaglio engraver (δακτυλοκοιλογύφος; see *Athenische Mitteilungen des Arch. Inst.* xv. p. 333). Unfortunately the relief is incomplete, and the published illustration inadequate. It would seem, however, that a revolving tool was supported by a kind of mandrel, and actuated in primitive fashion by a bow. An alternative plan of working was to use a splinter of diamond set in a handle and applied like a graver. Both systems are clearly indicated by Pliny, who in one passage (*H.N.* xxxvii. 60) states that diamond splinters are sought out by gem engravers and set in iron, and so easily hollow out stones of any degree of hardness; while elsewhere (*H.N.* xxxvii. 200) he speaks of the special efficacy of the *fervor terebrarum*, the vehement action of drills. A third method is also indicated by Pliny (*ibid.*) when he speaks of the use of a blunted tool, which must have been moistened and supplied with emery of Naxos.

A four-sided pendant of the Hellenistic period published by Furtwängler (*Antike Gemmen, Gesch.* p. 400) shows clearly the successive stages of the operation. On side *a* the subject is slightly sketched in with the diamond point. On side *b* the deepest parts of the figure have also been roughly scooped out with the wheel. On sides *c* and *d* the wheel work is fairly complete, but the finer internal work has not been begun.

After the design had been completed the stone must have received a final polish on its surface, to obliterate any erroneous strokes of the first sketch; but this process was not carried as far as in modern work. It is a popular error to suppose that a high degree of internal polish is a proof of antiquity. If the interior of the design has a high degree of polish it may be either ancient or modern, or it may be an ancient stone repolished in modern times. If it has a matt surface uniformly produced by intention, it is probably modern. If the design is slightly dimmed and worn or scratched the stone may be antique, but is not necessarily so, since modern engravers have observed this peculiarity, and have imitated it with a success which, were there no other grounds of suspicion, might escape detection.

History.—It has been a subject of controversy whether the first infancy of the art was passed in Egypt or in Babylonia, but it seems highly probable that it was developed in Babylonia, whence at any rate the oldest examples of engraved gems at present known are obtained. It does not necessarily follow, however, that Egypt was therefore a pupil. It may well be that the art was developed independently in the two countries, although certain points of possible contact in respect of the forms employed will be described below in the section dealing with primitive Egypt.

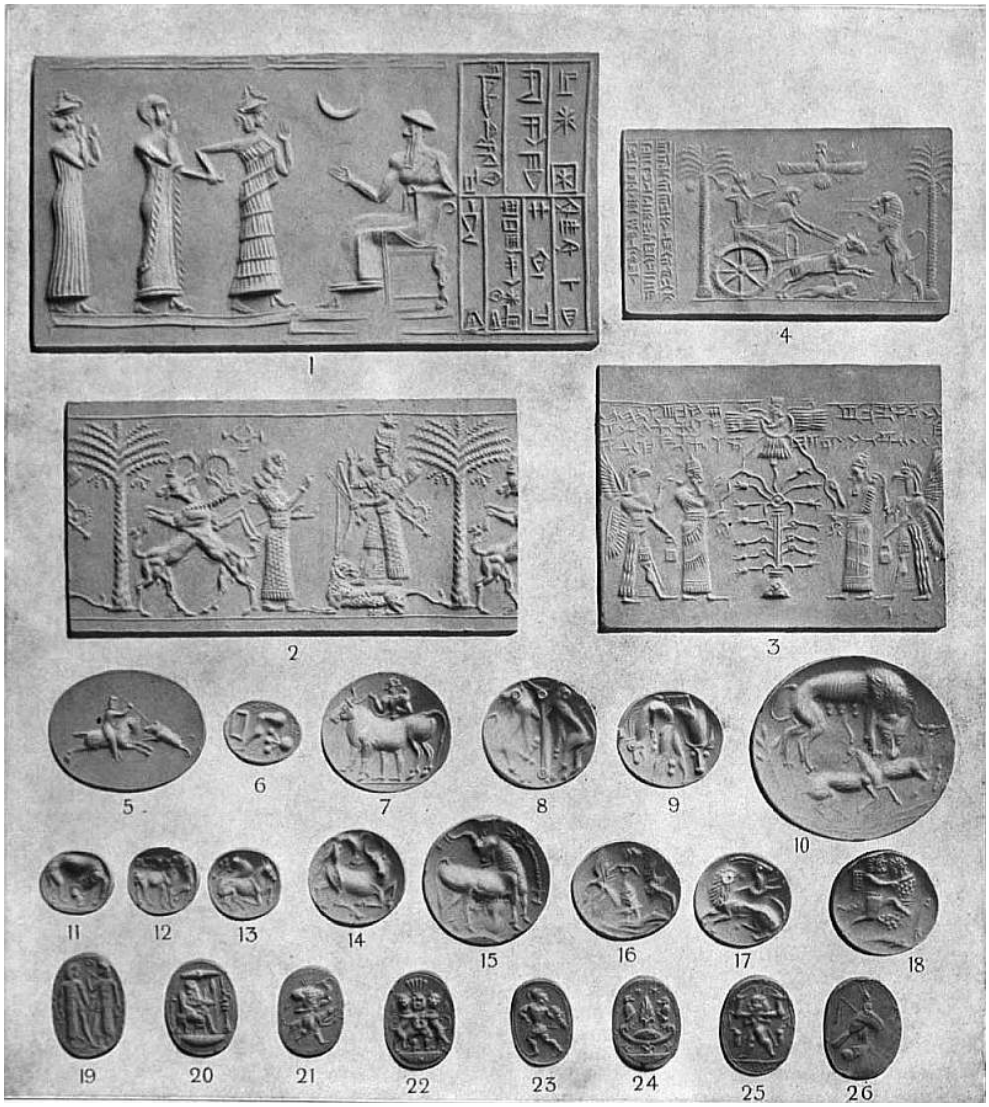
Babylonia.—At a very remote period the cylindrical form of stone was introduced and became the approved shape, while the technical skill of the artist was still slight, and the traces of the tools employed (drill and pencil point) were still unconcealed.

The cylinder was suspended by a string and used as a seal. Impressions of cylinders are frequent on contract tablets. If one of the parties cannot use a seal he makes a nail-mark in lieu thereof, as is recorded in the document.

But from a time that was still comparatively early the engravers could work with considerable skill in the hard stone. In particular a cylinder may be quoted in the de Clercq Collection bearing the name of Sargon I. of Agade, who is placed about 3500 B.C. The cylinder is engraved with the king's name and titles and two symmetrically disposed renderings of Izdubar, with a vase of flowing water giving drink to a bull. The whole is treated in a conventionalized style that indicates long traditions. An important early cylinder in the British Museum is inscribed with the name of a viceroy of Ur-Gur, king of Ur (about 2500 B.C.). The engraving shows Ur-Gur being led into the presence of Sin, the moon-god.

The cylinder seal was adopted by the Assyrians, and so was carried on continuously till the time of the Persian conquest of Babylon (538 B.C.). Meanwhile, as an alternative form the conoidal seal, rounded at the top and having a flat base for the intaglio, came into use beside the cylinder.

In style the Assyrians carried on the Babylonian tradition, but with no freedom of design. Subjects and treatment became rigidly conventional.



1-5.—ORIENTAL.

1. Babylonian (late Sumerian) Cylinder of a Viceroy of Ur-Gur (or Ur-Engur), 2500 B.C.
2. Assyrian Cylinder. Woman adoring Goddess.
3. Assyrian Cylinder. Assur worshipped by two Assyrian kings, and divine Attendants.
4. Persian Seal of Darius (500 B.C.). Lion Hunt.
5. Graeco-Persian Scarabaeoid. Boar Hunt.

6-15.—CRETAN AND MYCENAEAN INTAGLIOS.

6. Cretan Symbols.
7. Man and Bull. Crete.
8. Lions and Column. Ialysus.
9. Daemon. Crete.
10. Lioness and Deer.

11-13. Three-sided Stone. Peloponnesus.

14. Man and Bull. Crete.
15. Bull and Palm. Ialysus.

16-18.—GEMS OF THE ISLANDS.

16. Goddess on Waves. Birds.
17. Lion and Goat.
18. Heracles and Nereus.

19.—PHOENICIAN SEAL, inscribed.

20-26.—GRAECO-PHOENICIAN SCARABS FROM THARROS.

20. King, enthroned.
21. Bes with Antelope and Hound.
22. Bes with Lions.
23. Warrior.
24. Egyptian Device.
25. Bes and Goats.
26. Hawk of Horus.

All the above are in the British Museum.

27-34.—EARLY GREEK SCARABS AND SCARABAEOIDS.
27. Pluto and Persephone. (New York.)
28. Boreas and Oreithyia. (New York.)
29. Youth and Dog.
30. Archer feeling Arrow Tip. (Lord Southesk.)
31. Satyr and Wine Cup.
32. Archer and Dog.
33. Satyr with Wineskin.
34. Athena with Gorgon Spoils.

35-44.—FINEST GREEK SCARABS AND SCARABAEOIDS.
35. Head of Young Warrior.
36. Lyre Player. (Cockerell Coll.)
37. Crane, with Deer's Antler.
38. Head of Eos.
39. Lyre Player. (Woodhouse Coll. and B.M.)
40. Lyre Player, signed by Syries.
41. Stork and Grasshopper, signed by Dexamenos. (St. Petersburg.)
42. Flying Crane, signed by Dexamenos. (St. Petersburg.)
43. Flying Goose.
44. Lion and Stag.

45-54.—ETRUSCAN SCARABS.
45. Achilles in Retirement.
46. Victory.
47. Capaneus struck by the Bolt.
48. Heracles.
49. Capaneus struck by the Bolt.
50. Achilles.
51. Heracles and Cycnus.
52. Heracles.
53. Heracles and the Lion.
54. Machaon bandaging Philoctetes.

55-57—GREEK GEMS.
55. Girl with Scroll and Lyre.
56. Girl with Water-Jar.
57. Head of Aristippus—Deities.

58-61.—SIGNED GEMS.
58. Asclepius of Aulos.
59. Citharist of Allion.
60. Medusa of Solon.
61. Heracles of Gnaios.

62-70.—ROMAN GEMS.
62. Portrait.
63. Head of Trajan Decius.
64. Ares and Aphrodite.
65. Jupiter of Heliopolis.
66. Artemis of Ephesus.
67. So-called Psyche.
68. So-called Psyche.
69. Minerva with Mask, Stamp for the Eye Balsam of Herophi
70. Helios.

71-72.—CHRISTIAN GEMS.
71. Crucifixion.
72. Good Shepherd. Jonah.

73-76.—EIGHTEENTH CENTURY GEMS.
73. Achilles of Pamphilus, copied from the antique.
74. Eros and Psyche, by Pichler.
75. Head of Athena.
76. Athena, from Townley Bust by Marchant.

After the Persian conquest the victors adopted the cylinder form of the conquered, and continued to use it. A Persian cylinder seal of Darius (probably about 500 B.C.) in the British Museum shows the king in his chariot, transfixing a lion with his arrows, in a palm wood. Above is the winged emblem of the Persian deity Ahuramazda. The inscription gives the name and titles of Darius in the Persian, Scythic and Babylonian languages. The style is accurate and minute. The idea of the lion hunt is borrowed from the Assyrian monuments, but the engraver has been careful to make the necessary changes of costume and treatment. The cylinder was, as might be anticipated,

imitated to a certain extent by peoples of the Eastern world in touch with Babylonia. It occurs in Armenia, Media and Elam. It has been found in Crete (*British School Annual*, viii. p. 77) and is frequent in the early Cypriote deposits. In some instances it has been found unfinished and therefore must be supposed to be of local manufacture. Sometimes a direct imitation of cuneiform characters occurs on the Cypriote cylinders. The same form was also employed by the Phoenicians (about the 8th century-7th century B.C.). By the Greeks and Etruscans it was used, but only rarely, and by way of exception.

Egypt.—We must go back to the remotest periods for the origin of intaglio engraving in Egypt. Recent discoveries of tombs of the earliest dynasties at Abydos and Nagada have thrown much light on the early stages of Egyptian art, and have revealed the remarkable fact that in Egypt (as in Babylonia) the cylinder was the earliest form used for the purpose of a seal. The cylinders that have been found are comparatively few in number; but a large number of jar-stoppings of clay are preserved on which cylinder designs have been rolled off while the clay was still soft. Such early incised cylinders as are extant are made either of hard wood or (as in an instance in the British Museum) of stone. The identity of form has been thought to indicate a connexion with Babylonia, but none can be traced in the designs of the respective cylinders.

The Egyptians of the earliest dynasties had an admirable command of hard stones, as shown by their beads and stone vases, but with the exception of the cylinders quoted they are not known to have applied their skill to the production of intaglios. At this early period the scarab (or beetle) was still unknown as a gem-form. It was only about the time of the 4th dynasty that the scarab (*q.v.*) was first introduced, and gradually took the place of the cylinder as the prevailing shape.

The *Scarabaeus sacer* (Egyptian, *Kheperer*), rolling its eggs in a ball of mud, became the accepted emblem of the sun-god, and so the form had an amuletic value. Scarabs of obsidian and crystal date back to the 4th dynasty. Others, coarse and uninscribed, belong to the beginning of the first Theban empire. After the 18th dynasty they are counted by thousands. While the beetle form was naturalistically treated, the flat surface underneath was well adapted to receive a hieroglyphic sign. The scarabs, however, are by no means the only product of the art. We have also figures of all kinds in the round and in intaglio—statuettes, figures of animals and of deities, and sacred emblems such as the ankh (or *crux ansata*) and the eye. Among interesting variations from the scarab form is the oblong intaglio of green jasper in the Louvre (*Gazette arch.*, 1878, p. 41) with a design on both sides. It represents on the obverse Tethmosis (Thothmes) II. (1800 B.C.) slaying a lion, and identified by his cartouche. On the reverse we have the same king drawing his bow against his enemies from a war chariot. The scarabs of Egypt though uninteresting in themselves, considered as examples of engraving, have this accidental importance in the history of art, that they furnished the Phoenicians with a model which they were able to improve as regards the intaglio by a more free spirit of design, gathered partly from Egypt and partly from Assyria. The scarab thus improved exercised a lasting influence on the later history, since, as will be seen below, it was adopted and modified both by Greeks and Etruscans.

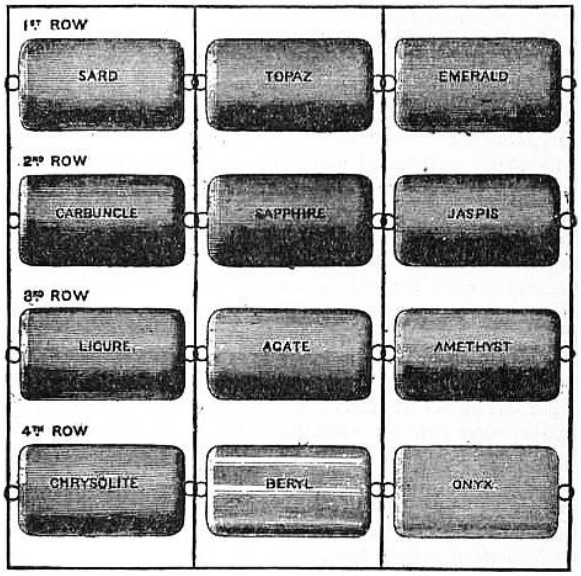


FIG. 1.—Jewish High Priest's Breastplate.

Engraved Gems in the Bible.—While the Phoenicians have left actual specimens to show with what skill they could adopt the systems of gem-engraving prevailing at their time in Egypt and Assyria, the Israelites, on the other hand, have left records to prove, if not their skill, at least the estimation in which they held engraved gems. "The sin of Judah is written with a pen of iron and with the point of a diamond" (Jerem. xvii. 1). To pledge his word Judah gave Tamar his signet, with its cord for suspension, and staff (Gen. xxxviii. 18); whence if this passage be compared with the frequent use of "seal" in a metaphorical sense in the Bible, and with the usage of the Babylonians of carrying a seal with an emblem engraved on it recorded by Herodotus, it may be concluded that among the Israelites also every man of mark at least wore a signet. Their acquaintance with the use of seals in Egypt and Assyria is seen in the statement that Pharaoh gave Joseph his signet ring as a badge of investiture (Gen. xli. 42), and that the stone which closed the den of lions was sealed by Darius with his own signet and with the signet of his lords (Daniel vi. 17). Then as to the stones which were most prized, Ezekiel (xxviii. 13), speaking of the prince of Tyre, mentions "the sardius, the topaz and the diamond, the beryl, the onyx, and the jasper, the sapphire, the emerald and the carbuncle," stones which again occur in that most memorable of records, the description of the breastplate of the high priest (Exodus xxviii. 16-21, and xxxix. 8-14). Twelve stones grouped in four rows, each with three specimens, may be arranged on a square, so as to have the rows placed either vertically or horizontally. If they are to cover the whole square, then, unless the gold mounts supplied the necessary compensation, they must be cut in an oblong form, and if the names engraved on them are to run lengthwise, as is the manner of Assyrian cylinders, then the stones, to be legible, must be grouped in four horizontal rows of three each. There is in fact no reason to suppose that the gems of the breastplate were in any other form than that of cylinders such as abounded to the knowledge of the Israelites, with this possibility, however, that they may have been cut lengthways into half-cylinders like a

fragmentary one of sard in the British Museum, which has been mounted in bronze, and, as a remarkable exception, has been set with three small precious stones now missing. It could not have been a seal, because of this setting, and because the inscription is not reversed. The names of the twelve tribes, not their standards, as has been thought, may have been engraved in this fashion, just as on the two onyx stones in the preceding verses (Exodus xxviii. 9-11), where there can be no question but that actual names were incised. On these two stones the order of the names was according to primogeniture, and this, it is likely, would apply to the breastplate also. The accompanying diagram will show how the stones, supposing them to have been cylinders or half-cylinders, may have been arranged consistently with the descriptions of the Septuagint. In the arrangement of Josephus (iii. 7. 5) the jasper is made to change places with the sapphire, the amethyst with the agate, and the onyx with the beryl, while our version differs partly in the order and partly in the names of the stones; but probably in all these accounts the names had in some cases other meanings than those which they now carry. It must be remembered that we have two series of equivalents, namely, the Hebrew compared with the Septuagint, and the Greek words of the Septuagint compared with the modern names, which in many cases, though derived from the Greek, have changed their applications. From the fact that to each tribe was assigned a stone of different colour, it may be taken that in each case the colour was one which belonged prescriptively to the tribe and was symbolic, as in Assyria, where the seven planets appropriated each a special colour [see Brandis in *Hermes*, 1867, p. 259 seq., and de Saulcy, *Revue archéologique*, 1869, ii. p. 91; and compare Revelation xxi. 12, 13, where the twelve gates, which have the names of the twelve tribes written upon them, are grouped in four threes, and 19, 20, where the twelve precious stones of the walls are given]. The precious stones which occur among the cylinders of the British Museum are sard, emerald, lapis lazuli (sapphire of the ancients), agate, onyx, jasper and rock crystal.

Gem-Engraving in Greek Lands.—We must now turn to the history of gem-engraving in Greek lands. The excavations in Crete in the first years of the 20th century revealed a previously unknown culture, which lasted on the lowest computation for more than two thousand years, and was only interrupted by the national upheavals which preceded the opening of Greek history proper. (See Crete; *Archaeology*; and Aegean Civilization.) Throughout the whole period the products of the gem-engraver occupy an important place among the surviving remains. It must suffice, however, in this place to indicate the chief groups of stones.

The earliest engraved stones of Minoan Crete are three-sided prism seals, made of a soft steatite, native in S.E. Crete (*Journ. of Hellenic Studies*, xvii. p. 328). These are incised with pictorial signs evidently belonging to a rudimentary hieroglyphic system, and are dated before 3000 B.C. At a period placed by A.J. Evans between 2800 and 2200 the method was fully systematized and employed on the signets, as well as on tablets and other materials. This development of the hieroglyphic system was accompanied by an increasing power of working in hard material, and cornelian and chalcedony superseded soft steatite (*Journ. of Hell. Studies*, xvii. p. 334).

Towards 2000 B.C. a highly developed linear form began to supersede the pictorial signs. It is abundant on the tablets, but the gems thus inscribed are comparatively rare. The linear form in turn died out some six hundred years later.

The signs of the pictorial script incised on the gems are representations of objects, expressed with precision, but giving little scope for the higher side of the gem-engraver's art. Simultaneously, however, with the use of the script, a high degree of skill was acquired by the engravers in rendering animal and human forms. Scenes occur of ritual observance, hunting, animal life, and strange compounded forms of demons. The excavations did not yield a large number of original gems of this class, but a great number of clay sealings from such signets were discovered. That they were synchronous with the use of the forms of script described above is proved by the fact that in the palace at Cnossus deposits were found, both in the linear and the hieroglyphic script, sealed with these signets, the seal impressions being again endorsed in the script (*Brit. School Annual*, xi. pp. 56, 62). For a remarkable group of sealings found at Zakro see *Journ. of Hell. Studies*, xxii. pll. 6-10. The finest naturalistic engravings are placed towards the close of the "Mid-Minoan" and beginning of the "Late-Minoan" periods (about 2200-1800 B.C.). During the progress of the "Late-Minoan" period the subjects tended to assume a more formal and heraldic character. The forms of stones in favour were the disk convex on each side (lenticular or lentoid stones), and during the "Mid-Minoan" period, elaborate signets in the form of modern fob-seals. Apart from the use of intaglios for sealing, the excavations have shown that the Cretan lapidaries were largely employed in the working of gems for purposes of decoration. Fragments of lapis lazuli and crystal for inlaying (the crystals having coloured designs on their lower surfaces) were found in the throne room at Cnossus; the royal gaming-board, also from the palace at Cnossus, had inlaid crystal disks and plaques. The workshop of a lapidary, with unfinished works in marble, steatite, jasper and beryl, was also found within the precincts of the palace (*Brit. School Annual*, vii. pp. 20, 77). Examples were also found of work in relief, substantially anticipating the art of cameo-cutting.

The area over which the Cretan influence extended was wide. Its manifestations in Greek lands proper, first revealed by Schliemann's excavation of the royal tombs of Mycenae, ran parallel with and outlasted the later periods of the Cretan culture to which it stood in close relation (see Aegean Civilization). Its gems and intaglio works in gold are known to us from the finds at Mycenae, and at analogous sites, such as Menidi, Vaphio and Ialysus. They have much in common with the finer class of Cretan stones already described. The engraved gems fall principally into two groups in respect of form, namely, the lenticular (or lentoid) stones already mentioned, and (more rarely) glandular stones, so called from their resemblance to a *glans* or sling bolt. A Cretan fresco shows a figure wearing an agate lenticular stone suspended from the left wrist. The finer specimens of the Aegean gems are engraved with the wheel and the point in hard stones, such as chalcedony, amethyst, sard, rock-crystal and haematite. A lapidary's workshop similar to that at Cnossus has been found at Mycenae, with a store of unused gems, and an unfinished lenticular stone (*Ephemeris Archaiologikè*, 1897, p. 121). The characteristic of the Aegean engraver is the free expression of living forms. His subjects are figures of animals, men and demons in combat, and heraldic compositions recalling the Gate of Lions at Mycenae. It was almost inevitable that the scarab should be found in the Cretan and Aegean deposits, but in such cases we have the Egyptian scarab directly imported, and not, as at a later period, non-Egyptian adaptations of the form. The cylinder also (except in Cyprus, the borderland between east and west) only occurs as an importation, and not as a currently manufactured shape.

Fig. 2.—Lenticular Rock-Crystal from Ialysus. (Brit. Mus.)

Fig. 3.—Lenticular Sard from Ialysus. (Brit. Mus.)

The "Island Gems."—The Aegean culture was swept away probably by that dimly

seen upheaval which separated Mycenaean from historical Greece, and which is commonly known as the Dorian invasion. One of the few facts which indicate a certain continuity of tradition in later Greece is this, that we again find the same characteristic forms, the glandular and lenticular stones, in the cemeteries, of Melos and elsewhere. It is only recently that archaeologists have learnt to distinguish between the later lenticular and glandular stones "of the Greek Islands," as they are commonly called, and those of the Aegean age. Engravings of the later class are worked in soft materials only, such as steatite. They have not the power of expressing action peculiar to the Aegean artist. In general, the continuity of tradition between the gems of the Mycenaean and the historical periods is in respect of shape rather than of art. The subjects are for the most part decorative forms (the Gryphon, the winged Sphinx, the winged horse, &c.) in course of development into characters of Greek myth.

The Phoenicians and the Greeks.—About the end of the 8th and beginning of the 7th century B.C. the Phoenicians began to exercise a powerful influence as intermediaries between Egypt and Assyria and the Mediterranean. Porcelain and other imitations of Egyptian ornaments, and especially of Egyptian scarabs, are found in great numbers on such sites as Amathus in Cyprus, Camirus in Rhodes, in Etruria, and at Tharros in Sardinia. The Egyptian hieroglyphics are imitated with mistakes, the figures introduced are stiff and formal, the animals as a rule heraldic. The scarab form, which in Egypt had had its sacred significance, was now become nothing more than a convenient shape for an object of jewelry or for the reverse side of a stone. It was adopted from the Phoenicians both by Greeks and Etruscans. By the Greeks, with whom we are at present concerned, its use was occasional, and about 500 B.C. it was superseded by the scarabaeoid. Under this name two forms, somewhat similar but independent in origin, are usually grouped without sufficient discrimination. The scarabaeoid proper is a simplification of the scarab, effected by the omission of all details of the beetle. But many of the stones known as scarabaeoids, with a flat and oval base and a convex back, are in respect of their form probably of North Syrian origin (so Furtwängler). The earliest examples of archaic Greek gem-engraving (other than the later "Island gems" already described) are works of Ionian art. They show a desire, only limited by imperfect power of expression, to represent the human figure, though the particular theme may be a god or other mythical personages. By the beginning of the 5th century the engravers had reached the point of full development, and the scarabaeoids of the time embody its results. As an example of fine scarabaeoids the Woodhouse intaglio of a seated citharist (fig. 5; *Cat. of Gems in Brit. Mus.* No. 555) may be quoted as perhaps the very finest example of Greek gem-engraving that has come down to us. It would stand early in the 5th century B.C., a date which would also suit the head of Eos from Ithome in Messenia (fig. 6). The number, however, of fine scarabaeoids known to us has been considerably increased in recent years. They are marked by a broad and simple treatment, which attains a large effect without excessive minuteness or laboured detail. In these respects the style has something in common with the reliefs of the 5th century.

FIG. 4.—Victory. Early Greek Scarab. (Brit. Mus.)

FIG. 5.—Citharist. Early Greek Scarabaeoid. (Brit. Mus.)

FIG. 6.—Head of Eos. (Brit. Mus.)

Literary History.—The literary references to the early gem-engravers are no longer of the same importance as before in view of the fuller knowledge we possess as to the quality of early gem-engraving, but it is necessary that they should be taken into account.

The records of gem-engravers in Greece begin in the island of Samos, where Mnesarchus, the father of the philosopher Pythagoras, earned by his art more of praise than of wealth. "Not to carry the image of a god on your seal," was a saying of Pythagoras; and, whatever his reason for it may have been, it is interesting to observe him founding a maxim on his father's profession of gem-engraving (Diogenes Laërt. viii. 1, 17). From Samos also came Theodorus, who made for Polycrates the seal of emerald (Herodotus iii. 41), which, according to the curious story, was cast in vain into the deep sea on purpose to be lost. That the design on it was a lyre, as is stated in one authority, is unlikely, at least if we accept Benndorf's ingenious interpretation of Pliny (*Nat. Hist.* xxxiv. 83). He has suggested that the portrait statue of Theodorus made by himself was in all probability a figure holding in one hand a graving tool, and in the other, not, as previously supposed, a quadriga so diminutive that a fly could cover it with its wings, but a scarab with the engraving of a quadriga on its face (*Zeitschrift für die österreich. Gymnasien*, 1873, pp. 401-411), whence it is not unreasonable to conclude that this scarab in fact represented the famous seal of Polycrates. Shortly after 600 B.C. there was a law of Solon's forbidding engravers to retain impressions of the seals they made, and this date would fall in roundly with that of Theodorus and Mnesarchus, as if there had in fact been at that time a special activity and unusual skill. That the use of seals had been general long before, in Cretan and Mycenaean times, we have seen above, and it is singular to find, as Pliny points out (xxxiii. 4), no direct mention of seals in Homer, not even in the passage (*Iliad*, vi. 168) where Bellerophon himself carries the tablets on which were written the orders against his life. From the time of Theodorus to that of Pyrgoteles in the 4th century B.C. is a long blank as to names, but not altogether as to gems, the production of which may be judged to have been carried on assiduously from the constant necessity of seals for every variety of purpose. The references to them in Aristophanes, for example, and the lists of them in the ancient inventories of treasures in the Parthenon and the Asclepieion at Athens confirm this frequent usage during the period in question. The mention of a public seal for authenticating state documents also becomes frequent in the inscriptions. In the reign of Alexander the Great we meet the name of Pyrgoteles, of whom Pliny records that he was no doubt the most famous engraver of his time, and that Alexander decreed that Pyrgoteles alone should engrave his portrait. Nothing else is known of Pyrgoteles. A portrait of Alexander in the British Museum (No. 2307), purporting to be signed by him, is palpably modern.

From literary sources we also learn the names of the engravers Apollonides, Chronius and Dioscorides, but the date of the last-mentioned only is certain. He is said to have made an excellent portrait of Augustus, which was used as a seal by that emperor in the latter part of his reign and also by his successors. Inscriptions on extant gems make it probable that Dioscorides was a native of Aegeae in Cilicia, and that three sons, Hyllos, Herophilus and

Eutyches, followed their father's occupation. We have also a few scattered notices of amateurs and collectors of gems, but it will be seen that for the whole period of classical antiquity the literary notices give little aid, and we must return to the gems.

Early Inscribed Gems.—Various early gems are inscribed with proper names, which may be supposed to indicate either the artist or the owner of the gem. In some cases there is no ambiguity, *e.g.* on a scarab is inscribed, "I am the seal of Thersis. Do not open me"; and a scarabaeoid (fig. 7) is inscribed, "Syries made me." But when we have the name alone, the general principle on which we must distinguish between owner and artist is that the name of the owner is naturally meant to be conspicuous (as in a gem in the British Museum inscribed in large letters with the name of Isagor[as]), while the name of an artist is naturally inconspicuous and subordinate to the design.

Fig. 7—Scarabaeioid by Syries. (Brit. Mus.)

The early engravers known to us by their signatures are: Syries, who was author of the modified scarab in the British Museum, mentioned above, with a satyr's head in place of the beetle, and a citharist on the base—a work of the middle of the 6th century; Semon, who engraved a black jasper scarab now at Berlin, with a nude woman kneeling at a fountain filling her pitcher, of the close of the 6th century; Epimenes, who was the author of an admirable chalcedony scarabaeoid of a nude youth restraining a spirited horse—formerly in the Tyszkiewicz Collection, and of about the beginning of the 5th century. But better known to us than any of these artists is the 5th-century engraver, Dexamenus of Chios, of whose work four examples[1] survive, viz.:—

1. A chalcedony scarabaeoid from Greece, in the Fitzwilliam Museum at Cambridge, with a lady at her toilet, attended by her maid. Inscribed ΔΕΞΑΜΕΝΟΣ, and with the name of the lady, ΜΙΚΗΣ. 566

2. An agate with a stork standing on one leg, inscribed ΔΕΞΑΜΕΝΟΣ simply.

3. A chalcedony with the figure of a stork flying, and inscribed in two lines, the letters carefully disposed above each other, ΔΕΞΑΜΕΝΟΣ ΕΠΟΙΕ ΧΙΟΣ.

4. A gem, apparently by the same Dexamenus, is a cornelian formerly belonging to Admiral Soteriades in Athens, and subsequently in the collection of Dr Arthur Evans. It has a portrait head, bearded and inscribed ΔΕΞΑΜΕΝΟΣ ΕΠΟΙΕ.

Fig. 8.—Greek Sard. 5th Cent. B.C. (Brit. Mus.)

The design of a stork flying occurs on an agate scarab in the British Museum, from the old Cracherode Collection, and therefore beyond all suspicion of having been copied from the more recently discovered Kertch gem.

For the period immediately following that early prime to which the gems above described belong, our materials are less copious. Some of the finest examples are derived from the Greek tombs in the Crimea and South Russia. Reckoned among the best of the Crimean gems, and that is equivalent to saying among the best of all gems, are the following: (1) a burnt scarabaeoid with an eagle carrying off a hare; (2) a gem with scarab border and the figure of a youth seated playing on the trigonon, very much resembling the Woodhouse intaglio (both engraved, *Compte rendu*, 1871, pl. vi. figs. 16, 17). In these, and in almost all Greek gems belonging to this period of excellence, the material is of indifferent quality, consisting of agate, chalcedony or cornelian, just as in the older specimens. Brilliant colour and translucency are as yet not a necessary element, and accordingly the design is worked out solely with a view to its own artistic merit. The scarab tends to die out. The scarabaeoid in its turn is abandoned for the simple ring stone. The subjects chosen take by degrees a different character. Aphrodite (nude), Eros, children and women tend to replace the older and severer themes. The motives of 4th-century sculpture appear by degrees on the gems.

Fig. 9.—Amethyst Pendant. (Brit. Mus.)

Etruscan Gems.—At this point it is convenient to discuss the gem-engraving of the Etruscans, which came into being towards the close of the archaic period of Greek art. In the early Etruscan deposits, such as that of the Polledrara tomb in the British Museum (towards 600 B.C.), we find nothing except Phoenician imports of porcelain or stone scarabs, both strongly Egyptian in character. During the 6th century a few of the semi-Egyptian stones of Sardinia make their appearance. But in the latter part of the century these oriental products tend to die out, and we have in their place the native works of Etruscan artists. These engravings stand in the closest relation to Greek works of the close of the 6th century and many imported Greek scarabs also occur.

The Etruscan scarab has its beetle form more minutely engraved than that of the Greeks. It is further distinguished in the better examples, alike from the Greek and the Egyptian form, by a small border of a sort of petal ornament round the lower edge of the beetle. Like the earlier Greek scarabs it has the cable border round the design, but the border continued in use in Etruria when it had been abandoned in Greece. The scarabaeoid form does not occur in Etruscan deposits. Etruscan engraving begins when Greek art was approaching maturity, with studies, sometimes stiff and cramped, of the heroic nude form. Some of the Greek deities such as Athena and Hermes occur, together with the winged personages of Greek mythology. To the heroic types the names of Greek legend are attached, with modifications of form, such as TYTE for Tydeus, and ΚΑΠΝΕ for Capaneus. Sometimes the names are appropriate and sometimes they are assigned at random. The subjects include certain favourite incidents in the Trojan and Theban cycles (*e.g.* the death of Capaneus); myths of Heracles; athletes, horsemen, a few scenes of daily life. Certain schemes of composition are frequent. In particular, a figure too large for the field, standing and bending over, is made to serve for many types. The engraving of the finer Etruscan gems is minute and precise,

marked with elegance and command of the material. Its fault is its want of original inspiration. Special mention must be made of a very numerous group of cornelian scarabs, roughly engraved for the most part with cup-shaped sinkings (whence they are known as gems *a globolo tondo*) roughly joined together by furrows. Notwithstanding their apparent rudeness, these gems are shown, by the conditions in which they are found, to be comparatively late works of the 4th century. Furtwängler ingeniously suggests that the rough execution was intended to emphasize the shining surfaces of the cup-sinkings, rather than to produce any particular intaglio subject. (For an elaborate classification of the Etruscan scarabs see Furtwängler, *Geschichte*, p. 170.)

The Cameos.—After the beginning of the regal period, in the 4th century B.C., the introduction of more splendid materials from the East was turned to good account by the development of the cameo, *i.e.* of gem-carving in relief (for the origin of the word see CAMEO). But in its simpler forms the principle of the cameo necessarily dates from the beginning of the art. Thus a lion in rock-crystal was found in the very early royal tomb of Nagada (de Morgan, *Recherches, Tombeau de Negadah*, p. 193). The Egyptian scarab, on its rounded side, had been naturalistically carved in relief in beetle form. Steatite engravings in relief (notably the harvest festival vase from Hagia Triada) were found in the Cretan deposits. Subjects are found carved in the round in hard stone in Mycenaean graves. When we come to historical Greece and to Etruria the cameo of later times is anticipated by various attempts to modify the traditional form of the scarab. An example in cornelian was found at Orvieto in 1874 in a tomb along with vases dating from the beginning of the 5th century B.C., and it will be seen from the engraving of this gem (*Arch. Zeit.*, 1877, pl. xi. fig. 3) that, while the design on the face is in intaglio, the half-length figure of a Gorgon on the back is engraved in relief. Compare a cornelian fragment, apparently cut from the back of a scarabaeoid, now in the British Museum. As further examples of the same rare form of cameo, the following gems in the British Museum may be mentioned:—(1) a cornelian cut from back of a scarabaeoid, with head of Gorgon surrounded by wings; (2) cornelian scarabaeoid: Gorgon running to left; on face of the gem an intaglio of Thetis giving armour to Achilles; (3) steatite scarabaeoid, already mentioned, signed by Syries, head of a satyr, full face, with intaglio of citharist. There is, however, no evidence at present available to show that the cameo proper had been introduced in Greece before the time of Alexander. The earliest examples found in known conditions are derived from Crimean tombs of the middle of the 3rd century B.C.

Among the most splendid of ancient cameos are those at St Petersburg and Vienna, each representing a monarch of the Diadochi and his consort (Furtwängler, pl. 53). There is much controversy as to the persons represented, but the cameos are probably works of the 3rd century.

The materials which ancient artists used for cutting into cameos were chiefly those siliceous minerals which, under a variety of names, present various strata or bands of two or more distinct colours. The minerals, under different names, are essentially the chalcedonic variety of quartz, and the differences of colour they present are due to the presence of variable proportions of iron and other foreign ingredients. These banded stones, when cut parallel to the layers of different colours, and when only two coloured bands—white and black, or sometimes white and black and brown—are present, are known as onyxes; but when they have with the onyx bands layers of cornelian or sard, they are termed sardonyxes. The sardonyx, which was the favourite stone of ancient cameo-engravers, and the material in which their masterpieces were cut, was procured from India, and the increased intercourse with the East after the death of Alexander the Great had a marked influence on the development of the art.

Akin in their nature to the great regal cameos, which from the nature of the case are cut on a nearly plane surface, are the cups and vases cut out of a homogeneous stone and therefore capable of being worked in the round. A few examples of such works survive. The most famous are the Farnese Tazza and the cup of the Ptolemies. The Tazza, which is now in the National Museum at Naples, was bought by Lorenzo de' Medici from Pope Paul II. in 1471. It is a large shallow bowl of sardonyx, 8 in. in diameter. On its exterior surface is a Gorgoneion upon an aegis; in the interior is an allegorical design, relating to the Nile flood. The cup of the Ptolemies, formerly known as the cup of St Denis, is preserved in the Cabinet des Médailles of the French Bibliothèque Nationale. It is a cup 4¾ in. high and 5⅛ in. in diameter, carved out of oriental sardonyx, and richly decorated with Dionysiac emblems and attributes in relief.

The Cameo in the Roman Empire.—During the 1st century of the empire the engraver's art alike in cameo and in intaglio was at a high degree of excellence. The artist in cameo took full advantage of his rich opportunities in the way of sumptuous materials, and of the requirements of an imperial court. The two most famous examples of this art which have come down to the present day are the Great Agate of the Sainte Chapelle in the Bibliothèque Nationale, Paris, and the Augustus Cameo in the Vienna Collection. The former was pledged among other valuables in 1244 by Baldwin II. of Constantinople to Saint Louis. It is mentioned in 1344 as "Le Camahieu," having been sent in that year to Rome for the inspection of Pope Clement VI. It is a sardonyx of five layers of irregular shape, like all classical gems, measuring 12 in. by 10½ in. It represents on its upper part the deified members of the Julian house. The centre is occupied with the reception of Germanicus on his return from his great German campaign by the emperor Tiberius and his mother Livia. The lower division is filled with a group of captives in attitudes expressive of woe and deep dejection. The Vienna gem (*Gemma augustea*), an onyx of two layers measuring 8⅝ in. by 7½, is a work of still greater artistic interest. The upper portion is occupied with an allegorical representation of the coronation of Augustus, the emperor being represented as Jupiter with Livia as the goddess Roma at his side. In the composition deities of Earth and Sea, and several members of the family of Augustus, are introduced; on the exergue or lower portion are Roman soldiers preparing a trophy, barbarian captives and female figures. This gem was in the 15th century at the abbey of St Sernin at Toulouse. According to tradition it had been placed there by Charlemagne. It came into the possession of the emperor Rudolph II. in the 16th century for the enormous sum of 12,000 gold ducats. The principal cameo in the collection of the British Museum was acquired at the final dispersion of the Marlborough Collection in 1899. It is a sardonyx measuring 8¾ in. by 6 in., and appears to represent a Roman emperor and empress in the forms of Serapis and Isis. Here also, in imperial times as in the Hellenistic period, side by side with the great cameos, we meet with works carved out in the round. Noted examples of such work are the Brunswick vase (at Brunswick), with the subject of Triptolemus; the Berlin vase with the lustration of a new-born imperial prince; and the Waddesdon vase in the British Museum, with a vine in relief set in a rich enamelled Renaissance mount. Hardly less precious than the cameos in sardonyx were the imitations carved out of coloured glass. The material was not costly, but its extreme fragility made the work of extreme difficulty. Examples of such work are the Barberini or Portland vase, deposited in the British Museum, with scenes supposed to be connected with the story of Peleus and Thetis; and the

FIG. 10.—Actaeon. Fragment of Sardonyx Cameo. (Brit. Mus.)

“vase of blue glass” from Pompeii, in the museum at Naples (see Mau and Kelsey, p. 408). The world’s great cameos, which are hardly more than a dozen in number, have not been found by excavation. They remained as precious objects in imperial and ecclesiastical treasuries and passed thence to the royal and national collections of modern Europe.

The Intaglio in the Roman Empire.—The art of engraving in intaglio was also at a high level of excellence in the beginning of the Roman empire. This is to be inferred alike from the admirable portraits of the 1st century A.D., and from the number of signed gems bearing Roman artists’ names, such as Aulus, Gnaius and the like, which could hardly belong to any other period. It is impossible, however, to found any argument upon the artists’ signatures without taking into account the intricate questions of authenticity which are discussed in the following section.

Signed Gems.—The number of gems which have, or purport to have, the name of the artist inscribed upon them is very large. A great many of the supposed signatures are modern forgeries, dating from the period between 1724 (when the book of Stosch, *Gemmae antiquae caelatae, scalptorum nominibus insignitae*, first drew general attention to the subject) and 1833, when the multitude of forged signatures (about 1800 in number) in the collection of Prince Poniatowski made the whole pursuit ridiculous. It is known, however, that forged signatures were current before 1724 (see Stosch, p. xxi.), and in the period immediately following they were very numerous. Thus Laurence Natter (*Méthode de graver en pierres fines* (1754), p. xxx.) confesses that, whenever desired, he made copies. For example, he copied a Venus (Brit. Mus. No. 2296), converting the figure into a Danaë and affixing the name of Aulos which he found on the Venus. Cf. Mariette, *Traité* (1750), i. p. 101.

The question which of the multitude of supposed signatures can be accepted as genuine has been a subject of prolonged and intricate controversy. In the period immediately following the Poniatowski forgeries the extreme height of scepticism is represented by Koehler, who only acknowledged five gems (Koehler, iii. p. 206) as having genuine signatures. In recent years the subject has been principally dealt with by Furtwängler, whose conclusion is to admit a considerable number of gems rejected by his predecessors.

It must suffice here to point out a few general principles. In the first place a certain number of gems recently discovered have inscriptions which are undoubtedly genuine and which record the names of the engravers. The form of the signature may be a nominative with a verb, a nominative without a verb or a genitive. The artists in this class are Syries, Dexamenus, Epimenes and Semon, mentioned above, and a few others. Another group of gems which must be accepted consists of stones whose known history goes back to a period at which a forged inscription was impossible. Thus a bust of Athena in the Berlin Collection, signed by Eutyches, was seen by Cyriac of Ancona in 1445. A glass cameo signed by Herophilus, son of Dioscorides, now at Vienna, was, in the 17th century, in the monastery of Echternach, where it had probably been from old times. The portrait of Julia, daughter of Titus, by Euodos (now in the Bibliothèque Nationale) was formerly a part of a reliquary presented to the abbey of St Denis by Charles the Bold. Another group of undoubtedly genuine signatures occurs on cameos (in stone and paste) which have the inscriptions in relief, and therefore as part of the original design. Such are the works of Athenion, and of Quintus, son of Alexas.

For the great majority of signed gems which do not fall into these categories the reader must refer to the discussions of Furtwängler and others (see *Bibliography* below). It must suffice to say that Furtwängler arrives at the result that we have in all genuine signatures of at least fifty ancient gem-engravers.

FIG. 11.—Christian Gem. The Good Shepherd. (Brit. Mus.)

FIG. 12.—Gnostic Gem. (Brit. Mus.)

FIG. 13.—Sassanian Gem. (Brit. Mus.)

Gem-Engraving in the Later Empire.—In the following centuries the art of intaglio engraving, which was still at a high degree of perfection in the first century of the Roman empire, became more mechanical. The designs have a very characteristic appearance, due to the method of production with rough and hasty strokes of the wheel only. A collection of gems found in England, such as that in the possession of the corporation of Bath, shows the feeble character in particular of the gems current in the provinces. Except in portraiture, and in grylli or conceits, in which various things are combined into one, often with much skill, the subjects were as a rule only variations or adaptations of old types handed down from the Greeks. When new and distinctly Roman subjects occur, such as the finding of the head on the Capitol, or Faustulus, or the she-wolf with the twins, both the stones and the workmanship are poor. In such cases, where the design stirs a genuine national interest, it may happen that very little of artistic rendering will be acceptable rather than otherwise, and much more is this true when the design is a symbol of some article of faith, as in the early Christian gems. There both the art and the material are at what may be called the lowest level. The usual subjects on the early Christian gems are the fish, anchor, ship, dove, the good shepherd, and, according to Clemens, the lyre. Under the Gnostics, however, with whom there was more of speculation than of faith, symbolism was developed to an extent which no art could realize without the aid of writing. A gem was to them a talisman more or less elaborate with long, but for the most part quite unintelligible, engraved formulae. The difficulty is to make out how the stones were carried; many specimens exist, but none show signs of mounting. The materials are usually haematite or jasper. As regards the designs, it is clear that Egyptian sources have been most drawn upon. But the symbolism is also largely associated with Mithraic worship. The name Abraxas, or more correctly Abrasax, which, from its frequency on these gems, has led to their being called also “Abraxas gems,” is, when the Greek letters of which it is composed are treated as Greek numerals, equal to 365, the number of days in a year, and the same is the case with ΜΕΙΘΡΑΣ.

More interesting, from the occasionally forcible portraiture and the splendour of some of the jacinths employed, are the Sassanian gems, which as a class may be said to represent the last stage of true gem-engraving in ancient times.

The art of cameo-engraving, which, as we have seen, attained its greatest splendour at the beginning of the empire, followed on the whole a similar course. It waned in the early part of the 3rd century after the death of the emperor Severus, but under the first Christian emperor Constantine it enjoyed a brief period of revival. Fine cameo portraits of Constantine are extant; and it was during or shortly after his reign that Christian Scripture subjects began to appear on cameos. That class of subjects constituted the staple of such work—generally rude and artistically debased—as continued to be cultivated under the Byzantine empire down to nearly the epoch of the Renaissance. From the Byzantine period downward one peculiarity of gem-engraving becomes noticeable. Cameo-work as compared with intaglios in classical times was rare and infrequent, but now and onwards the opposite is the case, intaglio-sinking having almost died out, and cameos being chiefly produced. Commercial intercourse with the East still secured for the engravers a supply of magnificent sardonyxes, although blood-stone and other non-banded stones were very commonly used for works in relief. Cameos during the long dark ages were used chiefly for the decoration of reliquaries and other altar furniture, and as such their designs were purely ecclesiastical or scriptural. To this period also belongs the class of complimentary or motto cameos, which, containing only inscriptions and an ornamental border, executed in nicolo stones, were used as personal gifts and adornments.

In medieval times antique cameos were held in peculiar veneration on account of the belief, then universal, in their potency as medicinal charms. This power was supposed to be derived from their origin, of which two theories, equally satisfactory, were current. By the one they were held to be the work of the children of Israel during their sojourn in the wilderness (hence the name *Pierres d'Israël*), while the other theory held them to be direct products of nature, the engraved figures pointing to the peculiar virtue lodged in them. Interpreters less mystically inclined found Biblical interpretations for the subjects. Thus the cameo of the Sainte Chapelle was supposed to represent the triumph of Joseph in Egypt. A cameo with Poseidon, Athena and her serpent was Adam and Eve.

The revival of the glyptic arts in western Europe dates from the pontificate of the Venetian Paul II. (1464-1471), himself an ardent lover and collector of gems, to which passion, indeed, it is gravely affirmed he was a martyr, having died of a cold caught by the multiplicity of gems exposed on his fingers. The cameos of the early part of the 16th century rival in beauty of execution the finest classical works, and, indeed, many of them pass in the cabinets of collectors for genuine antiques, which they closely imitated. The Oriental sardonyx was not available for the purposes of the Renaissance artists, who were consequently obliged to content themselves with the colder German agate onyx. The scarcity of worthy materials led them to use the backs of ancient cameos, or to improve on classical works of inferior value executed on good material, and probably to this cause must also be assigned the development of shell cameos, which are rarely found, of an older period.

Among the means of distinguishing antique cameos from cinquecento work, the kind of stone is one of the best tests, the classical artists having used only rich and warm-tinted Oriental stones, which further are frequently drilled through their diameter with a minute hole, from having been used by their original Oriental possessors in the form of beads. The cinquecento artists also, as a rule, worked their subjects in high relief, and resorted to undercutting, no case of which is found in the flat low work of classical times. The projecting portions of antique work exhibit a dull chalky appearance, which, however, fabricators learned to imitate in various ways, one of which was by cramming the gizzards of turkey fowls with the gems. Another index of antiquity is found in the different methods of working adopted in classical and Renaissance times. The tools employed by the Renaissance engraver were the drill and the wheel, while the ancient artist also employed the diamond point.

Fig. 14—Muse, by Pichler. (Brit. Mus.)

The gem-engraver's art again during the 18th century revived under an even greater amount of encouragement from men of wealth and rank. In this last period the names of engravers who succeeded best in imitating classical designs were Natter, Pichler (fig. 14), and the Englishmen Marchant (fig. 15) and Burch. Compared with Greek gems, it will be seen that what at first sight is attractive as refined and delicate is after all an exaggerated minuteness of execution, entirely devoid of the ancient spirit. The success with which modern engravers imposed on collectors is recorded in many instances, of which one may be taken as an instructive type. In the Bibliothèque Nationale is a gem (Chabouillet's catalogue, No. 2337), familiarly known as the signet of Michelangelo, the subject being a Bacchanalian scene. So much did he admire it, the story says, that he copied from it one of the groups in his paintings in the Sistine chapel. The gem, however, is evidently in this part of it a mere copy from Michelangelo's group, and therefore a subsequent production, probably by da Pescia.

Fig. 15.—Nereid and Sea-bull by Marchant. (Brit. Mus.)

In our own day the engraving of cameos has practically ceased to be pursued as an art. Roman manufacturers cut stones in large quantities to be used as shirt-studs and for setting in finger-rings; and in Rome and Paris an extensive trade is carried on in the cutting of shell cameos, which are largely imported into England and mounted as brooches by Birmingham jewelry manufacturers. The principal shell used is the large bull's-mouth shell (*Cassis rufa*), found in East Indian seas, which has a sard-like underlayer. The black helmet (*Cassis tuberosa*) of the West Indian seas, the horned helmet (*C. cornuta*) of Madagascar, and the pinky queen's conch (*Strombus gigas*) of the West Indies are also employed. The famous potter Josiah Wedgwood introduced a method of making imitations of cameos in pottery by producing white figures on a coloured ground, this constituting the peculiarity of what is now known as Wedgwood ware.

Gem Collectors.—The habit of gem-collecting is recorded first in the instance of Ismenias, a musician of Cyprus, who appears to have lived in the 4th century B.C. But though individual collectors are not again mentioned till the time of Mithradates, whose cabinet was carried off to Rome by Pompey, still it is to be inferred that they existed, if not pretty generally, yet in such places as Cyrene, where the passion for gems was so great that the thriftiest person owned one worth 10 minas, and where, according to Aelian (*Var. hist.* xii. 30), the skill in engraving was astonishing. The first cabinet (*dactyliotheca*) in Rome was that of Scaurus, a stepson of Sulla. Caesar is said to have formed six cabinets for public exhibition, and from the time of Augustus all men of refinement were supposed to be judges both of the art and of the quality of the stones.

In the middle ages the chief collections were incorporated in works of art in the church treasuries. The first collector of modern times was, as already mentioned, Pope Paul II., who was followed by a long succession of princely and noble collectors such as Lorenzo de' Medici and the great earl of Arundel. The collection of the latter

passed into the hands of the dukes of Marlborough and thence into the possession of Mr David Bromilow. The collection was finally dispersed by auction in June 1899.

In modern times the principal collections are contained in state museums. The cabinets of Vienna and of the Bibliothèque Nationale are incomparably rich in the historic cameos. Those of the British Museum and of Berlin are the strongest in their range over the whole field of the gem-engraver's art.

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(A. S. M.; A. H. Sm.)

1 For Nos. 1-4 see Furtwängler, pl. 14; for Nos. 2-4 see Evans, *Rev. archéologique*, xxxii. (1898) pl. 8.

GEM, ARTIFICIAL. The term "Artificial Gems" does not mean *imitations* of real gems, but the actual formation by artificial means of the real precious stone, so that the product is identical, chemically, physically and optically, with the one found in nature. For instance, in chemical composition the lustrous diamond is nothing but crystallized carbon. Could we take black amorphous carbon in the form of charcoal or lampblack and dissolve it in a liquid, and by the slow evaporation of that liquid allow the dissolved carbon to separate out, it would probably crystallize in the transparent form of diamond. This would be a true synthesis of diamond, and the product would be just as much entitled to the name as the choicest products of Kimberley or Golconda. But this is a very different thing from the imitation diamond so common in shop windows. Here the chemist has only succeeded in making a paste or glass having limpidity and a somewhat high refractivity, but wanting the hardness and "fire" of the real stone.

The Diamond.—Within recent years chemists have actually succeeded in making the real diamond by artificial means, and although the largest yet made is not more than one-fiftieth of an inch across, the process itself and the train of reasoning leading up to such an achievement are sufficiently interesting to warrant a somewhat full description. Attempts to make diamonds artificially have been numerous, but, with the sole exception of those of Henri Moissan, all have resulted in failure. The nearest approach to success was attained by J.B. Hannay in 1880 and R.S. Marsden in 1881; but their results have not been verified by others who have tried to repeat them, and the probability is that what was then thought to be diamond was in reality carborundum or carbide of silicon.

Attempts have been made by two methods to make carbon crystallize in the transparent form. One is to crystallize it slowly from a solution in which it has been dissolved. The difficulty is to find a solvent. Many organic and some inorganic bodies hold carbon so loosely combined that it can be separated out under the influence of chemical action, heat or electricity, but invariably the carbon assumes the black amorphous form. The other method is to try

to fuse the carbon by fierce heat, when from analogy it is argued that on cooling it will solidify to a clear limpid crystal. The progress of science in other directions has now made it pretty certain that the true mode of making diamond artificially is by a combination of these two methods. Until recently it was assumed that carbon was non-volatile at any attainable temperature, but it is now known that at a temperature of about 3600° C. it volatilizes readily, passing without liquefying directly from the solid to the gaseous state. Very few bodies act in this manner, the great majority when heated at atmospheric pressure to a sufficient temperature passing through the intermediate condition of liquidity. Some few, however, which when heated at atmospheric pressure do not liquefy, when heated at higher pressures in closed vessels obey the common rule and first become liquid and then volatilize. Sir James Dewar found the critical pressure of carbon to be about 15 tons on the sq. in.; that is to say, if heated to its critical temperature (3600° C.), and at the same time subjected to a pressure of 15 tons to the sq. in., it will assume the liquid form. Enormous as such pressures and temperatures may appear to be, they have been exceeded in some of Sir Andrew Noble's and Sir F. Abel's researches; in their investigations on the gases from gunpowder and cordite fired in closed steel chambers, these chemists obtained pressures as great as 95 tons to the sq. in., and temperatures as high as 4000° C. Here then, if the observations are correct, we have sufficient temperature and enough pressure to liquefy carbon; and, were there only sufficient time for these to act on the carbon, there is little doubt that the artificial formation of diamonds would soon pass from the microscopic stage to a scale more likely to satisfy the requirements of science, if not those of personal adornment.

It has long been known that the metal iron in a molten state dissolves carbon and deposits it on cooling as black opaque graphite. Moissan carried out a laborious and systematic series of experiments on the solubility of carbon in iron and other metals, and came to the conclusion that whereas at ordinary pressures the carbon separates from the solidifying iron in the form of graphite, if the pressure be greatly increased the carbon on separation will form liquid drops, which on solidifying will assume the crystalline shape and become true diamond. Many other metals dissolve carbon, but molten iron has been found to be the best solvent. The quantity entering into solution increases with the temperature of the metal. But temperature alone is not enough; pressure must be superadded. Here Moissan ingeniously made use of a property which molten iron possesses in common with some few other liquids—water, for instance—of increasing in volume in the act of passing from the liquid to the solid state. Pure iron is mixed with carbon obtained from the calcination of sugar, and the whole is rapidly heated in a carbon crucible in an electric furnace, using a current of 700 amperes and 40 volts. The iron melts like wax and saturates itself with carbon. After a few minutes' heating to a temperature above 4000° C.—a temperature at which the lime furnace begins to melt and the iron volatilizes in clouds—the dazzling, fiery crucible is lifted out and plunged beneath the surface of cold water, where it is held till it sinks below a red heat. The sudden cooling solidifies the outer skin of molten metal and holds the inner liquid mass in an iron grip. The expansion of the inner liquid on solidifying produces enormous pressure, and under this stress the dissolved carbon separates out in a hard, transparent, dense form—in fact, as diamond. The succeeding operations are long and tedious. The metallic ingot is attacked with hot *aqua regia* till no iron is left undissolved. The bulky residue consists chiefly of graphite, together with translucent flakes of chestnut-coloured carbon, hard black opaque carbon of a density of from 3.0 to 3.5, black diamonds—carbonado, in fact—and a small quantity of transparent colourless diamonds showing crystalline structure. Besides these there may be corundum and carbide of silicon, arising from impurities in the materials employed. Heating with strong sulphuric acid, with hydrofluoric acid, with nitric acid and potassium chlorate, and fusing with potassium fluoride—operations repeated over and over again—at last eliminate the graphite and impurities and leave the true diamond untouched. The precious residue on microscopic examination shows many pieces of black diamond, and other colourless transparent pieces, some amorphous, others crystalline. Although many fragments of crystals are seen, the writer has scarcely ever met with a complete crystal. All appear broken up, as if, on being liberated from the intense pressure under which they were formed, they burst asunder. Direct evidence of this phenomenon has been seen. A very fine piece of diamond, prepared in the way just described and carefully mounted on a microscopic slide, exploded during the night and covered the slide with fragments. This bursting paroxysm is not unknown at the Kimberley mines.

Sir William Crookes in 1906 communicated to the Royal Society a paper on a new formation of diamond. Sir Andrew Noble has shown that in the explosion of cordite in closed steel cylinders pressures of over 50 tons to the sq. in. and a temperature probably reaching 5400° were obtained. Here then we have conditions favourable for the liquefaction of carbon, and if the time of explosion were sufficient to allow the reactions to take place we should expect to get liquid carbon solidified in the crystalline state. Experiment proved the truth of these anticipations. Working with specially prepared explosive containing a little excess of carbon Sir Andrew Noble collected the residue left in the steel cylinder. This residue was submitted by Sir William Crookes to the lengthy operations already described in the account of H. Moissan's fused iron experiment. Finally, minute crystals were obtained which showed octahedral planes with dark boundaries due to high refracting index. The position and angles of their faces, and cleavages, the absence of bi-refringence, and their high refractive index all showed that the crystals were true diamond.

The artificial diamonds, so far, have not been larger than microscopic specimens, and none has measured more than about half a millimetre across. That, however, is quite enough to show the correctness of the train of reasoning leading up to the achievement, and there is no reason to doubt that, working on a larger scale, larger diamonds will result. Diamonds so made burn in the air when heated to a high temperature, with formation of carbonic acid; and in lustre, crystalline form, optical properties, density and hardness, they are identical with the natural stone.

It having been shown that diamond is formed by the separation of carbon from molten iron under pressure, it became of interest to see if in some large metallurgical operations similar conditions might not prevail. A special form of steel is made at some large establishments by cooling the molten metal under intense hydraulic pressure. In some samples of the steel so made Professor Rosel, of the university of Bern, has found microscopic diamonds. The higher the temperature at which the steel has been melted the more diamonds it contains, and it has even been suggested that the hardness of steel in some measure may be due to the carbon distributed throughout its mass being in this adamantine form. The largest artificial diamond yet formed was found in a block of steel and slag from a furnace in Luxembourg; it is clear and crystalline, and measures about one-fiftieth of an inch across.

A striking confirmation of the theory that natural diamonds have been produced from their solution in masses of molten iron, the metal from which has gradually oxidized and been washed away under cycles of atmospheric influences, is afforded by the occurrence of diamonds in a meteorite. On a broad open plain in Arizona, over an area of about 5 m. in diameter, lie scattered thousands of masses of metallic iron, the fragments varying in weight from half a ton to a fraction of an ounce. There is little doubt that these fragments formed part of a meteoric shower, although no record exists as to when the fall took place. Near the centre, where most of the fragments have been found, is a crater with raised edges, three-quarters of a mile in diameter and 600 ft. deep, bearing just the

appearance which would be produced had a mighty mass of iron—a falling star—struck the ground, scattered it in all directions, and buried itself deeply under the surface, fragments eroded from the surface forming the pieces now met with. Altogether ten tons of this iron have been collected, and specimens of the Canyon Diablo meteorite are in most collectors' cabinets. Dr A.E. Foote, a mineralogist, when cutting a section of this meteorite, found the tools injured by something vastly harder than metallic iron, and an emery wheel used for grinding it was ruined. He attacked the specimen chemically, and soon afterwards announced to the scientific world that the Canyon Diablo meteorite contained diamonds, both black and transparent. This startling discovery was subsequently verified by Professors C. Friedel and H. Moissan, and also by Sir W. Crookes.

The Ruby.—It is evident that of the other precious stones only the most prized are worth producing artificially. Apart from their inferior hardness and colour, the demand for what are known as "semi-precious stones" would not pay for the necessarily great expenses of the factory. Moreover, were it to be known that they were being produced artificially the demand—never very great—would almost cease. The only other gems, therefore, which need be mentioned in connexion with their artificial formation are those of the corundum or sapphire class, which include all the most highly prized gems, rivalling, and sometimes exceeding, the diamond in value. Here a remarkable and little-known fact deserves notice. Excepting the diamond and sapphire, each of the precious stones—the emerald, the topaz and amethyst—possesses a more noble, a harder, and more highly-prized counterpart of itself, alike in colour, but superior in brilliancy and hardness; still more strange, the precious stone to which its special name is usually attached is the variety the least prized. The ruby itself might almost be included in the same category. The true ruby consists of the earth alumina, in a clear, crystalline form, having a minute quantity of the element chromium as the colouring matter. It is often called the "Oriental Ruby," or red sapphire, and when of a paler colour, the "Pink Sapphire." But the ruby as met with in jewellers' shops of inferior standing is usually no true ruby, but a "spinel ruby" or "balas ruby," sometimes very beautiful in colour, but softer than the Oriental ruby, and different in chemical composition, consisting essentially of alumina and magnesia and a little silica, with the colouring matter chromium. The colourless basis of the true Oriental precious stones being taken as crystallized alumina or white sapphire, when the colouring matter is red the stone is called ruby, when blue sapphire, when green Oriental emerald, when orange-yellow Oriental topaz, and when violet Oriental amethyst. Clear, colourless crystals are known as white sapphire, and are very valuable. It is evident, therefore, that whosoever succeeds in making artificially clear crystals of white sapphire has the power, by introducing appropriate colouring matter, to make the Oriental ruby, sapphire, emerald, topaz and amethyst. All of these stones, even when of small size, are costly and readily saleable, while when they are of fine quality and large size they are highly prized, a ruby of fine colour, and free from flaws, a few carats in weight, being of more value than a diamond of the same weight.

This being the case, it is not surprising that repeated attempts have been made to effect the crystallization of alumina. This is not a matter of difficulty, but unfortunately the crystals generally form thin plates, of good colour, but too thin to be useful as gems. In 1837 M.A.A. Gaudin made true rubies, of microscopic size, by fusing alum in a carbon crucible at a very high temperature, and adding a little chromium as colouring matter. In 1847 J.J. Ebelmen produced the white sapphire and rose-coloured spinel by fusing the constituents at a high temperature in boracic acid. Shortly afterwards he produced the ruby by employing borax as the solvent. The boracic acid was found to be too volatile to allow the alumina to crystallize, but the use of borax made the necessary difference. But it was not till about the year 1877 that E. Frémy and C. Feil first published a method whereby it was possible to produce a crystallized alumina from which small stones could be cut. They first formed lead aluminate by the fusion together of lead oxide and alumina. This was kept in a state of fusion in a fireclay crucible (in the composition of which silica enters largely). Under the influence of the high temperature the silica of the crucible gradually decomposes the lead aluminate, forming lead silicate, which remains in the liquid state, and alumina, which crystallizes as white sapphire. By the admixture of 2 or 3% of a chromium compound with original materials the resulting white sapphire became ruby. More recently Edmond Frémy and A. Verneuil obtained artificial rubies by reacting at a red heat with barium fluoride on amorphous alumina containing a small quantity of chromium. The rubies obtained in this manner are thus described by Frémy and Verneuil: "Their crystalline form is regular; their lustre is adamantine; they present the beautiful colour of the ruby; they are perfectly transparent, have the hardness of the ruby, and easily scratch topaz. They resemble the natural ruby in becoming dark when heated, resuming their rose-colour on cooling." Des Cloizeaux says of them that "under the microscope some of the crystals show bubbles. In converging polarized light the coloured rings and the negative black cross are of a remarkable regularity."

Other experimentalists have attacked the problem in other directions. Besides those already mentioned, L. Eisner, H.H. De Senarmont, Sainte-Claire Deville, and H. Caron and H. Debray have succeeded with more or less success in producing rubies. The general plan adopted has been to form a mixture of salts fusible at a red heat, forming a liquid in which alumina will dissolve. Alumina is now added till the fused mass will take up no more, and the crucible is left in the furnace for a long time, sometimes extending over weeks. The solvent slowly volatilizes, and the alumina is deposited in crystals, coloured by whatever colouring oxide has been added.

Mention has been made above of a stone frequently substituted for the true ruby, called the "spinel" or "balas" ruby. The spinel and ruby occur together in nature, stones from Burma being as often spinel as true Oriental ruby. In the artificial production of the ruby it sometimes happens that spinel crystallizes out when true Oriental ruby is expected. The fusion bath is so arranged that only red-coloured alumina shall crystallize out, but it is difficult to have all the materials of such purity as to ensure the complete absence of silica and magnesia. In this case, when these impurities have accumulated to a certain point they unite with the alumina, and spinel then separates, as it crystallizes more easily than ruby. When all the magnesia and silica have been eliminated in this way the bath resumes its deposition of crystalline ruby. Rubies of fine colour and of considerable size have been shown in London, made on the Continent by a secret process. The writer has seen several cut stones so made weighing over a carat each, the uncut crystals measuring half an inch along a crystal edge, and weighing over 70 grains, and a clear plate of ruby cut from a single crystal weighing over 10 grains. Ruby has been made by Sir W. Roberts-Austen as a by-product in the production of metallic chromium. Oxide of chromium and aluminium powder are intimately mixed together in a refractory crucible, and the mixture is ignited at the upper part. The aluminium and chromium oxide react with evolution of so much heat that the reduced chromium is melted. Such is the intensity of the reaction that the resulting alumina is also completely fused, floating as a liquid on the molten chromium. Sometimes the alumina takes tip the right amount of chromium to enable it to assume the ruby colour. On cooling the melted alumina crystallizes in large flakes, which on examination by transmitted light are seen to be true ruby. The development of the red colour is said by C. Greville-Williams only to take place at a white heat. It is not due to the presence of chromic acid, but to a reaction between alumina and chromic oxide, which requires an elevated temperature.

Artificially made but real rubies have been put on the market, prepared by a process of fusion by A. Verneuil. He

finds that certain conditions have to be fulfilled in order to get the alumina in a transparent form. The temperature must not be higher than is absolutely necessary for fusion. The melted product must always be in the same part of the oxyhydrogen flame, and the point of contact between the melted product and the support should be reduced to as small an area as possible. M. Verneuil uses a vertical blowpipe flame directed on a support capable of movement up and down by means of a screw, so that the fused product may be removed from the zone of fusion as it gets higher by addition of fresh material. The material employed is either composed of small, valueless rubies, or alumina coloured with the right amount of chromium. It is very finely powdered and fed in through the blowpipe orifice, whence it is blown in a highly heated condition into the zone of fusion. The support is a small cylinder of alumina placed in the axis of the blowpipe. As the operation proceeds the fine grains of powder driven on to the support in the zone of fusion form a cone which gradually rises and broadens out until it becomes of sufficient size to be used for cutting. Rubies prepared in this way have the same specific gravity and hardness as the natural ruby, and they are also dichroic, and in the vacuum tube under the influence of the cathode stream they phosphoresce with a discontinuous spectrum showing the strong alumina line in the red. When properly cut and mounted it is almost impossible to distinguish them from natural stones.

The Sapphire.—Auguste Daubrée has shown that when a full quantity of chromium is added to the bath from which white sapphire crystallizes the colour is that of ruby, but when much less chromium is added the colour is blue, forming the true Oriental sapphire. The real colouring matter of the Oriental sapphire is not definitely known, some chemists considering it to be chromium and others cobalt. Artificial sapphires have been made of a fair size and perfectly transparent by the addition of cobalt to the igneous bath of alumina, but the writer does not consider them equal in colour to true Oriental sapphire.

The Oriental Emerald.—The stone known as emerald consists chemically of silica, alumina and glucina. Like the ruby, it owes its colour to chromium, but in a different state of oxidation. As already mentioned, there is another stone which consists of crystallized alumina coloured with chromium, but holding the chromium in a different state of oxidation. This is called the Oriental emerald, and, owing to its beauty of colour, its hardness and rarity, it is more highly prized than the emerald itself and commands higher prices. The Oriental emerald has been produced artificially in the same way as the ruby, by adding a larger amount of chromium to the alumina bath and regulating the temperature.

The Oriental Amethyst.—The amethyst is rock crystal (quartz) of a bluish-violet colour. It is one of the least valuable of the precious stones. The sapphire, however, is found occasionally of a beautiful violet colour; it is then called the Oriental amethyst, and, on account of its beauty and rarity, is of great value. It is evident that if to the igneous bath of alumina some colouring matter, such as manganese, is added capable of communicating a violet colour to the crystals of alumina, the Oriental amethyst will be the result. Oriental amethyst has been so formed artificially, but the stone being known only as a curiosity to mineralogists and experts in precious stones, and the public not being able to discriminate between the violet sapphire and amethystine quartz, there is no demand for the artificial stone.

The Oriental Topaz.—The topaz is what is called a semi-precious stone. It occurs of many colours, from clear white to pink, orange, yellow and pale green. The usual colour is from straw-yellow to sherry colour. The exact composition of the colouring matter is not known; it is not entirely of mineral origin, as it changes colour and sometimes fades altogether on exposure to light. Chemically the topaz consists of alumina, silica and fluorine. It is not so hard as the sapphire. There is also a yellow variety of quartz, which is sometimes called “false topaz.” The Oriental topaz, on the other hand, is a precious stone of great value. It consists of clear crystalline sapphire coloured with a small quantity of ferric oxide. It has been produced artificially by adding iron instead of chromium to the matrix from which the white sapphire crystallizes.

The Zircon.—The zircon is a very beautiful stone, varying in colour, like the topaz, from red and yellow to green and blue. It is sometimes met with colourless, and such are its refractive powers and brilliancy that it has been mistaken for diamond. It is a compound of silica and zirconia. H. Sainte-Claire Deville formed the zircon artificially by passing silicon fluoride at a red heat over the oxide zirconia in a porcelain tube. Octahedral crystals of zircon are then produced, which have the same crystalline form, appearance and optical qualities as the natural zircon.

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(W. C.)

GEMBLOUX, a town in the province of Namur and on the borders of Brabant, Belgium, 25 m. S.E. of Brussels on the main line to Namur and Luxemburg. Pop. (1904) 4643. It is a busy place with large railway and engine works, and the junction for several branch lines. On the 31st of January 1578 Don John of Austria gained here a signal victory over the army of the provinces led by Antony de Goignies.

GEMINI (“The Twins,” *i.e.* Castor and Pollux), in astronomy, the third sign in the zodiac, denoted by the symbol II. It is also a constellation, mentioned by Eudoxus (4th century B.C.) and Aratus (3rd century B.C.), and catalogued by Ptolemy, 25 stars, Tycho Brahe 25, and Hevelius 38. By the Egyptians this constellation was symbolized as a couple of young kids; the Greeks altered this symbol to two children, variously said to be Castor and Pollux, Hercules and Apollo, or Triptolemus and Iasion; the Arabians used the symbol of a pair of peacocks. Interesting objects in this constellation are: α Geminorum or Castor, a very fine double star of magnitudes 2.0 and 2.8, the fainter component is a spectroscopic binary; η Geminorum, a long period (231 days) variable, the extreme range in magnitude being 3.2 to 4; ζ Geminorum, a short period variable, 10.15 days, the extreme range in magnitude being 3.7 to 4.5; *Nova* Geminorum, a “new” star discovered in 1903 by H.H. Turner of Oxford; and the star cluster M.35 Geminorum, a fine and bright, but loose, cluster, with very little central condensation.

GEMINIANI, FRANCESCO (*c.* 1680-1762), Italian violinist, was born at Lucca about 1680. He received lessons in music from Alessandro Scarlatti, and studied the violin under Lunati (Gobbo) and afterwards under Corelli. In 1714 he arrived in London, where he was taken under the special protection of the earl of Essex, and made a living by teaching and writing music. In 1715 he played his violin concertos with Handel at the English court. After visiting Paris and residing there for some time, he returned to England in 1755. In 1761 he went to Dublin, where a servant robbed him of a musical manuscript on which he had bestowed much time and labour. His vexation at this loss is said to have hastened his death on the 17th of September 1762. He appears to have been a first-rate violinist, but most of his compositions are dry and deficient in melody. His *Art of Playing the Violin* is a good work of its kind, but his *Guida armonica* is an inferior production. He published a number of solos for the violin, three sets of violin concertos, twelve violin trios, *The Art of Accompaniment on the Harpsichord, Organ*, &c., *Lessons for the Harpsichord* and some other works.

GEMISTUS PLETHO [or Plethon], **GEORGIUS** (*c.* 1355-1450), Greek Platonic philosopher and scholar, one of the chief pioneers of the revival of learning in Western Europe, was a Byzantine by birth who settled at Mistra in the Peloponnese, the site of ancient Sparta. He changed his name from Gemistus to the equivalent Pletho (“the full”), perhaps owing to the similarity of sound between that name and that of his master Plato. He invented a religious system founded on the speculative mysticism of the Neoplatonists, and founded a sect, the members of which believed that the new creed would supersede all existing forms of belief. But he is chiefly memorable for having introduced Plato to the Western world. This took place upon his visit to Florence in 1439, as one of the deputies from Constantinople on occasion of the general council. Cardinal Bessarion became his disciple; he produced a great impression upon Cosimo de’ Medici; and though not himself making any very important contribution to the study of Plato, he effectually shook the exclusive domination which Aristotle had exercised over European thought for eight centuries. He promoted the union of the Greek and Latin Churches as far as possible, but his efforts in this direction bore no permanent fruit. He probably died before the capture of Constantinople. The most important of his published works are treatises on the distinction between Plato and Aristotle as philosophers (published at Venice in 1540); on the religion of Zoroaster (Paris, 1538); on the condition of the Peloponnese (ed. A. Ellissen in *Analekten der mittel- und neugriechischen Literatur*, iv.); and the Νόμοι (ed. C. Alexandre, Paris, 1858). In addition to these he compiled several volumes of excerpts from ancient authors, and wrote a number of works on geography, music and other subjects, many of which still exist in MS. in various European libraries.

See especially F. Schultze, *Geschichte der Philosophie der Renaissance*, i. (1874); also J.A. Symonds, *The Renaissance in Italy* (1877), ii. p. 198; H.F. Tozer, “A Byzantine Reformer,” in *Journal of Hellenic Studies*, vii. (1886), chiefly on Pletho’s scheme of political and social reform for the Peloponnese, as set forth in the pamphlets addressed to Manuel II. Palaeologus and his son Theodore, despot of the Morea; W. Gass, *Gennadius und Pletho* (1844). Most of Pletho’s works will be found in J.P. Migne, *Patrologia Graeca*, clx.; for a complete list see Fabricius, *Bibliotheca Graeca* (ed. Harles), xii.

GEMMI PASS, a pass (7641 ft.) leading from Frutigen in the Swiss canton of Bern to Leukerbad in the Swiss canton of the Valais. It is much frequented by travellers in summer. From Kandersteg (7½ m. by road above Frutigen, which is 12 m. by rail from Spiez on the Berne-Interlaken line) a mule path leads to the summit of the pass, passing over the Spitalmatte plain, where in 1782 and again in 1895 a great avalanche fell from the Altels (11,930 ft.) to the S.E., causing on both occasions great loss of life and property. The mule path descends on the south side of the pass by an extraordinary series of zigzags, made accessible for mules (though no rider is now allowed to descend on mule-back) by a band of Tirolese workmen in 1740-1741. They are cut in a very steep wall of rock, about 1800 ft. in height, and lead down to the village of Leukerbad, which is 9½ m. by carriage road past Leuk above the Susten station in the Rhône valley and on the Simplon line.

(W. A. B. C.)

GENDARMERIE, originally a body of troops in France composed of *gendarmes* or men-at-arms. In the days of chivalry they were mounted and armed cap-à-pie, exactly as were the lords and knights, with whom they

constituted the most important part of an army. They were attended each by five soldiers of inferior rank and more lightly armed. In the later middle ages the men-at-arms were furnished by owners of fiefs. But after the Hundred Years' War this feudal gendarmerie was replaced by the *compagnies d'ordonnance* which Charles VII. formed when the English were driven out of France, and which were distributed throughout the whole extent of the kingdom for preserving order and maintaining the king's authority. These companies, fifteen in number, were composed of 100 lances or gendarmes fully equipped, each of whom was attended by at least three archers, one *coutillier* (soldier armed with a cutlass) and one *varlet* (soldier's servant). The states-general of Orleans (1439) had voted a yearly subsidy of 1,200,000 livres in perpetuity to keep up this national soldiery, which replaced, and in fact was recruited chiefly amongst, the bands of mercenaries who for about a century had made France their prey. The number and composition of the *compagnies d'ordonnance* were changed more than once before the reign of Louis XIV. This sovereign on his accession to the throne found only eight companies of gendarmes surviving out of an original total of more than one hundred, but after the victory of Fleurus (1690), which had been decided by their courage, he increased their number to sixteen. The four first companies (which were practically guard troops) were designated by the names of *Gendarmes écossais*, *Gendarmes anglais*, *Gendarmes bourguignons* and *Gendarmes flamands*, from the nationality of the soldiers who had originally composed them; but at that time they consisted entirely of French soldiers and officers. These four companies had a captain-general, who was the king. The fifth company was that of the queen; and the others bore the name of the princes who respectively commanded them. This organization was dissolved in 1788. The Revolution swept away all these institutions of the monarchy, and, with the exception of a short revival of the *Gendarmes de la garde* at the Restoration, henceforward the word "gendarmerie" possesses an altogether different significance—viz. military police.

GENEALOGY (from the Gr. γένος, family, and λόγος, theory), a pedigree or list of ancestors, or the study of family history.

1. *Biblical Genealogies.*—The aims and methods of ancient genealogists require to be carefully considered before the value of the numerous ancestral lists in the Bible can be properly estimated. Many of the old "genealogies," like those of Greece, have arisen from the desire to explain the origin of the various groups which they include. Information relating to the subdivision of tribes, their relation to each other, the intermingling of populations and the like are thus frequently represented in the form of genealogies. The "sons" of a "father" often stand merely for the branches of a family as they existed at some one period, and since in course of time tribal relations would vary, lists which have originated at different periods will present discrepancies. It is obvious that many of the Biblical names are nothing more than personifications of nations, tribes, towns, &c., which are grouped together to convey some idea of the bond by which they were believed to be connected.

> For the personification of a people or tribe, cp. Gen. xxxiv. 30 ("Jacob said ... I am a few men"), Josh. xvii. 14 ("the children of Joseph said ... I am a numerous people"), Ex. xiv. 25 ("Egypt said, let me flee"), Jos. ix. 7, 1 Sam. v. 10, &c.; see G.B. Gray on Numbers, xx. 14 (*Internat. Crit. Comm.*). Thus we find among the "sons" of Japhet: (the nations) Gomer, Javan, Tubal; Canaan "begat" Sidon and Heth; the "sons" of Ishmael include the well-known tribes Kedar and Jetur; Jacob, or the synonym Israel, personifies the "children of Israel" (cf. use of "I," "thou" of the Israelites in Deut., and in poetical passages). The recognition of this characteristic usage often furnishes an ethnological interpretation to those genealogical stories which obviously do not relate to persons, but to tribes or peoples personified. The Edomites and Israelites are regarded as "brothers" (cf. Num. xx. 14, Deut. ii. 4, Am. i. 11), and since Esau (Edom) was born before Jacob (Israel) it would appear that the Edomites were held to be the older nation. The union of two clans is expressed as a marriage, or the wife is the territory which is dominated by the husband (tribe); see CALEB. If the woman is not of noble blood, but is a handmaiden or concubine, her children are naturally not upon the same footing as those of the wife; consequently the descendants of Ishmael, the son of Hagar (Sarah's maid), are inferior to Isaac and his descendants, whilst the children of Keturah ("incense"), Abraham's concubine, are still lower—from the Israelite point of view. This application of the terms of relationship is characteristic of the Semites. The "father" of the Rechabites is their head or founder (cf. 1 Sam. x. 12: "who is their father?"), and a common bond, which is not necessarily physical, unites all "sons," whether they are "sons of the prophets" (members of prophetic guilds) or "sons of Belial" (worthless men).

The interpretation of ethnological or statistical genealogies may easily be pushed too far. Every case has to be judged upon its own merits, and due allowance must be made both for the ambition of the weaker to claim or to 574
strengthen an alliance with the stronger, and for the not unnatural desire of clans or individuals to magnify the greatness of their ancestry. The first step must always be the careful comparison of related lists in order to test the consistency of the tradition. Next, these must be critically studied in the light of all available historical material, though indeed such evidence is not necessarily conclusive. Finally, (*a*) literary criticism must be employed to determine if possible the dates of such lists, since obviously a contemporary register is more trustworthy than one which is centuries later; (*b*) a critical estimate of the character of the names and of their use in various periods of Old Testament history is of importance in estimating the antiquity of the list[1]—for example, many of the names in Chronicles attributed to the time of David are indubitably exilic or post-exilic; and (*c*) principles of ordinary historical probability are as necessary here as in dealing with the genealogies of other ancient peoples, and attention must be paid to such features as fluctuation in the number of links, representation of theories inconsistent with the growth of national life, schemes of relationship not in accordance with sociological conditions, &c.

The Biblical genealogies commence with "the generations of the heaven and earth," and by a process of elimination pass from Adam and Eve by successive steps to Jacob and to his sons (the tribes), and finally to the subdivisions of each tribe (cp. 1 Chron. i.-ix. 1). According to this theory every Israelite could trace back his descent to Jacob, the common father of the whole nation (Josh. vii. 17 seq., 1 Sam. x. 21). Such a scheme, however, is full of manifest improbabilities. It demands that every tribe and every clan should have been a homogeneous group which had preserved its unity from the earliest times, that family records extending back for several centuries were in existence, and that such a tribe as Simeon was able to maintain its independence in spite of the tradition that it lost its autonomy in very early times (Gen. xlix. 7). The whole conception of the unity of the tribes cannot be referred to a date previous to the time of David, and in the older writings a David or a Jeroboam was sufficiently described as the son of Jesse or of Nebat. The genealogical zeal as represented in the Old Testament is chiefly of later growth, and the exceptions are due to interpolation (Josh. vii. 1 18, contrast v. 24), or to the desire to modify or qualify an older notice. This, in the case of Saul (1 Sam. ix. 1), has led to textual corruption; a list of such a length as his

should have reached back to one of the "sons" of Benjamin (cf. *e.g.* Gen. xlvi. 21), else it were purposeless. The genealogies, too, are often inconsistent amongst themselves and in contradiction to their object. They show, for example, that the population of southern Judah, so far from being "Israelite" was half-Edomite (see Judah), and several of the clans in this district bear names which indicate their original affinity with Midian or Edom. Moreover, there was a free intermixture of races, and many cities had a Canaanite (*i.e.* pre-Israelite) population which must have been gradually absorbed by the Israelites (cf. Judg. 1.). That spirit of religious exclusiveness which marked later Judaism did not become prominent before the Deuteronomic reformation (see Deuteronomy), and it is under its influence that the writings begin to emphasize the importance of maintaining the purity of Israelite blood, although by this time the fusion was complete (see Judg. iii. 6) and for practical purposes a distinction between Canaanites and Israelites within the borders of Palestine could scarcely be discerned.

Many of the genealogical data are intricate. Thus, the interpretation of Gen. xxxiv. is particularly obscure (see Levites *ad fin.*; Simeon). As regards the sons of Jacob, it is difficult to explain their division among the four wives of Jacob; viz. (*a*) the sons of Leah are Reuben, Simeon, Levi and Judah (S. Palestine), Issachar and Zebulun (in the north), and Dinah (associated with Shechem); (*b*) of Leah's maid Zilpah, Gad and Asher (E. and N. Palestine); (*c*) of Rachel, Joseph (Manasseh and Ephraim, *i.e.* central Palestine) and Benjamin; (*d*) of Rachel's maid Bilhah, Dan and Naphtali (N. Palestine). It has been urged that (*b*) and (*d*) stood upon a lower footing than the rest, or were of later origin; or that Bilhan points to an old clan associated with Reuben (Gen. xxxv. 22) or Edom (Bilhan, Gen. xxxvi. 27), whilst Zilpah represents an Aramaean strain. Tradition may have combined distinct schemes, and the belief that the wives were Aramaean at least coincides with the circumstance that Aramaean elements predominated in certain of the twelve tribes. The number "twelve" is artificial and can be obtained only by counting Manasseh and Ephraim as one or by omitting Levi, and a careful study of Old Testament history makes it extremely difficult to recover the tribes as historical units. See, on these points, the articles on the several tribes, B. Luther, *Zeit. d. alttest. Wissens.* (1901), pp. 1 sqq.; G.B. Gray, *Expositor* (March 1902), pp. 225-240, and in *Ency. Bib.*, art. "Tribes"; and H.W. Hogg's thorough treatment of the tribes in the last-mentioned work.

The ideal of purity of descent shows itself conspicuously in portions of Deuteronomic law (Deut. vii. 1-3, xxiii. 2-8), and in the reforms of Nehemiah and Ezra (Ezr. ix. 1-4, 11 sqq.; Neh. xiii. 1-3). The desire to prove the continuity of the race, enforced by the experience of the exile, gave the impetus to genealogical zeal, and many of the extant lists proceed from this age when the true historical succession of names was a memory of the past. This applies with special force to the lists in Chronicles which present finished schemes of the Levitical divisions by the side of earlier attempts, with consequent confusion and contradiction. Thus the immediate ancestors of Ethan appear in the time of Hezekiah (2 Chron. xxix. 12), but he with Asaiah and Heman are contemporaries of David, and their genealogies from Levi downwards contain a very unequal number of links (1 Chron. vi.). By another application of genealogical method the account of the institution of priests and Levites by David (1 Chron. xxiv.) presents many names which belong solely to post-exilic days, thus suggesting that the scribes desired to show that the honourable families of their time were not unknown centuries previously. Everywhere we find the results of much skill and labour, often in accordance with definite theories, but a thorough investigation reveals their weakness and often quite incidentally furnishes valuable evidence of another nature.

The intricate Levitical genealogies betray the result of successive genealogists who sought to give effect to the development of the hierarchal system (see Levites). The climax is reached when all Levites are traced back to Gershon, Kehath and Merari, to which are ascribed respectively Asaph, Heman and Ethan (or Jeduthun). The last two were not originally Levites in the later accepted sense of the term (see 1 Kings iv. 31). To Kehath is reckoned an important subdivision descended from Korah, but in 2 Chron. xx. 19 the two are distinct groups, and Korah's name is that of an Edomite clan (Gen. xxxvi. 5, 14, 18) related to Caleb, and thus included among the descendants of Judah (1 Chron. ii. 43). Cases of adjustment, redistribution and "Levitizing" of individuals are frequent. There are traces of varying divisions both of the singers (Neh. xi. 17) and of the Levites (Num. xxvi. 58; Ezr. ii. 40, iii. 9; 1 Chron. xv. 5-10, xxiii.), and it is noteworthy that in the case of the latter we have mention of such families as Hebroni (Hebronite), Libni (from Libnah)—ethnics of South Judaean towns. In fact, a significant number of Levitical names find their analogy in the lists of names belonging to Judah, Simeon and even Edom, or are closely connected with the family of Moses; *e.g.* Mushi (*i.e.* Mosaïte), Gershon and Eleazar (cp. Gershom and Eliezer, sons of Moses). The Levites bear a class-name, and the genealogies show that many of them were connected with the minor clans and families of South Palestine which included among them Moses and his kin. Hence, it is not unnatural that Obed-edom, for example, obviously a southerner, should have been reckoned later as a Levite, and the work ascribed by the chronicler's history to the closing years of David's life may be influenced by the tradition that it was through him these mixed populations first attained importance. See further David; Jews; Levites.

In the time of Josephus every priest was supposed to be able to prove his descent, and perhaps from the time of Ezra downwards lists were carefully kept. But when Anna is called an Asherite (Luke ii. 36), or Paul a Benjamite (Rom. xi. 1), family tradition was probably the sole support to the claim, although the tribal feeling had not become entirely extinct. The genealogies of Jesus prefixed to two of the gospels are intended to prove that He was a son of David. But not that alone, for in Matt. i. he is traced back to Abraham the father of the Jews, whilst in Luke iii. He, as the second Adam, is traced back to the first man. The two lists are hopelessly inconsistent; not because one of them follows the line of Mary, but because they represent independent attempts. That in Matthew is characteristically arranged in three series of fourteen generations each through the kings of Judah, whilst Luke's passes through an almost unknown son of David; in spite of this, however, both converge in the person of Zerubbabel.

See further, A.C. Hervey, *Genealogies of Our Lord*; H. von Soden, *Ency. Bib.* ii. col. 1666 sqq.; B.W. Bacon, Hastings' *Dict. Bib.* ii. pp. 138 seq. On the subject generally see J.F. M'Lennan's *Studies* (2nd ser., ch. ix., "fabricated genealogies"); S.A. Cook, *Ency. Bib.* ii. col. 1657 sqq. (with references); W.R. Smith, *Kinship and Marriage* (2nd ed., especially ch. i.).

(S. A. C.)

2. *Greek and Roman Genealogies.*—A passing reference only is needed to the intricate genealogies of gods and sons of gods which form so conspicuous a feature in classical literature.[2] In every one of the numerous states into which ancient Greece was divided there were aristocratic families, whose genealogies as a rule went back to prehistoric times, their first ancestor being some hero of divine descent, from whom, or from some distinguished younger ancestor, they derived their names. Many of these families were, as families, undoubtedly of great antiquity even at the beginning of the historical period; and in several instances they continued to maintain a conspicuous and separate existence for centuries. The element of family pride is prominent in the poetry of the Megarian Theognis; and in an inscription belonging to the 2nd century B.C. the recipient of certain honours from the community of Gythium is represented as the thirty-ninth in direct descent from the Dioscuri and the forty-first from Heracles. Even in Athens, long after the constitution had become thoroughly democratic, some of the clans

continued to be known as Eupatridae (of noble family); and Alcibiades, for example, as a member of the phratria of the Eurysacidae, traced his origin through many generations to Eurysaces, who was represented as having been the first of the Aeacidae to settle in Attica. The Corinthian Bacchiadae traced their descent back to Heracles, but took their name from Bacchis, a younger ancestor. It is very doubtful, however, whether such pedigrees as this were very seriously put forward by those who claimed them; and it is certain that, almost along the whole line, they were unsupported by evidence.[3] We have the authority of Pollux (viii. 111) for stating that the Athenian γένη, of which there were thirty in each φρατρία, were organized without any exclusive regard being had to blood-relationship; they were constantly receiving accessions from without; and the public written registers of births, adoptions and the like do not appear to have been preserved with such care as would have made it possible to verify a pedigree for any considerable portion even of the strictly historical period.[4]

The great antiquity of the early Roman (patrician) *gentes*, who universally traced themselves back to illustrious ancestors, is indisputable; and the rigid exclusiveness with which each preserved its *hereditates gentiliciae* or *sacra gentilicia* is sufficiently illustrated by the fact that towards the close of the republic there were not more than fifty patrician families (Dion. Halic. i. 85). Yet even in these it is obvious that, owing to the frequency of resort to the well-recognized practice of adoption, while there was every guarantee for the historical identity of the family, there was none (documents apart) for the personal genealogy of the individual. There is no evidence that sufficient records of pedigree were kept during the earlier centuries of the Roman commonwealth, although the leading houses drew up genealogical tables, and their family pedigree was painted on the walls of the entrance hall. In later times, it is true, even plebeian families began to establish a prescriptive right (known as the *jus imaginum*) to preserve in small wooden shrines in their halls the busts (or rather, wax portrait masks fastened on to busts) of those of their members who had attained to curule office, and to exhibit these in public on appropriate occasions. Under these *imagines majorum*[5] it became usual to inscribe on the wall their respective *tituli*, the relationship of each to each being indicated by means of connecting lines; and thus arose the *stemmata gentilicia*, which at a later time began to be copied into family records. In the case of plebeian families (whose stemmata in no case went farther back than 366 B.C.) these written genealogies were probably trustworthy enough; but in the case of patricians who went back to Aeneas,[6] so much cannot, it is obvious, be said; and from a comparatively early period it was clearly recognized that such records lent themselves too readily to the devices of the falsifier and the forger to deserve confidence or reverence (Pliny, *H.N.* xxxv. 2; Juv. viii. 1).

Thus, parvenus were known to place the busts of fictitious ancestors in the shrines and to engage needy literary men to trace back their descent even to Aeneas himself.

The many and great social changes which marked the closing centuries of the Western empire almost invariably militated with great strength against the maintenance of an aristocracy of birth; and from the time of Constantine the dignity of patrician ceased to be hereditary.[7]

3. *Modern.*—Two forces have combined to give genealogy its importance during the period of modern history: the laws of inheritance, particularly those which govern the descent of real estate, and the desire to assert the privileges of a hereditary aristocracy. But it is long before genealogies are found in the possession of private families. The succession of kings and princes are in the chronicle book; the line of the founders and patrons of abbeys are recorded by the monks with curious embellishment of legend. But the famous suit of Scrope against Grosvenor will illustrate the late appearance of private genealogies in England. In 1385 Sir Richard Scrope, lord of Bolton, displaying his banner in the host that invaded Scotland, found that his arms of a golden bend in a blue field were borne by a knight of the Chester palatinate, one Sir Robert Grosvenor. He carried the dispute to a court of chivalry, whose decision in his favour was confirmed on appeal to the king. Grosvenor asserted that he derived his right from an ancestor, Sir Gilbert Grosvenor, who had come over with the Conqueror, while an intervening claimant, a Cornish squire named Thomas Carminowe, boasted that his own ancestors had borne the like arms since the days of King Arthur’s Round Table. It is remarkable that in support of the false statements made by the claimants no written genealogy is produced. The evidence of tombs and monuments and the reports of ancient men are advanced, but no pedigree is exhibited in a case which hangs upon genealogy. It is possible that the art of pedigree-making had its first impulse in England from the many genealogies constructed to make men familiar with the claims of Edward III. to the crown of France, a second crop of such royal pedigrees being raised in later generations during the contests of York and Lancaster. But it is not until after the close of the middle ages that genealogies multiply in men’s houses and are collected into volumes. The medieval baron, knight or squire, although proud of the nobility of his race, was content to let it rest upon legend handed down the generations. The exact line of his descent was sought only when it was demanded for a plea in the king’s courts to support his title to his lands.

From the first the work of the genealogist in England had that taint of inaccuracy tempered with forgery from which it has not yet been cleansed. The medieval kings, like the Welsh gentry of later ages, traced their lines to the household of Eden garden, while lesser men, even as early as the 14th century, eagerly asserted their descent from a companion of the Conqueror. Yet beside these false imaginations we find the law courts, whose business was often a clash of pedigrees, dealing with genealogies centuries long which, constructed as it would seem from worthy evidences, will often bear the test of modern criticism.

Genealogies in great plenty are found in manuscripts and printed volumes from the 16th century onward. Remarkable among these are the descents recorded in the Visitation Books of the heralds, who, armed with commissions from the crown, the first of which was issued in 20 Hen. VIII., perambulated the English counties, viewing arms and registering pedigrees. The notes in their register books range from the simple registration of a man’s name and arms to entries of pedigrees many generations long. To the heralds these visitations were rare opportunities of obtaining fees from the visited, and the value of the pedigrees registered is notably unequal. Although it has always been the boast of the College of Arms that Visitation records may be produced as evidence in the law courts, few of these officially recorded genealogies are wholly trustworthy. Many of the officers of arms who recorded them were, even by the testimony of their comrades, of indifferent character, and even when the visiting herald was an honourable man and an industrious he had little time to spare for the investigation of any single genealogy. Deeds and evidences in private hands may have been hastily examined in some instances—indeed, a herald’s summons invites their production—and monuments were often viewed in the churches, but for the most part men’s memories and the hearsay of the country-side made the backbone of the pedigree. The further the pedigree is carried beyond the memory of living men the less trustworthy does it become. The principal visitations took place in the reigns of Elizabeth, James I. and Charles II. No commission has been issued since the accession of William and Mary, but from that time onwards large numbers of genealogies have been recorded in the registers of the College of Arms, the modern ones being compiled with a care which contrasts remarkably with the

unsupported statements of the Tudor heralds.

Outside the doors of the College of Arms genealogy has now been for some centuries a favourite study of antiquaries, whose researches have been of the utmost value to the historian, the topographer and the biographer. County histories, following the example of Dugdale's Warwickshire folios, have given much space to the elucidation of genealogies and to the amassing of material from which they may be constructed. Dugdale's great work on the English baronage heads another host of works occupied with the genealogy of English noble families, and the second edition of "G.E.C.'s" *Complete Peerage* shows the mighty advance of the modern critical spirit. Nevertheless, the 20th century has not yet seen the abandoning of all the genealogical fables nourished by the Elizabethan pedigree-mongers, and the ancestry of many noble houses as recorded in popular works of reference is still derived from mythical forefathers. Thus the dukes of Norfolk, who, by their office of earl marshal are patrons of the heralds, are provided with a 10th-century Hereward for an ancestor; the dukes of Bedford, descendants of a 15th-century burgess of Weymouth, are traced to the knightly house of Russell of Kingston Russell, and the dukes of Westminster to the mythical Gilbert le Grosvenor who "came over in the train of the Conqueror."

Genealogical research has, however, made great advance during the last generation. The critical spirit shown in such works as Round's *Studies in Peerage and Family History* (1901) has assailed with effective ridicule the methods of dishonest pedigree-makers. Much raw material of genealogy has been made available for all by the publication of parish registers, marriage-licence allegations, monumental inscriptions and the like, and above all by the mass of evidences contained in the volumes issued by the Public Record Office.

Within a small space it is impossible to set forth in detail the methods by which an English genealogy may be traced. But those who are setting out upon the task may be warned at the outset to avoid guesswork based upon the possession of a surname which may be shared by a dozen families between whom is no tie of kinship. A man whose family name is Howard may be presumed to descend from an ancestor for whom Howard was a personal name: it may not be presumed that this ancestor was he in whom the dukes of Norfolk have their origin. A genealogy should not be allowed to stray from facts which can be supported by evidence. A man may know that his grandfather was John Stiles who died in 1850 at the age of fifty-five. It does not follow that this John is identical with the John Stiles who is found as baptized in 1795 at Blackacre, the son of William Stiles. But if John the grandfather names in his letters a sister named Isabel Nokes, while the will of William Stiles gives legacies to his son and daughter John Stiles and Isabel Nokes, we may agree that reasonable proof has been given of the added generation. A new pedigree should begin with the carefully tested statements of living members of a family. The next step should be to collate such family records as bible entries, letters and diaries, and inscriptions on mourning rings, with monumental inscriptions of acknowledged members of the family. From such beginnings the genealogist will continue his search through the registers of parishes with which the family has been connected; wills and administrations registered in the various probate courts form, with parish registers, the backbone of most middle-class family histories. Court rolls of manors in which members of the family were tenants give, when existing and accessible, proofs which may carry back a line, however obscure, through many descents. When these have been exhausted the records of legal proceedings, and notably those of the court of chancery, may be searched. Few English households have been able in the past to avoid an appeal to the chancery court, and the bill and answer of a chancery plaintiff and defendant will often tell the story of a family quarrel in which a score of kinsfolk are involved, and the pleadings may contain the material for a family tree of many branching generations. Coram Rege and De Banco rolls may even, in the course of a dispute over a knight's fee or a manor carry a pedigree to the Conquest of England, although such good fortune can hardly be expected by the searcher out of an undistinguished line. In proving a genealogy it must be remembered that in the descent of an estate in land must be sought the best evidence for a pedigree.

At the present time the study of genealogy grows rapidly in English estimation. It is no less popular in America, where societies and private persons have of late years published a vast number of genealogies, many of which combine the results of laborious research in American records with extravagant and unfounded claims concerning the European origin of the families dealt with. A family with the surname of Cuthbert has been known to hail St Cuthbert of Lindisfarne as its progenitor, and one surnamed Eberhardt has incorporated in its pedigree such German princes of old times as were found to have Eberhardt for a Christian name.

Genealogy in modern France has, with a few honourable exceptions, fallen into the hands of the popular pedigree-makers, whose concern is to gratify the vanity of their employers. Italy likewise has not yet shaken off the influence of those venal genealogists who, three hundred years ago, sold pedigrees cheaply to all comers. But much laborious genealogical inquiry had been made in Germany since the days of Hübner, and even in Russia there has been some attempt to apply modern standards of criticism to the chronicles of the swarming descendants of the blood of Rurik.

In no way is the gap made by the Dark Ages between ancient and modern history more marked than by the fact that no European family makes a serious claim to bridge it with its genealogy. The unsupported claim of the Roman house of Massimo to a descent from Fabius Maximus is respectable beside such legends as that which made Lévis-Mirepoix head of the priestly tribe of Levi, but even the boast of such remote ancestry has now become rare. The ancient sovereign houses of Europe are, for the most part, content to attach themselves to some ancestor who, when the mist that followed the fall of the Western empire begins to lift, is seen rallying with his sword some group of spearmen.

AUTHORITIES.—Genealogical works have been published in such abundance that the bibliographies of the subject are already substantial volumes. Amongst the earlier books from the press may be noted Benvenuto de San Georgio's *Montisferrati marchionum et principum regiae propagium successionumque series* (1515); Pingonius's *Arbor gentilitiae Sabaudiae Saxoniaeque domus* (1521); Gebweiler's *Epitome regii ac vetustissimi ortus Caroli V. et Ferdinandi I., omniumque archiducum Austriae et comitum Habsburgiensium* (1527): Meyer's work on the counts of Flanders (1531), and Du Boulay's genealogies of the dukes of Lorraine (1547). Later in the same century Reineck of Helmstadt put forth many works having a wider genealogical scope, and we may cite Henninges's *Genealogiae Saxonicae* (1587) and *Theatrum genealogicum* (1598), and Reusner's *Opus genealogicum catholicum* (1589-1592). For the politically inconvenient falseness of François de Rosières' *Stemmata Lotharingiae ac Barri ducum* (1580), wherein the dukes of Lorraine were deduced from the line of Charlemagne, the author was sent to the Bastille by the parlement of Paris and his book suppressed.

The 17th century saw the production in England of Dugdale's great *Baronage* (1675-1676), a work which still holds a respectable place by reason of its citation of authorities, and of Sandford's history of the royal house. In the same century André Duchesne, the historian of the Montmorencys, Pierre d'Hozier, the chronicler of the house of La Rochefoucauld, Rittershusius, Imhoff, Spener, Lohmeier and many others contribute to the body of continental genealogies. Pierre de Guibours, known as Père Anselme de Ste Marie, published in 1674 the first edition of his

magnificent *Histoire généalogique de la maison royale de France, des pairs, grands officiers de la couronne et de la maison du roy et des anciens barons du royaume*. Of this encyclopaedic work a third and complete edition appeared in 1726-1733. A modern edition under the editorship of M. Potier de Courcy began to be issued in 1873, but remains incomplete. Among 18th-century work Johann Hübner's *Bibliotheca genealogica* (1729) and *Genealogische Tabellen* (1725-1733), with Lenzen's commentary on the latter work (*c.* 1756), may be signalized, with Gatterer's *Handbuch der Genealogie* (1761) and his Abriss der Genealogie (1788), the latter an early manual on the science of genealogy. Hergott's *Genealogia diplomatica augustae gentis Habsburgicae* (1737) is the imperial genealogy compiled by the emperor's own historiographer.

Modern peerages in England may be said to date from that of Arthur Collins, whose one-volume first edition was published in 1709. The fifth edition appeared in 1778, in eight volumes, to be republished in 1812 by Sir Egerton Brydges, the "Baptist Hatton" of Disraeli's novel, who corrected many legendary pedigrees, besides inserting his own forged descent from a common ancestor with the dukes of Chandos. From this work and from the Irish peerage of Lodge (as re-edited by Archdall) most of the later peerages have quarried their material. With these may be named the baronetages of Wotton and Betham. Of modern popular peerages and baronetages that of Burke has been published since 1822 in many editions and now appears yearly. Most important for the historian are the *Complete Peerage* of G.E. C[ockayne] (2nd ed., 1910), and the *Complete Baronetage* of the same author. The *Peerage of Scotland* (1769) of Sir Robert Douglas of Glenbervie came to a second edition in 1813, edited by J.P. Wood, and the whole work has been revised and re-edited by Sir James Balfour Paul (1904, &c.). Of the popular manuals of English untitled families, Burke's *Genealogical and Heraldic Dictionary of the Commoners* (1833-1838) is now brought up to date from time to time and reissued as the *Landed Gentry*.

Lists of pedigrees in English printed works are supplied by Marshall's *Genealogist's Guide* (1903), while pedigrees in the manuscript collections of the British Museum are indexed in the list of R. Sims (1849). Valuable genealogical material will be found in such periodicals as the *Genealogist*, the *Herald and Genealogist*, the *Topographer and Genealogist*, *Collectanea topographica et genealogica*, *Miscellanea genealogica et heraldica* and the *Ancestor*. In Germany the *Deutscher Herold* is the organ of the Berlin Heraldic and Genealogical Society. The *Nederlandsche Leeuw* is a similar publication in the Low Countries.

Modern criticism of the older genealogical methods will be found in J.H. Round's *Peerage and Pedigree*, 2 vols. (London, 1910), and in other volumes by the same author. The Harleian Society has published many volumes of the Herald's Visitations; and the British Record Society's publications, supplying a key to a vast mass of wills, Chancery suits and marriage licences, are of still greater importance. The *Victoria History of the Counties of England* includes genealogies of the ancient English county families still among the land-owning classes. English pedigrees of the age before the Conquest are collected in W.G. Searle's *Anglo-Saxon Bishops, Kings and Nobles* (1899).

Genealogical dictionaries of noble French families include Victor de Saint Allais's *Nobiliaire universel* (21 vols., 1872-1877) and Aubert de la Chenaye-Desbois' *Dictionnaire de la noblesse* (15 vols., 1863-1876). A sumptuous work on the genealogy and heraldry of the ancient duchy of Savoy by Count Amédée de Foras began to appear in 1863. Spain has Lopez de Haro's *Nobiliario genealogico de los reyes y títulos de España*. Italy has the *Teatro araldico* of Tettoni and Saladini (1841-1848), Litti's *Famiglie celebri* and an *Annuario della nobilità*. Such annuals are now published more or less intermittently in many European countries. Finland has a *Ridderscap och Adels Kalender*, Belgium the *Annuaire de la noblesse*, the Dutch Netherlands an *Adelsboek*, Denmark the *Adels-Garbog* and Russia the *Annuaire* of Ermerin. But chief of all such publications is the ancient *Almanach de Gotha*, containing the modern kinship of royal and princely houses, and now accompanied by volumes dealing with the houses of German and Austrian counts and barons, and with houses ennobled in modern times by patent. A useful modern reference book for students of history is Stokvis's *Manuel d'histoire et de généalogie de tous les états du globe* (1888-1893). The best manual for the English genealogist is Walter Rye's *Records and Record Searching* (1897), while an ill-arranged but valuable bibliography of English and foreign works on the subject is that of George Gatfield (1892).

(O. Ba.)

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1 G.B. Gray's *Hebrew Proper Names* (1896), with his article in the *Expositor* (Sept. 1897), pp. 173-190, should be consulted for the application and range of Hebrew names in O. T. genealogies and lists.

2 On the subject generally see articles "Genos" and "Gens," by A.H. Greenidge, in Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890), where the chief authorities are given.

3 The fondness of Euripides for genealogies is ridiculed by Aristophanes (*Acharnians*, 47).

4 All the earlier Greek historians appear to have constructed their narratives on assumed genealogical bases. The four books of Hecataeus of Miletus dealt respectively with the traditions about Deucalion, about Heracles and the Heraclidae, about the early settlements in Peloponnesus, and about those in Asia Minor; he further made a pedigree for himself, in which his sixteenth ancestor was a god. The works of Hellanicus of Lesbos bore titles (Δευκαλιώνεια and the like) which sufficiently explain their nature; his disciple, Damastes of Sigeum, was the author of genealogical histories of Trojan heroes; Apollodorus of Athens made use of three books of Γενεαλογικά by Acusilaus of Argos; Pherecydes of Leros also wrote γενεαλογίαι. See J.A.F. Töpffer, *Attische Genealogie* (1889); also J.H. Schubart, *Quaestt. geneal. historicae* (1832); G. Marckscheffel, *De genealogica Graecorum poësi* (1840).

5 The chief authority on this subject is Polybius (vi. 53); see also T. Mommsen, *Römisches Staatsrecht*, i. (1887), p. 442.

6 At the funeral of Drusus the images of Aeneas, of the Alban kings, of Romulus, of the Sabine nobles, of Attus Clausus, and of "the rest of the Claudians" were exhibited (Tac. *Ann.* iv. 9).

7 The Roman stemmata had, as will be seen afterwards, great interest for the older modern genealogists. Reference may be made to J. Glandorp's *Descriptio gentis Antoniae* (1557); to the *Descriptio gentis Juliae* (1576) of the same author; and to J. Hübner's *Genealogische Tabellen*. See also G.A. Ruperti's *Tabulae genealogicae sive stemmata nobiliss*. gent. Rom. (1794).

(X.)

GENELLI, GIOVANNI BUONAVENTURA (1798-1868), German painter, was born at Berlin on the 28th of September 1798. He was the son of Janus Genelli, a painter whose landscapes are still preserved in the Schloss at Berlin, and grandson to Joseph Genelli, a Roman embroiderer employed to found a school of gobelins by Frederick the Great. Buonaventura Genelli first took lessons from his father and then became a student of the Berlin academy. After serving his time in the guards he went with a stipend to Rome, where he lived ten years, a friend and assistant to Koch the landscape painter, a colleague of the sculptor Ernst Hähnel (1811-1891), Reinhart, Overbeck and Führich, all of whom made a name in art. In 1830 he was commissioned by Dr Härtel to adorn a villa at Leipzig with

frescoes, but quarrelling with this patron he withdrew to Munich, where he earned a scanty livelihood at first, though he succeeded at last in acquiring repute as an illustrative and figure draughtsman. In 1859 he was appointed a professor at Weimar, where he died on the 13th of November 1868. Genelli painted few pictures, and it is very rare to find his canvases in public galleries, but there are six of his compositions in oil in the Schack collection at Munich. These and numerous water-colours, as well as designs for engravings and lithographs, reveal an artist of considerable power whose ideal was the antique, but who was also fascinated by the works of Michelangelo. Though a German by birth, his spirit was unlike that of Overbeck or Führich, whose art was reminiscent of the old masters of their own country. He seemed to hark back to the land of his fathers and endeavour to revive the traditions of the Italian Renaissance. Subtle in thought and powerfully conceived, his compositions are usually mythological, but full of matter, energetic and fiery in execution, and marked almost invariably by daring effects of foreshortening. Impeded by straitened means, the artist seems frequently to have drawn from imagination rather than from life, and much of his anatomy of muscle is in consequence conventional and false. But none the less Genelli merits his reputation as a bold and imaginative artist, and his name deserves to be remembered beyond the narrow limits of the early schools of Munich and Weimar.

GENERAL (Lat. *generalis*, of or relating to a *genus*, kind or class), a term which, from its pointing to all or most of the members of a class, the whole of an area, &c. as opposed to “particular” or to “local,” is hence used in various shades of meaning, for that which is prevalent, usual, widespread or miscellaneous, indefinite, vague. It has been added to the titles of various officials, military officers and others; thus the head of a religious order is the “superior-general,” more usually the “general,” and we find the same combination in such offices as that of “accountant-general,” “postmaster-general,” “attorney-” or “solicitor-general,” and many others, the additional word implying that the official in question is of superior rank, as having a wider authority or sphere of activity. This is the use that accounts for the application of the term, as a substantive, to a military officer of superior rank, a “general officer,” or “general,” who commands or administers bodies of troops larger than a regiment, or consisting of more than one arm of the service (see also Officers). It was towards the end of the 16th century that the word began to be used in its present sense as a noun, and in the armies of the time the “general” was commander-in-chief, the “lieutenant-general” commander of the horse and second in command of the army, and the “major-general” (strictly “sergeant-major-general”) commander of the foot and chief of the staff. Field marshals, who have now the highest rank, were formerly subordinate to the general officers. These titles—general, lieutenant-general and major-general—are still applied in most armies to the first, second and third grades of general officer, and in the French service until 1870 the chief of the staff of the army bore the title of major-general. In the German and Russian services the three grades are qualified by the addition of the words “of cavalry,” “of infantry” and “of artillery.” The French service possesses only two grades, “general of brigade” and “general of division.” The Austrian service has two ranks of general officers peculiar to itself, “lieutenant field marshal,” equivalent to lieutenant-general, and *Feldzeugmeister* (master of the ordnance), equivalent to the German general of infantry or artillery. There is also the rank of “general of cavalry.” The Spanish army still retains the old term “captain-general.” In the German service *General Oberst* (colonel-general) and *General Feldzeugmeister* (master-general of ordnance) are ranks intermediate between that of full general and that of general field marshal. It may be noted that during the 17th century “general” was not confined to a commanding officer of an army, and was also equivalent to “admiral”; thus when under the Protectorate the office of lord high admiral was put into commission, the three first commissioners, Blake, Edward Popham and Richard Deane, were styled “generals at sea.”

GENERATION (from Lat. *generare*, to beget, procreate; *genus*, stock, race), the act of procreation or begetting, hence any one of the various methods by which plants, animals or substances are produced. As applied to the result of procreation, “generation” is used of the offspring of the same parents, taken as one degree in descent from a common ancestor, or, widely, of the body of living persons born at or near the same time; thus the word is also used of the age or period of a generation, usually taken as about thirty years, or three generations to a century. As a term in biology or physiology, generation is synonymous with the Gr. βιογένεσις and the Ger. *Zeugung*, and may comprehend the whole history of the first origin and continued reproduction of living bodies, whether plants or animals; but it is frequently restricted to the sexual reproduction of animals. The subject may be divided into the following branches, viz.: (1) the first origin of life and living beings, (2) non-sexual or agamic reproduction, and (3) gamic or sexual reproduction. For the first two of these topics see Abiogenesis, Biogenesis and Biology; for the third and more extensive division, including (1) the formation and fecundation of the ovum, and (2) the development of the embryo in different animals, see Reproduction and Embryology.

GENESIS (Gr. γένεσις, becoming; the term being used in English as a synonym for origin or process of coming into being), the name of the first book in the Bible, which derives its title from the Septuagint rendering of ch. ii. 4. It is the first of the five books (the Pentateuch), or, with the inclusion of Joshua, of the six (the Hexateuch), which cover the history of the Hebrews to their occupation of Canaan. The “genesis” of Hebrew history begins with records of antediluvian times: the creation of the world, of the first pair of human beings, and the origin of sin (i.-iii.), the civilization and moral degeneration of mankind, the history of man to the time of Noah (iv.-vi. 8), the flood (vi. 9-ix.), the confusion of languages and the divisions of the human race (x.-xi.). Turning next to the descendants of Shem, the book deals with Abraham (xii.-xxv. 18), Isaac and Jacob (xxv. 19-xxxv.), the “fathers” of the tribes of Israel, and concludes with the personal history of Joseph, and the descent of his father Jacob (or Israel) and his brethren into the land of Egypt (xxxvii.-l.). The book of Genesis, as a whole, is closely connected with the

subsequent oppression of the sons of Israel, the revelation of Yahweh the God of their fathers (Ex. iii. 6, 15 seq., vi. 2-8), the "exodus" of the Israelites to the land promised to their fathers (Ex. xiii. 5, Deut. i. 8, xxvi. 3 sqq., xxxiv. 4) and its conquest (Josh. i. 6, xxiv.); cf. also the summaries Neh. ix. 7 sqq., Ps. cv. 6 sqq.

Analysis.

The words, "these are the generations of the heavens and of the earth when they were created" (ii. 4), introduce an account of the creation of the world, which, however, is preceded by a relatively later and less primitive record (i. 1-ii. 3). The differences between the two accounts lie partly in the style and partly in the form and contents of the narratives. i. 1-ii. 3 is marked by stereotyped formulae ("and God [*Elōhīm*] said ... and it was so ... and God saw that it was good, and there was evening and there was morning," &c.); it is precise and detailed, whereas ii. 4b-iii. is less systematic, fresher and more anthropomorphic. The former is cosmic, the latter is local. It is the latter which mentions the mysterious garden and the wonderful trees which Yahweh planted, and depicts Yahweh conversing with man and walking in the garden in the cool of the evening. The former, on the other hand, has an enlightened conception of *Elōhīm*; the Deity, though grand, is a lifeless figure; several antique ideas are nevertheless preserved. The account of the creation, too, is different; for example, in chap. i. man and woman are created together, whereas in ii. man is at first alone. The naiveness of the story of the creation of woman is in line with the interest which this more popular source takes in the origin or existence of phenomena, customs and contemporary beliefs (the garden, the naming of animals, &c.). The primitive record is continued in the story of Cain and Abel (iv.), where the old-time problem of Cain's wife and the reference to other human beings (iv. 14 seq.) gave rise in pre-critical days to the theory of pre-Adamites, as though Adam and Eve were not the only inhabitants of the earth. But all the indications go to show that there were at least two distinct popular narratives, one of which ignores the flood. Cain the murderer, doomed to be a wanderer, now becomes the builder of a city, and his descendants introduce various arts (iv. 16*b*-24).[1] (See the articles Abel; Adam; Cain; Cosmogeny; Enoch; Eve; Lamech.) From the "generations" of the heavens and the earth (which one would have expected at the head of ch. i.) we pass to the "generations of Adam" (v. 1). The list of the "Sethites," with its characteristically stereotyped framework, has an older parallel in iv. 25 seq. (with the origin of the worship of Yahweh contrast Ex. vi. 2. seq.), and a fragment from the same source is found in v. 29.

After the birth of Noah the son of Lamech (v. 29, contrast iv. 19 sqq.) comes the brief story of the demigods (vi. 1-4). It is no part of the account of the fall or of the flood (note verse 4 and Num. xiii. 33), least of all does it furnish grounds for the old view of the division of the human race into evil Cainites and God-fearing Sethites. The excerpt with its description of the fall of the angels is used to form a prelude to the wickedness of man and the avenging flood (vi. 5). Noah, the father of Ham, Shem and Japheth, appears as the hero in the Hebrew version of the flood (see Deluge; Noah). Duplicates (vi. 5-8, 9-13) and discrepancies (vi. 19 sq. contrasted with vii. 2; or vii. 11, viii. 14 contrasted with viii. 8, 10, 12) point to the use of two sources (harmonizing passages in vii. 3, 7-9). The later narrative, which begins with "the generations" of Noah (vi. 9-22; vii. 6, 11, 13-17*a*, 18-21, 24; viii. 1-2*a*, 3*b*-5, 13*a*, 14-19; ix. 1-17), is almost complete; note the superscription and the length of the flood (365 days; according to other notices the flood apparently lasted only 61 or 68 days). In the earlier source Noah collects seven pairs of clean animals, one of each kind; he sacrifices after leaving the ark, and Yahweh promises not to curse the ground or to smite living things again. But in the later, he takes only one pair, and subsequently Elōhīm blesses Noah and makes a covenant never again to destroy all flesh by a flood.[2] The covenant (characteristic of the latest narratives in Genesis) also prohibits the shedding of blood (cf. the story of Cain and Abel in the earlier source). Mankind is now made to descend from the three sons of Noah. The older story, however, continues with another step in the history of civilization, and to Noah is ascribed the cult of the vine, the abuse of which leads to the utterance of a curse upon Canaan and a blessing upon Shem and Japheth (ix. 20-27). The table of nations in x. ("the generations of the sons of Noah") preserves several signs of composite origin (contrast *e.g.* x. 7 with *vv.* 28 sq., Ludim *v.* 13 with *v.* 22, and the Canaanite families v. 16 with the dispersion "afterwards," *v.* 18, &c.); see Canaan; Genealogy; Nimrod. The history of the primitive age concludes with the story of the tower of Babel (xi. 1-9), which, starting from a popular etymology of Babel ("gate of God"), as though from Balbel ("confusion"), tells how Yahweh feared lest mankind should become too powerful (cf. iii. 22-24), and seeks to explain the origin of the numerous languages in use. It is independent of x., which already assumes a confusion of tongues (*vv.* 5, 20, 31), the existence of Babel (*v.* 10), and gives a different account of the rise of the various races. This incident in the journey eastwards (xi. 2) is equally independent of the story of the Deluge and of Noah's family (see Wellhausen, *Prolegomena*, p. 316). The continuation of the chapter, "the generations of Shem" (xi. 10-27, see the Shemite genealogy in x. 21 sqq., and contrast the ages with vi. 3), is in the same stereotyped style as ch. v., and prepares the way for the history of the patriarchs.

The "generations of Terah" (xi. 27) lead to the introduction of the first great patriarch Abraham (*q.v.*).[3] There is a twofold account of his migration to Bethel with his nephew Lot; the more statistical form in xi. 31 sq., xii. 4*b*, 5 belongs to the latest source. The statement that the Canaanite was then in the land (xii. 6, cf. xiii. 7) points to a time long after the Israelite conquest, when readers needed such a reminder (so Hobbes in his *Leviathan*, 1651). A famine forces him to descend into Egypt, where a story of Sarai (here at least 65 years of age; see xii. 4, xvii. 17) is one of three variants of a similar peculiar incident (cf. xx. 1-17, xxvi. 6-14). The passage is an insertion (xii. 10-xiii. 2; xii. 9, xiii. 3 seq. being harmonistic). The thread is resumed in the account of the separation of the patriarch and his nephew Lot, who divide the land between them. Abraham occupies Canaan, but moves south to Hebron, which, according to Josh. xiv. 15, was formerly known as Kirjath-Arba. Lot dwells in the basin of the Jordan, and his history is continued in the story of the destruction of Sodom and Gomorrah (xviii.-xix.; Hos. xi. 8, Deut. xxix. 23 speak of Admah and Zeboim). Lot is saved and becomes the ancestor of the Moabites and Ammonites, who are thus closely related to the descendants of Abraham (note xix. 37, "unto this day"). The great war with Amraphel and Chedorlaomer—the defeat of a world-conquering army by 318 men—with the episode of Melchizedek, noteworthy for the reference to Jerusalem (xiv. 18, cf. Ps. lxxvi. 2), has nothing in common with the context (see Abraham; Melchizedek). It treats as individuals the place-names Mamre and Eshcol (xiv. 13, cf. Num. xiii. 23 seq.), and by mentioning Dan (*v.* 14) anticipates the events in Josh. xix. 47, Judg. xviii. 29.[4] A cycle of narratives deals with the promise that the barren Sarai (Sarah) should bear a child whose descendants would inhabit the land of Canaan. The importance of the tradition for the history of Israel explains both the prominence given to it (cf. already xii. 7, xiii. 14-17) and their present complicated character (due to repeated revision). The older narratives comprise (*a*) the promise that Abraham shall have a son of his own flesh (xv.)—the account is composite;[5] (*b*) the birth of Ishmael, Abraham's son by Hagar, their exile, and Yahweh's promise (xvi., with a separate framework in *vv.* 1*a*. 3, 15 seq.)—before the birth of Isaac; and (*c*) the promise of a son to Sarai (xviii. 1-15), now combined with the story of Lot and the overthrow of Sodom. The latest source (xvii.) is marked by the solemn covenant between Yahweh and Abraham, the revelation of God Almighty (El-Shaddai, cf. Ex. vi. 3), and the institution of circumcision (otherwise treated in Ex. iv. 26, Josh. v. 2 seq.). The more elevated character of this source as contrasted with xv. and xviii. is as striking as the difference of religious tone in the two accounts of the creation (above). Abraham now travels thence (xx. 1, Hebron, see xviii. 1), and his adventure in the land of Abimelech, king of Gerar (xx.), is a duplicate of xii. (above). It is continued in xxi. 22-34, which has a close parallel in the life of Isaac (xxvi., below). Isaac is born in accordance with the divine promise (xviii. 10 at Hebron); the scene is the south of Palestine. The story of the dismissal of Hagar and Ishmael, and the revelation (xxi. 8-21) cannot be separated from xvi. 4-14, where *vv.* 9 seq. are intended to

harmonize the passages. Although about sixteen years intervene (see xvi. 16; xxi. 5, 8), Ishmael is a young child who has to be carried (xxi. 15), but the Hebrew text of xxi. 14 (not, however, the Septuagint) endeavours to remove the discrepancy.[6] "After these things" comes the offering of Isaac which implicitly annuls the sacrifice of the first-born, a not unfamiliar rite in Palestine as the denunciations prove (cf. Ezek. xvi. 20 seq., xx. 26; Mic. vi. 7; Is. lvii. 5), and thus marks an advance, *e.g.* upon the story of Jephthah's daughter (Judg. xi.). The story may be contrasted with the Phoenician account of the sacrifice by Cronos (to be identified with El) of his only son, which practically justified the horrid custom. The detailed account of the purchase of the cave of Machpelah (contrast the brevity of xxxiii. 19) is of great importance for the traditions of the patriarchs, and, like the references to the death of Sarah and Abraham, belongs to the latest source (xxiii., xxv. 7-11*a*).[7] The idyllic picture of life in xxiv. presupposes that Isaac is sole heir (*v.* 36); since this is first stated in xxv. 5, it is probable that xxv. 5, 11b (and perhaps *vv.* 6, 18) are out of place. It is noteworthy that the district is Abraham's native place (xxiv. 4, 7, 10; contrast the Babylonian home specified in xi. 28, 31; xv. 7). In xxv. 1 sqq. Abraham takes as wife (but *concubine*, 1 Chron. i. 32 seq.) Keturah ("incense") and becomes the father of various Arab tribes, *e.g.* Sheba and Dedan (grandsons of Cush in x. 7).

After "the generations of Ishmael" (xxv. 12 sqq.) the narrative turns to "the generations of Isaac" (xxv. 19 sqq.). The story of the events at the court of Abimelech (xxvi.) finds a parallel in the now disjointed xx., xxi. 22-34; note the new explanation of Beersheba, the reference in xxvi. 1 to the parallel story in xii., the absence of allusion to xx., and the apparent editorial references to xxi. in *vv.* 15, 18. On the whole, the story of Isaac's wife at Gerar is briefer and not so elevated as that of Sarah, but the parallel to xxi. 22-34 is more detailed. The birth of Esau and Jacob (xxv. 21-34) introduces the story of Jacob's craft when Isaac is on the point of death (xxvii.). Jacob flees to Laban at Haran to escape Esau's hatred (xxvii. 41-45); but, according to the latest source (P), he is charged by Isaac to go to Paddan-Aram, and take a wife there, and his father transfers to him the blessing of Abraham (xxvii. 46-xxviii. 9). On his way to Haran he stops at Bethel (formerly Luz, according to Judg. i. 22-26), where a vision prompts him to accept the God of the place should he return in peace to his father's home (xxviii. 10-22). He passes to the land of "the children of the east" (xxix. 1), and the scenes which follow are scarcely situated at Haran, the famous and ancient seat of the worship of the moon-god, but in the desert. Here he resides fifteen years or more, and by the daughters of Laban and their handmaidens becomes the "father" of the tribes of Israel. There are numerous traces of composition from different sources, but a satisfactory analysis is impossible.[8] The flight of Jacob and his household (from Paddan-Aram, xxxi. 18 P) leads over "the River" (*v.* 21, *i.e.* the Euphrates); though the seven days' journey of this concourse of men and cattle suggests that he came to Gilead, not from Haran (300 m. distant), but from some nearer locality. This is to be taken with the evidence against Haran already noticed, with the use of the term "children of the east" (xxix. 1; cf. Jer. xlix. 28; Ezek. xxv. 4, 10), and with the details of Laban's kindred (xxii. 20-24).[9] The arrival at Mahanaim ("[two?] camps") gives rise to specific allusions to the meaning of the name (xxxii. 1 seq., 7-12, 13-21); cf. also the plays upon Jabbok, Israel and Peniel in xxxii. 22-32. He meets Esau (xxxii. 3-21, xxxiii. 1-16, another reference to Peniel, "face of God," in *v.* 10), but they part. Jacob now comes to Shechem "in peace" (cf. the phrase in xxviii. 21), where he buys land and erects an altar (xxxiii. 18-20, cf. Abraham in xii. 6 seq.). There is a remarkable story of the violation of his daughter Dinah by Shechem, the son of Hamor the Hivite (xxxiv.). It has been heavily revised; note the alternating prominence of Hamor and Shechem, the condemnation of Simeon and Levi for their vengeance (cf. the curse in xlix. 5-7), the destruction of the city Shechem by all the sons of Jacob, and the survival of the Hamorites as a family centuries later (xxxiii. 19, Judg. ix. 28). The narrative continues with Jacob's journey to Bethel, the death of Deborah (who accompanied Rebekah to Palestine 140 years previously, see xxiv. 59, and the latest source in xxv. 20, xxxv. 28), the death of Rachel (xxxv. 16-20, contrast xxxvii. 10), and ceases abruptly in the middle of a sentence (xxxv. 22, but see xlix. 3-4). The latest source (xxxv. 9-13, 15, 22*b*-29) gives another account of the origin of the names Israel (cf. xxxii. 28) and Bethel (cf. xxviii. 19), and the genealogy wrongly includes Benjamin among the sons born outside Palestine (*vv.* 24-26). In narrating Jacob's leisurely return to Isaac at Hebron, the writers quite ignore the many years which have elapsed since he left his father at the point of death in Beersheba (xxvii. 1, 2, 7, 10, 41).

"The generations of Esau, the same is Edom," provide much valuable material for the study of Israel's rival (xxxvi.). The chapter gives yet another account of the separation of Jacob and Esau (with *vv.* 6-8, cf. Abraham and Lot, xiii. 5 seq.), and describes the latter's withdrawal to Seir (cf. already xxxii. 3; xxxiii. 14, 16). It includes lists of diverse origin (*e.g. vv.* 2-5, contrast xxvi. 34, xxviii. 9); various "dukes" (R.V. marg. "chiefs"), or rather "thousands" or "clans"; and also the "sons" of Seir the Horite, *i.e.* Horite clans (*vv.* 20 seq. and *vv.* 29 seq.). A summary of Edomite kings is ascribed to the period before the Israelite monarchy (*vv.* 31-39), and the record concludes with the "dukes" of Esau, the father of the Edomites (*vv.* 40-43, cf. names in *vv.* 10-14, 15-19).[10]

Finally, Genesis turns from the patriarchs to the "generations of Jacob" (xxxvii. 2), and we have stories of the "sons," the ancestors of the tribes. (In xxxiv. the incidents which primarily concerned Simeon and Levi alone have, however, been adjusted to the general history of Jacob and his family.) The first place is given to Joseph (xxxvii.), although xxxviii. crowds the early history of the family of Judah into the twenty-two years between xxxvii. 2 and Jacob's descent into Egypt (see xli. 46, 47; xlv. 6).[11] In xxxvii., xxxix. sqq. we have an admirable specimen of writing quite distinct in stamp from the patriarchal stories. The romance which has here been utilized shows an acquaintance with Egypt; the narratives are discursive, not laconic, everything is more detailed, and more under the influence of literary art. The Reuben and Simeon which appear in it are not the characters which we meet in xxxiv., xxxv. 22, or in the poem xlix. 3-7; and the tribes of Ephraim and Manasseh do not scruple to claim ancestry from Joseph and the daughter of an Egyptian priest at the seat of the worship of the sun-god (xli. 45). The narratives are composite. Joseph incurs the ill-will of his brethren because of Israel's partiality or because of his significant dreams. He is at Shechem or at Dothan; and when the brothers seek to slay him, Judah proposes that he should be sold to Ishmaelites, or Reuben suggests that he should be cast into a pit, where Midianites find and kidnap him (xxxvii., cf. xl. 15). The latter sell him to the eunuch Potiphar, but he appears in the service of a married householder (xxxix., the second clause of v. 1 harmonizes). Among other signs of dual origin are the alternation of "Jacob" and "Israel," and the prominence of Judah (xliii. 3, 8; xliv. 14, 18) or of Reuben (xlii. 22, 37). The money is found in a "bag" as the brothers encamp (xlii. 27, 28*a*; xliii.), or in a "sack" when they reach home (xlii. 8-26, 29-35, 28*b*, 36 sq.). When Israel and his family descend into Egypt, the latest source gives a detailed list which agrees in the main with the Israelite subdivisions (xlvi. 6-27, cf. Num. xxvi. and 1 Chron. ii.-viii.). The families dwell in the land of Goshen, east of the Delta, "for every shepherd is an abomination unto the Egyptians" (xlv. 10; xlvi. 28-34; xlvii. 1-6); or they are in the "land of Rameses" (xlvii. 11, and Septuagint in xlvi. 28);[12] Joseph's policy during the famine is next described (xlvii. 13-26), although it would have been more in place after xli. (see *ib.* 34). There are several difficulties in Jacob's blessing of the sons of Joseph (xlviii.).[13] The blessing in xlix. is a collection of poetical passages praising or blaming the various tribes, and must certainly date after the Israelite settlement in Palestine; see further the articles on the tribes. Jacob's dying instructions to Joseph (xlvii. 29-31) are continued in l. 1 sqq., his charge to his sons (xlix. 28 sqq., P) in l. 12 seq. It is significant that Jacob's body is taken to Palestine, but the brethren return to Egypt; in spite of a possible allusion to the famine in *v.* 21, the late chronological scheme would imply that it had long ceased (see xlv. 6, xlvii. 28). The book closes with the death of Joseph about fifty years later, after the birth of the children of Machir, who himself was a contemporary of Moses forty years after the Exodus

(Num. xxxii. 39-41). Joseph's body is embalmed, but it is not until the concluding chapter of the book of Joshua (xxiv. 32) that his bones find their last resting-place.

Only on the assumption that the book of Genesis is a composite work is it possible to explain the duplication of events, the varying use of the divine names *Yahweh* and *Elōhīm*, the linguistic and stylistic differences, the internal intricacies of the subject matter, and the differing standpoints as regards tradition, chronology, morals and religion.[14] The cumulative effect of the whole evidence is too strong to be withstood, and already in the 17th century it was recognized that the book was of composite origin. Immense labour has been spent in the critical analysis of the contents, but it is only since the work of Graf (1866) and Wellhausen (1878) that a satisfactory literary hypothesis has been found which explained the most obvious intricacies. The Graf-Wellhausen literary theory has gained the assent of almost all trained and unbiased biblical scholars, it has not been shaken by the more recent light from external evidence, and no alternative theory has as yet been produced. The internal features of Genesis demand some formulated theory, more precise than the indefinite concessions of the 17th century, beyond which the opponents of modern literary criticism scarcely advance, and the Graf-Wellhausen theory, in spite of the numerous difficulties which it leaves untouched, is the only adequate starting-point for the study of the book. According to this, Genesis is a post-exilic work composed of a post-exilic priestly source (P) and non-priestly earlier sources which differ markedly from P in language, style and religious standpoint, but much less markedly from one and another.[15] These sources can be traced elsewhere in the Pentateuch and Joshua, and P itself is related to the post-exilic works Chronicles, Ezra and Nehemiah. In its *present* form Genesis is an indispensable portion of the biblical history, and consequently its literary growth cannot be viewed apart from that of the books which follow. On internal grounds it appears that the Pentateuch and Joshua, as they now read, virtually come in between an older history by "Deuteronomic" compilers (easily recognizable in Judges and Kings), and the later treatment of the monarchy in Chronicles, where the influence of the circle which produced P and the present Mosaic legislation is quite discernible. There have been stages where earlier extant sources have been cut down, adjusted or revised by compilers who have incorporated fresh material, and it is the later compilers of Genesis who have made the book a fairly knit whole. The technical investigation of the *literary* problems (especially the extent of the earlier sources) is a work of great complexity, and, for ordinary purposes, it is more important to obtain a preliminary appreciation of the general features of the contents of Genesis.

A composite work.

That the records of the pre-historic ages in Gen. i.-xi. are at complete variance with modern science and archaeological research is unquestionable.[16] But although it is impossible to regard them any longer either as genuine history or as subjects for an allegorical interpretation (which would prove the accuracy of *any* record) they are of distinct value as human documents. They reflect the ideas and thoughts of the Hebrews, they illustrate their conceptions of God and the universe, and they furnish material for a comparison of the moral development of the Hebrews with that of other early races. Some of the traditions are closely akin to those current in ancient Babylonia, but a careful and impartial comparison at once illustrates in a striking manner the relative moral and spiritual superiority of our writers. On these subjects see further Cosmogony; Deluge.[17]

Value of traditions.

The records of the patriarchal age, xii.-l. are very variously estimated, although the great majority of scholars agree that they are not contemporary and that they cannot be used, as they stand, for pre-Mosaic times. Apart from the ordinary arguments of historical criticism, it is to be noticed that external evidence does not support the assumption that the records preserve genuine pre-Mosaic history. There are no grounds for any arbitrary distinction between the "pre-historic" pre-Abrahamic age and the later age. External evidence, which recognizes no universal deluge and no dispersal of mankind in the third millennium B.C., throws its own light upon the opening centuries of the second. It has revealed conditions which are not reflected in Genesis, and important facts upon which the book is silent—unless, indeed, there is a passing allusion to the great Babylonian monarch Khammurabi in the Amraphel of Gen. xiv. Any careful perusal of modern attempts to recover historical facts or an historical outline from the book will show how very inadequate the material proves to be, and the reconstructions will be found to depend upon an interpretation of the narratives which is often liberal and not rarely precarious, and to imply such reshaping and rewriting of the presumed facts that the cautious reader can place little reliance on them. Whatever future research may bring, it cannot remove the *internal* peculiarities which combine to show that Genesis preserves, not literal history, but popular traditions of the past. External evidence has proved the antiquity of various elements, but not that of the form or context in which they now appear; and the difference is an important one. We have now a background upon which to view the book, and, on the one hand, it has become obvious that the records preserve—as is only to be expected—Oriental customs, beliefs and modes of thought. But it has not been demonstrated that these are exclusively pre-Mosaic. On the other hand, a better acquaintance with the ancient political, sociological and religious conditions has made it increasingly difficult to interpret the records as a whole literally, or even to find a place in pre-Mosaic Palestine for the lives of the patriarchs as they are depicted.[18] Nevertheless, though one cannot look to Genesis for the history of the early part of the second millennium B.C., the study of what was thought of the past, proves in this, as in many other cases, to be more instructive than the facts of the past, and it is distinctly more important for the biblical student and the theologian to understand the thought of the ages immediately preceding the foundation of Judaism in the 5th century B.C. than the actual history of many centuries earlier.

A noteworthy feature is the frequent *personification* of peoples, tribes or clans (see Genealogy: *Biblical*). Midian (*i.e.* the Midianites) is a son of Abraham; Canaan is a son of Ham (ix. 22), and Cush the son of Ham is the father of Ramah and grandfather of the famous S. Arabian state Sheba and the traders of Dedan (x. 6 sq., cf. Ezek. xxvii. 20-22). Bethuel the father of Rebekah is the brother of the tribal names Uz and Buz (xxii. 21 sqq., cf. Jer. xxv. 20, 23). Jacob is otherwise known as Israel and becomes the father of the tribes of Israel; Joseph is the father of Ephraim and Manasseh, and incidents in the life of Judah lead to the birth of Perez and Zerah, Judaean clans. This personification is entirely natural to the Oriental, and though "primitive" is not necessarily an ancient trait.[19] It gives rise to what may be termed the "prophetical interpretation of history" (S.R. Driver, *Genesis*, p. 111), where the character, fortunes or history of the apparent individual are practically descriptive of the people or tribe which, according to tradition, is named after or descended from him. The utterance of Noah over Canaan, Shem and Japheth (ix. 25 sqq.), of Isaac over Esau and Jacob (xxvii.), of Jacob over his sons (xlix.) or grandsons (xlviii.), would have no meaning to Israelites unless they had some connexion with and interest for contemporary life and thought. Herein lies the force of the description of the wild and independent Ishmael (xvi. 12), the "father" of certain well-known tribes (xxv. 13-15); or the contrast between the skilful hunter Esau and the quiet and respectable Jacob (xxv. 27), and between the tiller Cain who becomes the typical nomad and the pastoral Abel (iv. 1-15). The interest of the struggles between Jacob and Esau lay, not in the history of individuals of the distant past, but in the fact that the names actually represented Israel

Fusion of diverse features.

and its near rival Edom. These features are in entire accordance with Oriental usage and give expression to current belief, existing relationships, or to a poetical foreshadowing of historical vicissitudes. But in the effort to understand them as they were originally understood it is very obvious that this method of interpretation can be pressed too far. It would be precarious to insist that the entrances into Palestine of Abraham and Jacob (or Israel) typified two distinct immigrations. The separation of Abraham from Lot (cf. Lotan, an Edomite name), of Isaac from Hagar-Ishmael, or of Jacob from Esau-Edom scarcely points to the relative antiquity of the origin of these non-Israelite peoples who, to judge from the evidence, were closely related. Or, if the "sons" of Jacob had Aramaean mothers, to prove that those which are derived from the wives were upon a higher level than the "sons" of the concubines is more difficult than to allow that certain of the tribes must have contained some element of Aramaean blood (cf. 1 Chron. vii. 14, and see Asher; Gad; Manasseh). Some of the names are clearly not those of known clans or tribes (*e.g.* Abraham, Isaac), and many of the details of the narratives obviously have no natural ethnological meaning. Stories of heroic ancestors and of tribal eponyms intermingle; personal, tribal and national traits are interwoven. The entrance of Jacob or Israel with his sons suggests that of the children of Israel. The story of Simeon and Levi at Shechem is clearly not that of two individuals, sons of the patriarch Israel; in fact the story actually uses the term "wrought folly in Israel" (cf. Jud. xx. 6, 10), and the individual Shechem, the son of Hamor, cannot be separated from the city, the scene of the incidents. Yet Jacob's life with Laban has many purely individual traits. And, further, there intervenes a remarkable passage with an account of his conflict with the divine being who fears the dawn and is unwilling to reveal his name. In a few verses the "wrestling" (*'-b -ḳ*) of Jacob (*yă'ăqōb*) is associated with the Jabbok (*yabbōq*); his "striving" explains his name Israel; at Peniel he sees "the face of God," and when touched on his vulnerable spot—the hollow of the thigh—he is lamed, hence "the children of Israel eat not the sinew of the hip which is upon the hollow of the thigh unto this day" (xxxii. 24-32). Other examples of the fusion of different features can be readily found. Three divine beings appear to Abraham at the sacred tree of Hebron, and when the birth of Isaac (from *ṣāḥaq*, "laugh") is foretold, the account of Sarah's behaviour is merely a popular and trivial story suggested by the child's name (xviii. 12-15; see also xvii. 17, xxi. 6, 9). An extremely fine passage then describes the patriarch's intercession for Sodom and Gomorrah, and the narrative passes on to the catastrophe which explains the Dead Sea and its desert region and has parallels elsewhere (*e.g.* the Greek legend of Zeus and Hermes in Phrygia). Lot escapes to Zoar, the name gives rise to the pun on the "little" city (xix. 20), and his wife, on looking back, becomes one of those pillars of salt which still invite speculation. Finally the names of his children Moab and Ammon are explained by an incident when he is a cave-dweller on a mountain.

To primitive minds which speculated upon the "why and wherefore" of what they saw around them, the narratives of Genesis afforded an answer. They preserve, in fact, some of the popular philosophy and belief of the Hebrews. They furnish what must have been a satisfactory origin of the names Edom, Moab and Ammon, Mahanaim and Succoth, Bethel, Beersheba, &c. They explain why Shechem, Bethel and Beersheba were ancient sanctuaries (see further below); why the serpent writhes along the ground (iii. 14); and why the hip sinew might not be eaten (xxxii. 32). To these and a hundred other questions the national and tribal stories—of which no doubt only a few have survived, and of which other forms, earlier or later, more crude or more refined, were doubtless current—furnish an evidently adequate answer. Myth and legend, fact and fiction, the common stock of oral tradition, have been handed down, and thus constitute one of the most valuable sources for popular Hebrew thought.

The book is not to be judged from any one-sided estimate of its contents. By the side of much that seems trivial, and even non-moral—for the patriarchs themselves are not saints—it is noteworthy how frequently the narratives are didactic. The characteristic sense of collective responsibility, which appears more incidentally in xx. 7, is treated with striking intensity in a passage (xviii. 23-33) which uses the legend of Sodom and Gomorrah as a vehicle for the statement of a familiar problem (cf. Ezek. xviii., Ps. lxxiii., Job). It will be observed that interviews with divine beings presented as little difficulty to the primitive minds of old as to the modern native; even the idea of intercourse of supernatural beings with mortals (vi. 1-4) is to-day equally intelligible. The modern untutored native has a not dissimilar undeveloped and childlike attitude towards the divine, a naive theology and a simple cultus. The most circumstantial tales are told of imaginary figures, and the most incredible details clothe the lives of the historical heroes of the past. So abundant is the testimony of modern travellers to the extent to which Eastern custom and thought elucidate the interpretation of the Bible, that it is very important to notice those features which illustrate Genesis. "The Oriental," writes S.I. Curtiss (*Bibl. sacra*, Jan. 1901, pp. 103 sqq.), "is least of all a scientific historian. He is the prince of story-tellers, narratives, real and imaginative, spring from his lips, which are the truest portraiture of composite rather than individual Oriental life, though narrated under forms of individual experience." There are, therefore, many preliminary points which combine to show that the critical student cannot isolate the book from Oriental life and thought; its uniqueness lies in the manner in which the material has been shaped and the use to which it has been put.

Questions of date.

The Book of Jubilees (not earlier than the 2nd century B.C.) presents the history in another form. It retains some of the canonical matter, often with considerable reshaping, omits many details (especially those to which exception could be taken), and adds much that is novel. The chronological system of the latest source in Genesis becomes an elaborate reckoning of heavenly origin. Written under the obvious influence of later religious aims, it is especially valuable because one can readily compare the two methods of presenting the old traditions.[20] There is the same kind of personification, fresh examples of the "prophetical interpretation of history," and by the side of the older "primitive" thought are ideas which can only belong to this later period. In each case we have merely a selection of current traditional lore. For example, Gen. vi. 1-4 mentions the marriage of divine beings with the daughters of men and the birth of Nephīlīm or giants (cf. Num. xiii. 33). Later allusions to this myth (*e.g.* Baruch iii. 26-28, Book of Enoch vi. sqq., 2 Peter ii. 4, &c.) are not based upon this passage; the fragment itself is all that remains of some more organic written myth which, as is well-known, has parallels among other peoples.[21] Old myths underlie the account of the creation and the garden of Eden, and traces of other versions or forms appear elsewhere in the Old Testament. Again, the Old Testament throws no light upon the redemption of Abraham (Is. xxix. 22), although the Targums and other sources profess to be well-informed. The isolated reference to Jacob's conquest of Shechem in Gen. xlviii. 22 must have belonged to another context, and later writings give in a later and thoroughly incredible form allied traditions. In Hosea xii. 4, Jacob's wrestling is mentioned before the scene at Bethel (Gen. xxxii. 24 sqq., xxviii. 11 sqq.). The overthrow of Sodom and Gomorrah is described in Genesis (xviii. seq.), but Hosea refers only to that of Admah and Zeboim (xi. 8, cf. Deut. xxix. 23, Gen. x. 19)—different versions of the great catastrophe were doubtless current. Consequently investigation must start with the particular details which happen to be preserved, and these not necessarily in their original or in their only form. Since the antiquity of elements of tradition is independent of the shape in which they appear before us, a careful distinction must be drawn between those details which do not admit of being dated or located and those which do. There is evidence for the existence of the *names* Abram, Jacob and Joseph previous to 900 B.C., but this does not prove the antiquity of the present narratives encircling them. Babylonian tablets of the creation date from the 7th century B.C., but their contents are many centuries earlier (viz. the age of Khammurabi),

whereas the Phoenician myths of the origin of things are preserved in a late form by the late writers Damascius and Philo of Byblus. Gen. xiv., which may preserve some knowledge of the reign of Khammurabi, is on internal literary grounds of the post-exilic age, and it is at least a coincidence that the Babylonian texts, often quoted in support of the genuineness of the narrative, belong to about the same period and use early Babylonian history for purely didactic purposes.[22] In general, just as the Book of Jubilees, while presenting many elements of old tradition, betrays on decisive internal grounds an age later than Genesis itself, so, in turn, there is sufficient conclusive evidence that Genesis in its present form includes older features, but belongs to the age to which (on quite independent grounds) the rest of the Pentateuch must be ascribed.

Historical backgrounds.

Popular tradition often ignores events of historical importance, or, as repeated experience shows, will represent them in such a form that the true historical kernel could never have been recovered without some external clue. The absence of definite references to the events of the Israelite monarchy does not necessarily point to the priority of the traditions in Genesis or their later date. Nevertheless, some allusion to national fortunes is reflected in the exaltation of Jacob (Israel) over Esau (Edom), and in the promise that the latter should break the yoke from his neck.[23] Israelite kings are foreshadowed (xvii. 6, xxxv. 11, P), and Israel's kingdom has the ideal limits as ascribed to Solomon (xv. 18, see 1 Kings iv. 21; but cf. art. Solomon). Judah is promised a world-wide king (xlix. 8-10), though elsewhere the supremacy of Joseph rouses the jealousy of his "brothers" (xxxvii. 8). Different dates and circles of interest are thus manifest. The cursing and dispersion of Simeon and Levi (xlix. 5-7) recall the fact that Simeon's cities were in the territory of Judah (Josh. xix. 1, 9), and that the Levitical priests are later scattered and commended to the benevolence of the Israelites. But the curse obviously represents an attitude quite opposed to the blessing pronounced upon Levi by Moses (Deut. xxxiii. 8-11). The Edomite genealogies (xxxvi.) represent a more extensive people than the references in the popular stories suggest, and the latter by no means indicate that Edom had so important a career as we actually gather from a few allusions to its kings (xxxvi. 31-39).[24] The references to Philistines are anachronistic for the pre-Mosaic age, and it is clear that the tradition of a solemn covenant with a Philistine king and his general (xxi. 22 seq., xxvi. 26 sqq.) does not belong to the age or the circle which remembered the grievous oppressions of the Philistines or felt contempt for these "uncircumcised" enemies of Israel[25]. Finally, the thread of the tradition unmistakably represents a national unity of the twelve sons (tribes) of Israel; but this unity was not felt at certain periods of disorganization, and the idea of including Judah among the sons of Israel could not have arisen at a time when Israel and Judah were rival kingdoms.[26] In so far as the traditions can be read in the light of biblical history it is evident that they belong to different ages and represent different national, tribal, or local standpoints.

Interest in holy places.

Another noteworthy feature is the interest taken in *sacred sites*. Certain places are distinguished by theophanies or by the erection of an altar (*lit.* place of sacrificial slaughter), and incidents are narrated with a very intelligible purpose. *Mizpah* in Gilead is the scene of a covenant or treaty between Jacob and his Aramaean relative commemorated by a pillar (*Maṣṣēbah*). It was otherwise known for an annual religious ceremony, the traditional origin of which is related in the story of Jephthah's vow and sacrifice (Judg. xi.), and its priests are denounced by Hosea (v. i). *Shechem*, the famous city of the Samaritans ("the foolish nation," Ecclus. I. 26), where Joseph was buried (Josh. xxiv. 32), had a sanctuary and a sacred pillar and tree. It was the scene of the coronation (a religious ceremony) of Abimelech (Judg. ix.), and Rehoboam (1 Kings xii. 1). The pillar was ascribed to Joshua (Josh. xxiv. 26 seq.), and although Jacob set up at Shechem an "altar," the verb suggests that the original object was a pillar (Gen. xxxiii. 20). The first ancestor of Israel, on the other hand, is merely associated with a theophany at an oracular tree (xii. 6). The Benjamite *Bethel* was especially famous in Israelite religious history. The story tells how Jacob discovered its sanctity,—it was the gate of heaven,—made a covenant with its God, established the sacred pillar, and instituted its tithes (xxviii.). The prophetess Deborah dwelt under a palm-tree near Bethel (Judg. iv. 5), and her name is also that of the foster-mother of Rebekah who was buried near Bethel beneath the "oak of weeping" (xxxv. 8). *Bochim* ("weeping") elsewhere receives its name when an angel appeared to the Israelites (Judg. ii. 1, Septuagint adds Bethel). To the prophets Hosea and Amos the cultus of Bethel was superstitious and immoral, even though it was Yahweh himself who was worshipped there (see Bethel). South of Hebron lay *Beersheba*, an important centre and place of pilgrimage, with a special numen by whom oaths were taken (Amos viii. 14, see Sept. and the commentaries). Isaac built its altar, and Isaac's God guarded Jacob in his journeying (xxxi. 29, xlvi. 1). This patriarch and his "brother" Ishmael are closely associated with the district south of Judah, both are connected with *Beer-lahai-roi* (xxiv. 62, Sept. xxv. 11), whose fountain was the scene of a theophany (xvi.), and their traditions are thus localized in the district of Kadesh famous in the events of the Exodus (cf. xvi. 14, xxi. 21, xxv. 18, Ex. xv. 22). (See Exodus, The.) Abraham planted a sacred tree at Beersheba and invoked "the everlasting God" (xxi. 33). But the patriarch is more closely identified with *Hebron*, which had a sanctuary (cf. 2 Sam. xv. 7 seq.), and an altar which he built "unto Yahweh" (xiii. 18). The sacred oak of Mamre was famous in the time of Josephus (*B. J.* iv. 9, 7), it was later a haunt of "angels" (Sozomen), and Constantine was obliged to put down the heathenish cultus. The place still has its holy tree. Beneath the oak there appeared the three divine beings, and in the cave of Machpelah the illustrious ancestor and his wife were buried. The story of his descent into Egypt and the plaguing of Pharaoh is a secondary insertion (xii. 10-xiii. 2), and where the patriarch appears at Beersheba it is in incidents which tend to connect him with his "son" Isaac. There is a very distinct tendency to emphasize the importance of Hebron. Taken from primitive giants by the non-Israelite clan Caleb (*q.v.*) it has now become predominant in the patriarchal traditions. Jacob leaves his dying father at Beersheba (xxviii. 10), but according to the *latest* source he returns to him at Hebron (xxxv. 27), and here, north of Beersheba, he continues to live (xxxvii. 14, xlvi. 1-5). The cave of Machpelah became the grave of Isaac, Rebekah and Leah (but not Rachel); and though Jacob appears to be buried beyond the Jordan, it is the latest source which places his grave at Hebron (1. i-11 and 12 seq.). So in still later tradition, all the sons of Jacob with the exception of Joseph find their last resting-place at Hebron, and in Jewish prayers for the dead it is besought that their souls may be bound up with those of the patriarchs, or that they may go to the cave of Machpelah and thence to the Cherubim.[27] The increasing prominence of the old Calebite locality is not the least interesting phase in the comparative study of the patriarchal traditions.

The association of the ancestors of Israel with certain sites is a feature which finds analogies even in modern Palestine. There are old centres of cult which have never lost the veneration of the people; the shrines are known as the tombs of saints or *walis* (patrons) with such orthodox names as St George, Elijah, &c. Traditions justify the reputation for sanctity, and not only are similar stories told of distinct figures, but there are varying traditions of a single figure.[28] The places have retained their sacred character despite political and religious vicissitudes; they are far older than their present names, and such is the conservatism of the east that it is not surprising when, for example, a sacred tomb at Gezer stands quite close to the site of an ancient holy place, about 3000 years old, the existence of which was first made known in the course of excavation. Genesis preserves a selection of traditions relating to a few of the old Palestinian centres of cult. We cannot suppose that these first gained their sacred

character in the pre-Mosaic "patriarchal" age; there is in any case the obvious difficulty of bridging the gap between the descent into Egypt and the Exodus, and it is clear that when the Israelites entered Palestine they came among a people whose religion, tradition and thought were fully established. It is only in accordance with analogy if stories were current in Israel of the institution of the sacred places, and closer study shows that we do not preserve the original version of these traditions.[29]

A venerated tree in modern Palestine will owe its sanctity to some tradition, associating it, it may be, with some saint; the Israelites in their turn held the belief that the sacred tree at Hebron was one beneath which their first ancestor sat when three divine beings revealed themselves to him. But it is noteworthy that Yahweh alone is now prominent; the tradition has been revised, apparently in writing, and, later, the author of Jubilees (xvi.) ignores the triad. At Beer-lahai-roi an El ("god") appeared to Hagar, whence the name of her child Ishmael; but the writer prefers the unambiguous proper name Yahweh, and, what is more, the divine being is now Yahweh's angel—the Almighty's subordinate (xvi.). The older traits show themselves partly in the manifestation of various *Els*, and partly in the cruder anthropomorphism of the earlier sources. Later hands have by no means eliminated or modified them altogether, and in xxxi. 53 one can still perceive that the present text has endeavoured to obscure the older belief that the God of Abraham was not the God of his "brother" Nahor (see the commentaries). The sacred pillar erected by Jacob at Bethel was solemnly anointed with oil, and it (and not the place) was regarded as the abode of the Deity (xxviii. 18, 22). This agrees with all that is known of stone-cults, but it is quite obvious that this interesting example of popular belief is far below the religious ideas of the writer of the chapter in its present form.[30] There were many places where it could be said that Yahweh had recorded his name and would bless his worshippers (Ex. xx. 24). They were abhorrent to the advanced ethical teaching of prophets and of those imbued with the spirit of Deuteronomy (cf. 2 Kings xviii. 4 with v. 22), and it is patent from Jeremiah, Ezekiel and Is. lvi.-lxvi. that even at a late date opinion varied as to how Yahweh was to be served.[31] It is significant, therefore, that the narratives in Genesis (apart from P) reflect a certain tolerant attitude; there is much that is contrary to prophetical thought, but even the latest compilers have not obliterated all features that, from a strict standpoint, could appear distasteful. Although the priestly source shows how the lore could be reshaped, and Jubilees represents later efforts along similar lines, it is evident that for ordinary readers the patriarchal traditions could not be presented in an entirely new form, and that to achieve their aims the writers could not be at direct variance with current thought.

> It will now be understood why several scholars have sought to recover earlier forms of the traditions, the stages through which the material has passed, and the place of the earlier forms and stages in the history and religion of Israel. These labours are indispensable for scientific biblical study, and are most fruitful when they depend upon comprehensive methods of research. When, for example, one observes the usual forms of hero-cult and the tendency to regard the occupant of the modern sacred shrine as the ancestor of his clients, deeper significance is attached to the references to the protective care of Abraham and Israel (Is. lxiii. 16), or to the motherly sympathy of Rachel (Jer. xxxi. 15). And, again, when one perceives the tendency to look upon the alleged ancestor or *weli* as an almost divine being, there is much to be said for the view that the patriarchal figures were endowed by popular opinion with divine attributes. But here the same external evidence warns us that these considerations throw no light upon the original significance of the patriarchs. It is impossible to recover the earliest traditions from the present narratives, and these alone offer sufficiently perplexing problems.[32]

Southern interests.

From a careful survey of all the accessible material it is beyond doubt that Genesis preserves only a selection of traditions of various ages and interests, and often not in their original form. We have relatively little tradition from North Israel; Beersheba, Beer-lahai-roi and Hebron are more prominent than even Bethel or Shechem, while there are no stories of Gilgal, Shiloh or Dan. Yet in the nature of the case, there must have been a great store of local tradition accessible to some writers and at some periods.[33] Interest is taken not in Phoenicia, Damascus or the northern tribes, but in the east and south, in Gilead, Ammon, Moab and Ishmael. Particular attention is paid to Edom and Jacob, and there is good evidence for a close relationship between Edomite and allied names and those of South Palestine (including Simeon and Judah). Especially significant, too, is the interest in traditions which affected the South of Palestine, that district which is of importance for the history of Israel in the wilderness and of the Levites.[34] It is noteworthy, therefore, that while different peoples had their own theories of their earliest history, the first-born of the first human pair is Cain, the eponym of the Kenites, and the ancestor of the beginnings of civilization (iv. 17, 20-22). This "Kenite" version had its own view of the institution of the worship of Yahweh (iv. 26); it appears to have ignored the Deluge, and it implies the existence of a fuller corpus of written tradition. Elsewhere, in the records of the Exodus, there are traces of specific traditions associated with Kadesh, Kenites, Caleb and Jerahmeel, and with a movement into Judah, all originally independent of their present context. Like the prominence of the traditions of Hebron and its hero Abraham, these features cannot be merely casual.[35]

> The fact that one is not dealing with literal history complicates the question of the nomadic or semi-nomadic life of the Israelite ancestors.[36] They are tent-dwellers, shepherds, sojourners (xvii. 8, xxiii. 4, xxviii. 4, xxxvi. 7, xxxvii. 1), and we breathe the air of the open country. But the impression gained from the narratives is of course due to the narrators. The movements of the patriarchs serve mainly to connect them with traditions which were originally independent. When Abraham separates from Lot he settles in "the land of Canaan," while Lot dwells in "the cities of the plain" (xiii. 12). Isaac at Beersheba enters into an alliance with the Philistines (xxvi. 12 sqq.), while Jacob seems to settle at Shechem (xxxiv.), and there or at Dothan, a few miles north, his sons pasture their father's flock (xxxvii. 12 sqq.).[37] Indeed, according to an isolated fragment Jacob conquered Shechem and gave it to Joseph (xlviii. 22), and this tradition underlies (and has not given birth to) the late and fantastic stories of his warfare (Jub. xxxiv. 1-9, Test. of Judah iii.). Judah, also, is represented as settling among the Canaanites (xxxviii.), and Simeon marries a Canaanite—according to late tradition, a woman of Zephath (xlvi. 10; Jub. xxxiv. 20, xliv. 13; see Judg. i. 17). These representations have been subordinated to others, in particular to the descent into Egypt of Jacob (Israel) and his sons, and the Exodus of the Israelites. But the critical study of these events raises very serious historical problems. Abraham's grandson, with his family—a mere handful of people—went down into Egypt during a famine (cf. Abraham xii. 10, and Isaac xxvi. 1 seq.); 400 years pass, all memory of which is practically obliterated, and the Israelite nation composed of similar subdivisions returns. Although the later genealogies from Jacob to Moses allow only four generations (cf. Gen. xv. 16), the difficulties are not removed. Joseph lived to see the children of Machir (l. 23, note Ex. i. 8), though Machir received Gilead from the hands of Moses (Num. xxxii. 40); Levi descended with Kehath, who became the grandfather of Aaron and Moses, while Aaron married a descendant in the fifth generation from Judah (Ex. vi. 23). On the other hand the genealogies in 1 Chron. ii. sqq. are independent of the Exodus; Ephraim's children raid Gath, his daughter founds certain cities, and Manasseh has an Aramaean concubine who becomes the mother of Machir (1 Chron. vii. 14, 20-24).[38] Moreover the whole course of the invasion and settlement of Israel (under Joshua) has no real connexion with pre-Mosaic patriarchal history. If we reinterpret the history of the *family* and its descent into Egypt, and belittle its increase into a *nation*, and if we figure to ourselves a more gradual occupation of Palestine, we destroy the entire continuity of history as it was understood by those who

compiled the biblical history, and we have no evidence for any confident reconstruction. With such thoroughness have the compilers given effect to their views that only on closer examination is it found that even at a relatively late period fundamentally differing traditions still existed, and that those which belonged to circles which did not recognize the Exodus have been subordinated and adjusted by writers to whom this was the profoundest event in their past.[39]

That the journey of Jacob-Israel from his Aramaean relatives into Palestine hints at some pre-Mosaic immigration is possible, but has not been either proved or disproved. The details point rather to a reflection of the entrance of the children of Israel, elsewhere ascribed to the leadership of Joshua (*q.v.*). Though the latter proceeded to Gilgal, a variant tradition, now almost lost, seems to have recorded an immediate journey to Shechem (Deut. xxvii. 1-10, Josh. viii. 30-35) previous to Joshua's great campaigns (Josh. x. seq., cf. Jacob's wars). His religious gathering at Shechem before the dismissal of the tribes finds its parallel in Jacob's reforms before leaving for Bethel (xxiv.; cf. v. 26, Gen. xxxv. 4). Owing, perhaps, to the locale of the writers, we hear relatively little of the northern tribes. Judah and Simeon are the first to conquer their lot, and the "house of Joseph" proceeds south to Bethel, where the story of the "weeping" at Bochim finds a parallel in the "oak of weeping" (Gen. xxxv. 8). In Gen. xxxviii. "at that time Judah went down from his brethren"—in xxxvii. they are at Shechem or Dothan—and settled among Canaanites, and there is a fragmentary allusion to a similar alliance of Simeon (xlvi. 10). The trend of the two series of traditions is too close to be accidental, yet the present sequence of the narratives in Joshua and Judges associates them with the Exodus. Further, Jacob's move to Shechem, Bethel and the south is parallel to that of Abraham, but his history actually represents a twofold course. On the one hand, he is the Aramaean (Deut. xxvi. 5), the favourite son of his Aramaean mother. On the other, Rebekah is brought to Beer-lahai-roi (xxiv.), Jacob belongs to the south and he leaves Beersheba for his lengthy sojourn beyond the Jordan. His separation from Esau, the revelation at Bethel, and the new name Israel are recorded twice, and if the entrance into Palestine reflects one ethnological tradition, the possibility that his departure from Beersheba reflects another, finds support (*a*) in the genealogies which associate the nomad "father" of the southern clans Caleb and Jerahmeel with Gilead (1 Chron. ii. 21), and (*b*) in the hints of an "exodus" from the district of Kadesh northwards.

The Southern nucleus.

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The history of an immigration into Palestine from beyond the Jordan would take various shapes in local tradition. In Genesis it is preserved from the southern point of view. The northern standpoint appears when Rachel, mother of Joseph and Benjamin, is the favoured wife in contrast to the despised Leah, mother of Judah and Simeon; when Joseph is supreme among his brethren; and when Judah is included among the "sons" of Israel. It is possible that the application of the traditional immigration to the history of the tribes is secondary. This at all events suggests itself when xxxiv. extends to the history of all the sons, incidents which originally concerned Simeon and Levi alone, and which may have represented the Shechemite version of a "Levitical" tradition (see Levites). However this may be, it is necessary to account for the nomadic colouring of the narratives (cf. Meyer, pp. 305, 472) and the prominence of southern interests, and it would be in accordance with biblical evidence elsewhere if northern tradition had been taken over and adapted to the standpoint of the southern members of Israel, with the incorporation of local tradition which could only have originated in the south.[40] These and other indications point to a late date in biblical history. There is a manifest difference between the religious importance of Shechem in the traditions of Joshua (xxiv.) and Jacob's reforms when he leaves behind him the heathen symbols before journeying to the holy site of Bethel (Gen. xxxv. 4). There is even some polemic against marriage with Shechemites (xxxiv.; more emphatic in Jub. xxx.), while in the story of the Hebronite Abraham, Bethel itself is avoided and Shechem is of little significance. Again, the present object of xxxviii. is to trace the origin of certain Judaean subdivisions after the death of the wicked Er and Onan. It is purely local and is interested in Shelah, and more especially in Perez and Zerah, names of families or clans of the post-exilic age.[41] Elsewhere, in 1 Chron. ii. and iv., the genealogies represent a Judah composed of clans from the south (Caleb and Jerahmeel) and of small families or guilds, Shelah included. It is not the Judah of the monarchy or of the post-exilic Babylonian-Israelite community. But the mixed elements were ultimately reckoned among the descendants of Judah, through Hezron the "father" of Caleb and Jerahmeel, and just as the southern groups finally became incorporated in Israel, so it is to be observed that although Hebron and Abraham have gained the first place in the patriarchal history, the traditions are no longer specifically Calebite, but are part of the common Israelite heritage.

We are taken to a period in biblical history when, though the historical sources are almost inexplicably scanty, the narratives of the past were approaching their present shape. Some time after the fall of Jerusalem (587 B.C.) there was a movement from the south of Judah northwards to the vicinity of Jerusalem (Bethlehem, Kirjath-jearim, &c.), where, as can be gathered from 1 Chron. ii., were congregated Kenite and Rechabite communities and families of scribes. Names related to those of Edomite and kindred groups are found in the late genealogies of both Judah and Benjamin, and recur even among families of the time of Nehemiah.[42] The same obscure period witnessed the advent of southern families,[43] the revival of the Davidic dynasty and its mysterious disappearance, the outbreak of fierce hatred of Edom, the return of exiles from Babylonia, the separation of Judah from Samaria and the rise of bitter anti-Samaritan feeling. It closes with the reorganization associated with Ezra and Nehemiah and the compilation of the historical books in practically their present form. It contains diverse interests and changing standpoints by which it is possible to explain the presence of purely southern tradition, the southern treatment of national history, and the antipathy to northern claims. As has already been mentioned, the specifically southern writings have everywhere been modified or adjusted to other standpoints, or have been almost entirely subordinated, and it is noteworthy, therefore, that in narratives elsewhere which reflect rivalries and conflicts among the priestly families, there is sometimes an animus against those whose names and traditions point to a southern origin (see Levites).

Thus the book of Genesis represents the result of efforts to systematize the earliest history, and to make it a worthy prelude to the Mosaic legislation which formed the charter of Judaism as it was established in or about the 5th century B.C. It goes back to traditions of the most varied character, whose tone was originally more in accord with earlier religion and thought. Though these have been made more edifying, they have not lost their charm and interest. The latest source, it is true, is without their freshness and life, but it is a matter for thankfulness that the simple compilers were conservative, and have neither presented a work entirely on the lines of P, nor rewritten their material as was done by the author of Jubilees and by Josephus. It is obvious that from Jubilees alone it would have been impossible to conceive the form which the traditions had taken a few centuries previously—viz. in Genesis. Also, from P alone it would have been equally impossible to recover the non-priestly forms. But while there is no immeasurable gulf between the canonical book of Genesis and Jubilees, the internal study of the former reveals traces of earlier traditions most profoundly different as regards thought and contents. It is not otherwise when one looks below the traditional history elsewhere (*e.g.* Samuel, Kings). An explanation may be found in the vicissitudes of the age. The movement from the south, which seems to

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account for a considerable cycle of the patriarchal traditions, belongs to the age after the downfall of the Israelite and (later) the Judaean monarchies when there were vital political and social changes. The removal of prominent inhabitants, by Assyria and later by Babylonia, the introduction of colonists from distant lands, and the movements of restless tribes around Palestine were more fatal to the continuity of trustworthy tradition than to the persistence of popular thought. New conditions arose as the population was reorganized, a new Israel claimed to be the heirs of the past (cf. *e.g.* the Samaritans, Ezr. iv. 2, Joseph. *Antiq*. ix. 14, 3; xi. 8, 6), and not until after these vicissitudes did the book of Genesis begin to assume its present shape.[44] (See Jews; Palestine: *History*.)

The above pages handle only the more important details for the study of a book which, as regards contents and literary history, cannot be separated from the series to which it forms the introduction. As regards the literary-critical problems it is clear that with the elimination of P we have the sources (minor adjustment and revision excepted) which were accessible to the last compiler in the post-exilic age. Most critics have inclined to date these sources (J and E) as early as possible, whereas the admitted presence of secondary and of relatively late passages (*e.g.* xviii. 22 sqq., J; xxii., E) shows that one must work back from the sources as known in P's age, and that one can rely only upon those criteria which can be approximately dated. It is usual to regard the more primitive character of J and E as a mark of antiquity; but this ignores the regular survival of primitive modes of thought and of popular tradition outside more cultured circles. It is also recognized that J and E are non-prophetical and non-Deuteronomic, but it has not been proved that the present J and E are earlier than the prophets or the Deuteronomic reforms of Josiah (2 Kings xxii. seq.). J and E are linguistically almost identical (in contrast to P), and differ from P in features which are often not of chronological but of sociological significance (*e.g.* the mentality of the writers). Their language is without some of the phenomena found in narratives which emanate from the north (*e.g.* Judges v., stories of Elijah and Elisha), and their stylistic variations may be, as Gunkel suggests, the mark of a district or region; for this district one would look in the neighbourhood of Jerusalem. The conclusion that P's narratives and laws in the Pentateuch are post-exilic was found by biblical scholars to be a necessary correction to the original hypothesis of Graf (1866) that P's *narratives* were to be retained (with J and E) at an early date. This view was influenced by the close connexion between the subject-matter, J, E and P representing the same trend of tradition. But by still ascribing J and E as written sources to about the 9th or 8th century (individual opinion varies), many difficulties and inconsistencies are involved. The present J and E reflect a reshaping and readjustment of earlier tradition which is found elsewhere, and the suggestion that they are not far removed from the age of the priestly writers and redactors does not conflict with what is known of language, forms of religious thought, or tendencies of tradition. We reach thus approximately the age when post-Deuteronomic editors were able to utilize such records as Judg. i., xvii. sqq., 2 Sam. ix.-xx. (see Judges; Samuel, Books of), which are equally valuable as specimens of current thought and of written tradition. In conclusion, the tendency of criticism has been to recognize "schools" of J and E extending into the exile, thus making the three sources J, E and P more nearly contemporaneous. The most recent conservative authority also inclines to a similar contemporaneity ("collaboration" or "co-operation"), but at an impossibly early date (J. Orr, *Problem of the O. T.*, 1905, pp. 216, 345, 354, 375 seq., 527). By admitting possible revision in the post-exilic age (pp. 226, 369, 375 seq.), the conservative theory recalls the old legend that Ezra rewrote the Old Testament (2 Esd. xiv.) and thus restored the Law which had been lost; a view which, through the early Christian Fathers, gained currency and has enjoyed a certain popularity to the present day. But when once revision or rewriting is conceded, there is absolutely no guarantee that the present Pentateuch is in any way identical with the five books which tradition ascribed to Moses (*q.v.*), and the necessity for a comprehensive critical investigation of the *present* contents makes itself felt.[45]

Literature.—Only a few of the numerous works can be mentioned. Of those written from a conservative or traditional standpoint the most notable are: W.H. Green's *Unity of Genesis* (1895); and J. Orr, *Problem of the O. T.* (which is nevertheless a great advance upon earlier non-critical literature). S.R. Driver's commentary (*Westminster Series*) deals thoroughly with all preliminary problems of criticism, and is the best for the ordinary reader; that of A. Dillmann (6th ed.; Eng. trans.) is more technical, that of W.H. Bennett (*Century Bible*) is more concise and popular. G.J. Spurrell, Notes on the Text of Genesis, and C.J. Ball (in Haupt's *Sacred Books of the O. T.*) appeal to Hebrew students. W.E. Addis, *Documents of the Hexateuch*, Carpenter and Harford-Battersby, *The Hexateuch*, and C.F. Kent, *Beginnings of Hebrew History*, are more important for the literary analysis. J. Wellhausen's sketch in his *Proleg. to Hist. of Israel* (Eng. trans., pp. 259-342) is admirable, as also is the general Introduction (trans. by W.H. Carruth, 1907) to H. Gunkel's valuable commentary. Of recent works bearing upon the subject-matter reference may be made to J.P. Peters, *Early Hebrew Story* (1904), A.R. Gordon, *Early Traditions of Genesis* (1907), and T.K. Cheyne, *Traditions and Beliefs of Ancient Israel* (1907). Special mention must be made of Eduard Meyer and B. Luther, to whose *Die Israëliten und ihre Nachbarstämme* (1906) the present writer is indebted for many valuable suggestions and hints. Fuller bibliographical information will be found in the works already mentioned, in the articles in the *Ency. Bib.* (G.F. Moore), and Hastings's *Dict.* (G.A. Smith), and in the volume by J. Skinner in the elaborate and encyclopaedic *International Critical Series*.

(S. A. C.)

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1 The abrupt introduction of a small poem (iv. 23 seq.) was long ago regarded as due to the use of separate sources (so the Calvinist Isaac de la Peyrère, 1654).

2 The divergences of detail, with corresponding stylistic variations, were recognized long ago (*e.g.* by Father Simon in 1682).

3 As early as 1685 Jean le Clerc observed that Ur of the Chaldees (*Chasdim*) in xi. 28 anticipates *Chesed* in xxii. 22, and implied some knowledge of the land of the Chaldaeans (cf. Ezek. i. 3, xi. 24).

4 The Catholic priest Andrew du Maes (1570) already pointed to the names Hebron and Dan as signs of post-Mosaic date.

5 Note the repetitions in vv. 2 and 3; Abraham's faith, vv. 4-6, and his request, *v.* 8; contrast the time of day, *v.* 5 and *v.* 12, and the dates, *v.* 13 and *v.* 16. In *vv.* 12-15 there is a reference to the bondage in Egypt.

6 These and other chronological embarrassments, now recognized as due to the framework of the post-exilic writer (P), have long been observed—by Spinoza, 1671.

7 Points of resemblance in xxiii. with Babylonian usage have often been exaggerated; comparison "shows noteworthy differences" (T.G. Pinches, *The Old Testament*, p. 238); see Carpenter and Harford-Battersby, *Hexateuch*, i. 64, Driver, Gen. p. 230, and *Addenda*.

8 Note, *e.g.*, the sudden introduction of xxix. 15, the curious position of *v.* 24 (due to P), the double play upon the names Zebulun and Joseph, xxx. 20, 23 seq., the internal intricacies in the agreement, *ib. vv.* 31-43; the difficulties in the reference to the latter in xxxi. 6 sqq. (especially v. 10).

9 See Ed. Meyer (and B. Luther), *Die Israëliten und ihre Nachbarstämme* (1906), pp. 238 sqq.; also the shrewd remarks of C.T. Beke, *Origines biblicae* (1834), pp. 123 sqq.

10 It is interesting to find that the Spanish Rabbi Isaac (of Toledo, A.D. 982-1057), noticing that the royal list must be later

than the time of Saul (also recognized by Martin Luther and others), proposed to assign the chapter to the age of Jehoshaphat.

11 But the chronology is hopeless, and only ten years are allowed according to another and later scheme (xxv. 26, xxxv. 28, xlvii. 9).

12 Cf. the account of the Israelites in Egypt, where they are in Goshen, unaffected by the plagues (Ex. viii. 22, ix. 26), or, according to another view, are living in the midst of the Egyptians (*e.g.* xii. 23).

13 V. 7 breaks the context; there is repetition in *vv.* 10*b* and 13b; interchange of the names Jacob and Israel; *v.* 12 suggests a blessing upon Joseph himself; and with *vv.* 15 seq. (the blessing of the sons, not of Joseph), contrast vv. 20 sqq. (the singular "in thee," v. 20).

14 Only the more noticeable peculiarities have been mentioned in the preceding columns.

15 On the course of modern criticism and on the various sources: P, J (Judaean or Yahwist), E (Ephraimite or Elohist), see BIBLE (*Old Test. Criticism*). The passages usually assigned to P in Genesis are: i. 1-ii. 4*a*; *v.* 1-28, 30-32; vi. 9-22; vii. 6 (and parts of 7-9), 11, 13-16*a*, 18-21, 24; viii. 1-2*a*, 3*b*-5, 13*a*, 14-19; ix. 1-17, 28-29; x. 1-7, 20, 22-23, 31-32; xi. 10-27, 31-32; xii. 4b-5; xiii. 6, 11*b*-12*a*; xvi. 1*a*, 3, 15-16; xvii.; xix. 29; xxi. 1*b*, 2b-5; xxiii.; xxv. 7-11*a*, 12-17, 19-20, 26*b*; xxvi. 34-35; xxvii. 46-xxviii. 9; xxix. 24, 28*b*, 29; xxxi. 18*b*; xxxiii. 18a; xxxiv. 1-2*a*, 4, 6, 8-10, 13-18, 20-24, part of 25, 27-29; xxxv. 9-13, 15, 22b-29; xxxvi. (in the main); xxxvii. 1-2*a*; xli. 46; xlvi. 6-27; xlvii. 5-6*a*, 7-11, 27*b*-28; xlviii. 3-7; xlix. 1*a*, 28*b*-33, l. 12-13.

16 See on this, especially, S.R. Driver's *Genesis* in the "Westminster Commentaries" (seventh ed., 1909).

17 The above is typical of modern biblical criticism which is compelled to recognize the human element (and can thus have no a priori preconceptions in approaching the Old Testament), but at the same time reveals ever more decisively the presence of purifying influences, without which the records of Israel would have had no permanent interest or value. They thus gain a new value which cannot be impaired when it is realized that their significance is quite independent of their origins.

18 See the remarks of W.R. Smith, *Eng. Hist. Rev.* (1888), pp. 128 seq. (from the sociological side), and for general considerations, A.A. Bevan, *Crit. Rev.* (1893), pp. 138 sqq.; S.R. Driver, *Genesis*, pp. xliii. sqq.

19 Cf. Amos i. 11; 1 Chron. ii. iv. (note iv. 10), the Book of Jubilees (see above), and also Arabian usage (W.R. Smith, *Kinship and Marriage*, ch. i.). For modern examples, see E. Littmann, *Orient. Stud. Theodor Nöldeke* (ed. Bezold, 1906), pp. 942-958.

20 The Book of Jubilees also enables the student to test the arguments based upon any study restricted to Genesis alone. Thus it shows that the "primitive" features of Genesis afford a criterion which is sociological rather than chronological. This is often ignored. For example, the conveyance of the field of Machpelah (xxiii.) is conspicuous for the absence of any reference to a written contract in contrast to the "business" methods in Jer. xxxii. This does not prove that Gen. xxiii. is early, because writing was used in Palestine about 1400 B.C., and, on the other hand, the more simple forms of agreement are still familiar after the time of Jeremiah (*e.g.* Ruth, Proverbs). Similarly, no safe argument can be based upon the institution of blood-revenge in Gen. iv., when one observes the undeveloped conditions among the Trachonites of the time of Herod the Great (Josephus, Ant. xvi. 9, 1), or the varying usages among modern tribes.

21 On the Jewish forms, see R.H. Charles, *Book of Jubilees* (1902), pp. 33 seq.

22 A.H. Sayce, *Proc. of the Soc. of Bibl. Arch.* (1907), pp. 13-17.

23 xxvii. 27-29, 39 seq. This is significantly altered in the later writings (Jub. xxvi. 34 and the Targums). It is worth noticing that in Jub. xxvi. 35 a new turn is given to Gen. xxvii. 41 by changing Isaac's approaching death (which raises serious difficulties in the history of Jacob) into Esau's wish that it may soon come.

24 See E. Meyer (and B. Luther), *Die Israëliten und ihre Nachbarstämme* (1906), pp. 386-389, 442-446.

25 See PHILISTINES. The covenant with Abimelech may be compared with the friendship between David and Achish (1 Sam. xxvii.), who is actually called Abimelech in the heading of Ps. xxxiv. (see 1 Sam. xxi. 10). If this is a mistake (and not a variant tradition) it is a very remarkable one. The treatment of the covenant by the author of Jubilees (xxiv. 28 sqq.), on the other hand, is only intelligible when one recalls the attitude of Judah to the Philistine cities in the 2nd century B.C.; see R.H. Charles, ad loc.

26 In 2 Sam. xix. 43 (original text) the men of Israel claim to be the first-born rather than Judah; cf. 1 Chron. v. 1 seq., where the birthright (after Reuben was degraded) is explicitly conferred upon Joseph (Ephraim and Manasseh).

27 Cf. Josephus, *Antiq.* ii. 8, 2; *Test. of xii. Patriarchs*; Acts vii. 16 (where Shechem is an error); Oesterley and Box, *Religion and Worship of the Synagogue*, pp. 340 seq.; M.G. Dampier, in *Church and Synagogue* (1909), p. 78.

28 See J.P. Peters, *Early Heb. Story* (1904), pp. 81 sqq.; S.A. Cook, *Relig. of Anc. Palestine* (1908), pp. 19 sqq.

29 In like manner the Babylonian story of the flood has been revised and adapted to the Hebrew Noah (cf. *Nippur, ad fin.*).

30 The writer in Jub. xxvii. 27 treats the pillar as a "sign." Another useful example of revision is to be found in Josh. xxii., where what was regarded (by a reviser) as an object unworthy of the religion of Yahweh is now merely commemorative.

31 For popular religious thought and practice (often described as pre-prophetical, though non-prophetical would be a safer term), see HEBREW RELIGION.

32 Among recent efforts to find and explain mythical elements, see especially Stucken, *Astralmythen*: H. Winckler, *Geschichte Israëls*, vol. ii.; and P. Jensen, *Das Gilgamesch-Epos in der Weltlitteratur*.

33 Again the analogy of the modern East is instructive. Especially interesting are the traditions associating the same figure or incident with widely separated localities.

34 See EXODUS, THE; LEVITES. On this feature see Luther and Meyer, op. cit. pp. 158 seq., 227 sqq., 259, 279, 305, 386, 443. Their researches on this subject are indispensable for a critical study of Genesis.

35 The notion of an Eve (*hawwah*, "serpent") as the first woman may be conjecturally associated with (*a*) the frequent traditions of the serpent-origin of clans, and (*b*) with evidence which seems to connect the Levites and allied families with some kind of serpent-cult (see Meyer, op. cit. pp. 116, 426 seq., 443, and art. SERPENT-WORSHIP). The account of mankind as it now reads (ii. seq.) is in several respects less primitive (contrast vi. 1 seq.), and the present story of Cain and his murder of Abel really places the former in an unfavourable light.

36 See the discussion between B.D. Eerdmans and G.A. Smith in the *Expositor* (Aug.-Oct. 1908), and the former's *Alttest. Studien*, ii. (1908), *passim.*

37 xxxiv. (note v. 9) indicates a possible alliance with Shechemites, and xxxv. 4 (taken literally) implies a residence long enough for a religious reform to be necessary. Yet the present aim of the narratives is to link together the traditions and emphasize Jacob's return from Laban to his dying father (xxviii. 21; xxxi. 3, 13, 18; xxxii. 9; xxxv. 1, 27).

38 Cf. Benjamin's descendants in 1 Chron. viii. 6 seq. and see on the naive and primitive character of these traditions, Kittel, comment. *ad loc.*

39 That there are traditions in Genesis which do not form the prelude to Exodus is very generally recognized by those who agree that the Israelites after entering Palestine took over some of the indigenous lore (whether from the Canaanites or from a presumed earlier layer of Israelites). This adoption of native tradition by new settlers, however, cannot be confined to any single period. See further, Luther and Meyer, *op. cit.* pp. 108, 110, 156, 227 seq., 254 seq., 414 seq., 433; on traditions related to the descent into Egypt, *ib.* 122 sqq., 151 seq., 260; and on the story of Joseph (ch. xxxv., xxxvii. sqq.), as an independent cycle used to form a connecting link, Luther, *ib.* pp. 142-154.

40 Cf. the late "Deuteronomic" form of Judges where a hero of Kenizzite origin (and therefore closely connected with Caleb) stands at the head of the Israelite "judges"; also, from another aspect, the specifically Judaean and anti-Israelite treatment of the history of the monarchy. But in each case the feature belongs to a relatively late stage in the literary history of the books; see JUDGES; SAMUEL, BOOKS OF; KINGS.

41 Mahalalel (son of Kenan, another form of Cain, v. 12) is also a prominent ancestor in Perez (Neh. xi. 4), and Zerah claimed the renowned sages of Solomon's day (1 Chron. ii. 6, 1 Kings iv. 31). The story implies that Perez surpassed his "brother" clan Zerah (xxxviii. 27-30), and in fact Perez is ultimately reckoned the head of the Judaean subdivisions (1 Chron. ii. 4 sqq.), and thus is the reputed ancestor of the Davidic dynasty (Ruth iv. 12, 18 sqq.).

The sympathies of these traditions are as suggestive as their presence in the canonical history, which, it must be remembered, ultimately passed through the hands of Judaean compilers.

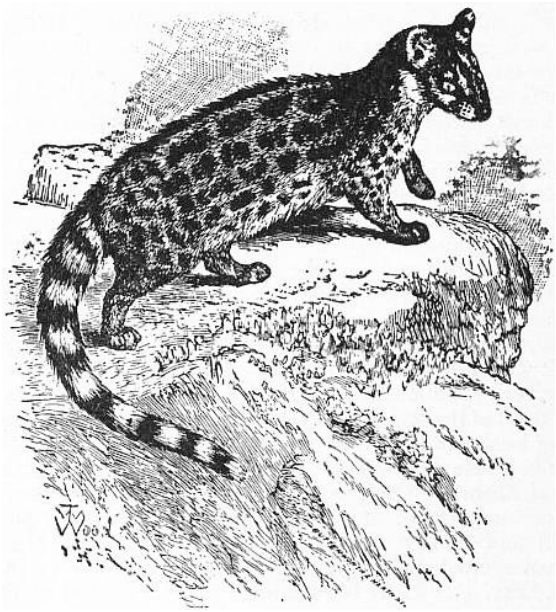
42 Neh. iii. 9, 14; see Meyer, pp. 300, 430; S.A. Cook, *Critical Notes on O. T. History*, p. 58 n. 2. While the evidence points to an early close relationship among S. Palestinian groups (Edom, Ishmael, &c.; cf. Meyer, p. 446), there are many allusions to subsequent treacherous attacks which made Edom execrable. Here again biblical criticism cannot at present determine precisely when or precisely why the changed attitude began; see EDOM; JEWS, §§ 20, 22.

43 Although the movement reflected in 1 Chron. ii. is scarcely pre-exilic, yet naturally there had always been a close relation between Judah and the south, as the Assyrian inscriptions of the latter part of the 8th century B.C. indicate.

44 The south of Palestine, if less disturbed by these changes, may well have had access to older authoritative material.

45 For Orr's other concessions bearing upon Genesis, see *op. cit.*, pp. 9 seq., 87, 93, and (on J, E, P) 196, 335, 340. These, like the concessions of other apologetic writers, far outweigh the often hypercritical, irrelevant, and superficial objections brought against the literary and historical criticism of Genesis.

GENET, typically a south European carnivorous mammal referable to the *Viverridae* or family of civets, but also taken to include several allied species from Africa. The true genet (*Genetta vulgaris* or *Genetta genetta*) occurs throughout the south of Europe and in Palestine, as well as North Africa. The fur is of a dark-grey colour, thickly spotted with black, and having a dark streak along the back, while the tail, which is nearly as long as the body, is ringed with black and white. The genet is rare in the south of France, but commoner in Spain, where it frequents the banks of streams, and feeds on small mammals and birds. It differs from the true civets in that the anal pouch is a mere depression, and contains only a faint trace of the highly characteristic odour of the former. In south-western Europe and North Africa it is sought for its soft and beautifully spotted fur. In some parts of Europe, the genet, which is easily tamed, is kept like a cat for destroying mice and other vermin.



The Genet (*Genetta vulgaris*).

GENEVA, a city of Ontario county, New York, U.S.A., at the N. end of Seneca Lake, about 52 m. S.E. of Rochester. Pop. (1890) 7557; (1900) 10,433 (of whom 1916 were foreign-born); (1910 census) 12,446. It is served by the New York Central & Hudson River, and the Lehigh Valley railways, and by the Cayuga & Seneca Canal. It is an attractively built city, and has good mineral springs. Malt, tinware, flour and grist-mill products, boilers, stoves and ranges, optical supplies, wall-paper, cereals, canned goods, cutlery, tin cans and wagons are manufactured, and there are also extensive nurseries. The total value of the factory product in 1905 was $4,951,964, an increase of 82.3% since 1900. Geneva has a public library, a city hospital and hygienic institute. It is the seat of the New

York State Agricultural Experiment Station and of Hobart College (non-sectarian), which was first planned in 1812, was founded in 1822 (the majority of its incorporators being members of the Protestant Episcopal church) as successor to Geneva Academy, received a full charter as Geneva College in 1825, and was renamed Hobart Free College in 1852 and Hobart College in 1860, in honour of Bishop John Henry Hobart. The college had in 1908-1909 107 students, 21 instructors, and a library of 50,000 volumes and 15,000 pamphlets. A co-ordinate woman's college, the William Smith school for women, opened in 1908, was endowed in 1906 by William Smith of Geneva, who at the same time provided for a Hall of Science and for further instruction in science, especially in biology and psychology. In 1888 the Smith Observatory was built at Geneva, being maintained by William Smith, and placed in charge of Dr William Robert Brooks, professor of astronomy in Hobart College. The municipality owns its water-supply system. Geneva was first settled about 1787 almost on the site of the Indian village of Kanadasega, which was destroyed in 1779 during Gen. John Sullivan's expedition against the Indians in western New York. It was chartered as a city in 1898.

GENEVA (Fr. *Genève*, Ger. *Genf*, Ital. *Ginevra*, Late Lat. *Gebenna*, though *Genava* in good Latin), a city and canton of Switzerland, situated at the extreme south-west corner both of the country and of the Lake of Geneva or Lake Leman. The canton is, save Zug, the smallest in the Swiss Confederation, while the city, long the most populous in the land, is now surpassed by Zürich and by Basel.

The canton.

The canton has an area of 108.9 sq. m., of which 88.5 sq. m. are classed as "productive" (forests covering 9.9 sq. m. and vineyards 6.8 sq. m., the rest being cultivated land). Of the "unproductive" 20.3 sq. m., 11½ are accounted for by that portion of the Lake of Geneva which belongs to the canton. It is entirely surrounded by French territory (the department of Haute Savoie lying to the south, and that of the Ain to the west and the north), save for about 3½ m. on the extreme north, where it borders on the Swiss canton of Vaud. The Rhone flows through it from east to west, and then along its south-west edge, the total length of the river in or within the canton being about 13 m., as it is very sinuous. The turbid Arve is by far its largest tributary (left), and flows from the snows of the chain of Mont Blanc, the only other affluent of any size being the London (right). Market gardens, orchards, and vineyards occupy a large proportion of the soil (outside the city), the apparent fertility of which is largely due to the unremitting industry of the inhabitants. In 1901 there were 6586 cows, 3881 horses, 2468 swine and 2048 bee-hives in the canton. Besides building materials, such as sandstone, slate, &c., the only mineral to be found within the canton is bituminous shale, the products of which can be used for petroleum and asphalt. The broad-gauge railways in the canton have a length of 18¾ m., and include bits of the main lines towards Paris and Lausanne (for Bern or the Simplon), while there are also 72¾ m. of electric tramways. The canton was admitted into the Swiss Confederation in 1815 only, and ranks as the junior of the 22 cantons. In 1815-1816 it was created by adding to the old territory belonging to the city (just around it, with the outlying districts of Jussy, Genthod, Satigny and Cartigny) 16 communes (to the south and east, including Carouge and Chêne) ceded by Savoy, and 6 communes (to the north, including Versoix), cut off from the French district of Gex.

Statistics of canton and city.

In 1900 there were, not counting the city, 27,813 inhabitants in the canton, or, including the city, 132,609, the city alone having thus a population of 104,796. (In the following statistics those for the city are enclosed within brackets.) In 1900 this population was thus divided in point of religion: Romanists, 67,162 (49,965), Protestants, 62,400 (52,121), and Jews 1119 (1081). In point of language 109,741 (84,259) were French-speaking, 13,343 (12,004) German-speaking, and 7345 (6574) Italian-speaking, while there were also 89 (76) Romonsch-speaking persons. More remarkable are the results as to nationality: 43,550 (31,607) were Genevese citizens, and 36,415 (30,582) Swiss citizens of other cantons. Of the 52,644 (42,607) foreigners, there were 34,277 (26,018) French, 10,211 (9126) Italians, 4653 (4283) subjects of the German empire, 583 (468) British subjects, 832 (777) Russians, and 285 (251) citizens of the United States of America. In the canton there were 10,821 (5683) inhabited houses, while the number of separate households was 35,450 (28,621). Two points as to these statistics deserve to be noted. The number of foreign residents is steadily rising, for in 1900 there were only 79,965 (62,189) Swiss in all as against 52,644 (42,607) foreigners. One result of this foreign immigration, particularly from France and Italy, has been the rapid increase of Romanists, who now form the majority in the canton, while in the city they were still slightly less numerous than the Protestants in 1900; later (local) statistics give in the Canton 75,400 Romanists to 64,200 Protestants, and in the city 52,638 Romanists to 51,221 Protestants. Geneva has always been a favourite residence of foreigners, though few can ever have expected to hear that the "protestant Rome" has now a Romanist majority as regards its inhabitants. Galiffe (*Genève hist. et archéolog.*) estimates the population in 1356 at 5800, and in 1404 at 6490, in both cases within the fortifications. In 1536 the old city acquired the outlying districts mentioned above, as well as the suburb of St Gervais on the right bank of the Rhone, so that in 1545 the number is given as 12,500, reduced by 1572 to 11,000. After the revocation of the Edict of Nantes (1685) it rose, by 1698, to 16,934. Thenceforward the progress was fairly steady: 18,500 (1711); 24,712 (1782); 26,140 (1789). After the creation of the canton (1815) the numbers were (those for the city are enclosed within brackets) 48,489 (25,289), the city rising in 1837 to 33,714, and in 1843 to 36,452. The result of the Federal censuses (begun in 1850) are as follows: in 1850, 64,146 (42,127); in 1860, 82,876 (59,826); in 1870, 88,791 (65,606); in 1880, 99,712 (76,197), and in 1888, 105,509 (81,407).

Government.

The canton comprises 3 administrative districts: the 13 communes on the right bank and the 34 on the left bank each form one, while the city proper, on both sides of the river, forms one district and one commune. From 1815 to 1842 the city and the cantonal government was the same. But at that date the city obtained its independence, and is now ruled by a town council of 41 members, and an executive of 5 members, the election in each case being made direct by the citizens, and the term of office being 4 years. The existing cantonal constitution dates, in most of its main features, from 1847. The legislature or *Grand Conseil* (now composed of 100 members) is elected (in the proportion of 1 member for every 1000 inhabitants or fraction over 500) for 3 years by a direct popular vote, subject (since 1892) to the principles of proportional representation, while the executive or *conseil d'état* (7 members) is elected (no proportional representation) by a popular vote for 3 years. By the latest enactments (one dating from 1905) 2500 citizens can claim a vote ("facultative referendum") as to any legislative project, or can exercise the "right of initiative" as to any such project or as to the revision of the cantonal constitution. The canton sends 2 members (elected by a popular vote) to the Federal *Ständerath*, and 7 to the Federal *Nationalrath*.

The Consistory rules the Established Protestant Church, and is now composed of 31 members, 25 being laymen and 6 (formerly 15) clerics, while the "venerable company of pastors" (pastors actually holding cures) has greatly lost its former importance and can now only submit proposals to the Consistory. The Christian Catholic Church is also "established" at Geneva (since 1873) and is governed by the *conseil supérieur*, composed of 25 lay members and 5 clerics. No other religious denominations are "established" at Geneva. But the Romanists (who form 13% of the electors) are steadily growing in numbers and in influence, while the Christian Catholics are losing ground rapidly, the highest number of votes received by a candidate for the *conseil supérieur* having fallen from 2003 in 1874 to 806 in 1890 and 507 in 1906, while they are abandoning the country churches (some were lost as early as 1892) which they had taken from the Romanists in the course of the *Kulturkampf*.

Religion.

The fairs of Geneva (held 4 times a year) are mentioned as early as 1262, and attained the height of their prosperity about 1450, but declined after Louis XI.'s grants of 1462-1463 in favour of the fairs of Lyons. Among the chief articles brought to these fairs (which were largely frequented by Italian, French and Swiss merchants) were cloth, silk, armour, groceries, wine, timber and salt, this last coming mainly from Provence. The manufacturers of Geneva formed in 1487 no fewer than 38 gilds, including tailors, hatters, mercers, weavers, tanners, saddle-makers, furriers, shoe-makers, painters on glass, &c. Goldsmiths are mentioned as early as 1290. Printing was introduced in 1478 by Steinschaber of Schweinfurth, and flourished much in the 16th century, though the rigorous supervision exercised by the Consistory greatly hampered the Estiennes (Stephanus) in their enterprises. Nowadays the best known industry at Geneva is that of watchmaking, which was introduced in 1587 by Charles Cusin of Autun, and two years later regulations as to the trade were issued. In 1685 there were in Geneva 100 master watchmakers, employing 300 work-people, who turned out 5000 pieces a year, while in 1760 this trade employed 4000 work-people. Of recent years its prosperity has diminished greatly, so that the watchmaking and jewelry trades in 1902 numbered respectively but 38 and 32 of the 394 establishments in Geneva which were subject to the factory laws. Lately, huge establishments have been constructed for the utilization of the power contained in the Rhone. The local commerce of Geneva is much aided by the fact that the city is nearly entirely surrounded by "free zones," in which no customs duties are levied, though the districts are politically French: this privilege was given to Gex in 1814, and to the Savoyard districts in 1860, when they were also neutralized.

Industry.

Considering the small size of Geneva, till recently, it is surprising how many celebrated persons have been connected with it as natives or as residents. Here are a few of the principal, special articles being devoted to many of them in this work. In the 16th century, besides Calvin and Bonivard, we have Isaac Casaubon, the scholar; Robert and Henri Estienne, the printers, and, from 1572 to 1574, Joseph Scaliger himself, though but for a short time. J.J. Rousseau is, of course, the great Genevese of the 18th century. At that period, and in the 19th century, Geneva was a centre of light, especially in the case of various of the physical sciences. Among the scientific celebrities were de Saussure, the most many-sided of all; de Candolle and Boissier, the botanists; Alphonse Favre and Necker, the geologists; Marignac, the chemist; Deluc, the physicist, and Plantamour, the astronomer. Charles Bonnet was both a scientific man and a philosopher, while Amiel belonged to the latter class only. Pradier and Chaponnière, the sculptors; Arlaud, Diday and Calame, the artists; Mallet, who revealed Scandinavia to the literary world; Necker, the minister; Sismondi, the historian of the Italian republics; General Dufour, author of the great survey which bears the name of the "Dufour Map," have each a niche in the Temple of Fame. Of a less severe type were Cherbuliez, the novelist; Töpffer, who spread a taste for pedestrianism among Swiss youth; Duchosal, the poet; Marc Monnier, the littérateur; not to mention the names of any persons still living, or of politicians of any date.

Celebrities.

The city of Geneva is situated at the south-western extremity of the beautiful lake of the same name, whence the "arrowy Rhone" flows westwards under the seven bridges by which the two halves of the town communicate with each other. To the south is the valley of the Arve (descending from the snows of the Mont Blanc chain), which unites with that of the Rhone a little below the town; while behind the Arve the grey and barren rocks of the Petit Salève rise like a wall, which in turn is overtopped by the distant and ethereal snows of Mont Blanc. Yet the actual site of the town is not as picturesque as that of several other spots in Switzerland. Though the cathedral crowns the hillock round which clusters the old part of the town, a large portion of the newer town is built on the alluvial flats on either bank of the Rhone. Since the demolition of the fortifications in 1849 the town has extended in every direction, and particularly on the right bank of the Rhone. It possesses many edifices, public and private, which are handsome or elegant, but it has almost nothing to which the memory reverts as a masterpiece of architectural art. It is possible that this is, in part, due to the artistic blight of the Calvinism which so long dominated the town. But, while lacking the medieval appearance of Fribourg or Bern, or Sion or Coire, the great number of modern fine buildings in Geneva, hotels, villas, &c., gives it an air of prosperity and comfort that attracts many visitors, though on others modern French architecture produces a blinding glare. On the other hand, there are broad quays along the river, while public gardens afford grateful shade.

The city and its buildings.

The cathedral (Protestant) of St Pierre is the finest of the older buildings in the city, but is a second-rate building, though as E.A. Freeman remarks, "it is an excellent example of a small cathedral of its own style and plan, with unusually little later alteration." The hillock on which it rises was no doubt the site of earlier churches, but the present Transitional building dates only from the 12th and 13th centuries, while its portico was built in the 18th century, after the model of the Pantheon at Rome. It contains a few sepulchral monuments, removed from the cloisters (pulled down in 1721), and a fine modern organ, but the historical old bell *La Clémence* has been replaced by a newer and larger one which bears the same name. More interesting than the church itself is the adjoining chapel of the Maccabees, built in the 15th century, and recently restored. Near the cathedral are the arsenal (now housing the historical museum, in which are preserved many relics of the "Escalade" of 1602, including the famous ladders), and the maison de ville or town hall. The latter building is first mentioned in 1448, but most of the present building dates from far later times, though the quaint paved spiral pathway (taking the place of a staircase in the interior) was made in the middle of the 16th century. In the *Salle du Conseil d'État* some curious 15th-century frescoes have lately been discovered, while the old Salle des Festins is now known as the Salle de l'Alabama, in memory of the arbitration tribunal of 1872. In the 15th-century Tour Baudet, adjoining the Town Hall, are preserved the rich archives of the city. Not far away is the palais de justice, built in 1709 as a hospital, but used as a court house since 1858. On the Île in the Rhone stands the tower (built c. 1219) of the old castle belonging to the bishop. Among the modern buildings we may mention the following: the University (founded in 1559, but raised to the rank of a University in 1873 only), the Athénée, the Conservatoire de Musique, the Victoria Hall (a concert hall, presented in 1904 to the city by Mr Barton, formerly H.B.M.'s Consul), the theatre, the Salle de la Réformation (for

religious lectures and popular concerts), the Bâtiment Electoral, the Russian church and the new post office. At present the museums of various kinds at Geneva are widely dispersed, but a huge new building in course of construction (1906) will ultimately house most of them. The Musée Rath contains pictures and sculptures; the Musée Fol, antiquities of various dates; the Musée des Arts Décoratifs, *inter alia*, a fine collection of prints; the Musée Industriel, industrial objects and models; the Musée Archéologique, prehistoric and archaeological remains; the Musée d'Histoire Naturelle, scientific collections; and the Musée Epigraphique, a considerable number of inscriptions. Some way out of the town is the Musée Ariana (extensive art collections), left, with a fine park, in 1890 to the city by a rich citizen, Gustave Revilliod. The public library is in the university buildings and contains many valuable MSS. and printed books. Geneva boasts also of a fine observatory and of a number of technical schools (watchmaking, chemistry, medicine, commerce, fine arts, &c.), some of which are really annexes of the university, which in June 1906 was attended by 1158 matriculated students, of whom 903 were non-Swiss, the Russians (475 in number) forming the majority of the foreign students. Geneva is well supplied with charitable institutions, hospitals, &c. Among other remarkable sights of the city may be mentioned the great hydraulic establishment (built 1882-1899) of the *Forces Motrices du Rhône* (turbines), the singular monument set up to the memory of the late duke of Brunswick who left his fortune to the city in 1873, and the Île Jean-Jacques Rousseau now connected with the Pont des Bergues. The house occupied by Rousseau is No. 40 in the Grand' Rue, while No. 13 in the same street is on the site of Calvin's house, though not the actual dwelling inhabited by him.

History.

The real name of the city is *Genava*, that being the form under which it appears in almost all the known documents up to the 7th century, A.D., the variation *Genua* (which has led to great confusion with Genoa) being also found in the 6th century. But *Geneva* and *Gebenna* are of later date. The first mention of the city is made by Caesar (*Bell. Galli*. i. 6-7) who tells us that it was the last *oppidum* of the Allobroges, and the nearest to the territory of the Helvetii, with which it was connected by a bridge that, for military reasons, he was forced to destroy. Inscriptions of later date state that it was only a *vicus* of the Viennese province, while mentioning the fact that a gild of boatmen flourished there. But the many Roman remains found on the original site (in the region of the cathedral) of the city show that it must have been of some importance, and that it possessed a considerable commerce. About 400 the *Notitia Galliarum* calls it a *civitas* (so that it then had a municipal administration of its own), and reckons it as first among those of the Viennese. Probably this rise in dignity was connected with the establishment of a bishop's see there, the first bishop certainly known, Isaac, being heard of about 400 in a letter addressed by St Eucherius to Salvius, while, in 450, a letter of St Leo states that the see was then a suffragan of the archbishopric of Vienne. It is possible that there may be some ground for the local tradition that Christianity was introduced into this region by Dionysius and Paracodus, who successively occupied the see of Vienne, but another tradition that the first bishop was named St Nazarius rests on a confusion, as that saint belongs to Genoa and not to Geneva.

About the middle of the 5th century A.D. it came into the possession of the Burgundians, who held it as late as 527 (thus leaving no room for any occupation by the Ostrogoths), and in 534 passed into the hands of the Franks. The Burgundian kings seem to have made Geneva one of their principal residences, and the *Notitia* (above named) tells us that the city was *restaurata* by King Gundibald (d. 516) which is generally supposed to mean that he first surrounded it with a wall, the city then comprising little more than the hill on which the present cathedral stands. That building is of course of much later date, but it seems certain that when (*c.* 513-516) Sigismund, son of King Gundibald, built a stone church on the site, it took the place of an earlier wooden church, constructed on Roman foundations, all three layers being clearly visible at the present day. We know that St Avitus, archbishop of Vienne (d. 518), preached a sermon (preserved to us) at the dedication of a church at Geneva which had been built on the site of one burnt by the enemy, and the bits of half-burnt wood found in the second of the two layers mentioned above, seem to make it probable that the reference is to Sigismund's church. But Geneva was in no sense one of the great cities of the region, though it is mentioned in the *Antonine Itinerary* and in the *Peutinger Table* (both 4th century A.D.), no doubt owing to its important position on the bank of the Rhone, which then rose to the foot of the hill on which the original city stood. This is no doubt the reason why, apart from some passing allusions (for instance, Charles the Great held a council of war there in 773, on his first journey to Italy), we hear very little about it.

In 1032, with the rest of the kingdom of Burgundy or Arles, it reverted to the emperor Conrad II., who was crowned king at Payerne in 1033, and in 1034 was recognized as such at Geneva by a great assembly of nobles from Germany, Burgundy and Italy, this rather unwilling surrender signifying the union of those 3 kingdoms. It is said that Conrad granted the temporal sovereignty of the city to the bishop, who, in 1162, was raised to the rank of a prince of the Holy Roman Empire, being elected, from 1215, by the chapter, but, after 1418, named directly by the pope himself.

Like many other prince-bishops, the ruler of Geneva had to defend his rights: without against powerful neighbours, and within against the rising power of the citizens. These struggles constitute the entire political history of Geneva up to about 1535, when a new epoch of unrest opens with the adoption of Protestantism. The first foe without was the family of the counts of the Genevois (the region south of the city and in the neighbourhood of Annecy), who were also "protectors" (*advocati*) of the church of Geneva, and are first heard of in the 11th and 12th centuries. Their influence was probably never stronger than during the rule as bishop (1118-1119) of Guy, the brother of the reigning count. But his successor, Humbert de Grammont, resumed the grants made to the count, and in 1125 by the Accord of Seyssel, the count fully acknowledged the suzerainty of the bishop. A fresh struggle under Bishop Ardutius (1135-1185) ended in the confirmation by Frederick Barbarossa, as emperor, of the position of the bishop as subject to no one but himself (1153), this declaration being strengthened by the elevation of the bishop and his successors to the rank of princes of the empire (1162).

In 1250 the counts of Savoy first appear in connexion with Geneva, being mortgagees of the Genevois family, and, in 1263, practically their heirs as "protectors" of the city. It was thus natural that the citizens should invoke the aid of Savoy against their bishop, Robert of the Genevois (1276-1287). But Count Amadeus of Savoy not merely seized (1287) the castle built by the bishops (about 1219) on the Île, but also (1288) the office of *vicedominus* [*vidomne*], the official through whom the bishop exercised his minor judicial rights. The new bishop, William of Conflans (1287-1295) could recover neither, and in 1290 had to formally recognize the position of Savoy (which was thus legalized) in his own cathedral city. It was during this struggle that about 1287 (these privileges were finally sanctioned by the bishop in 1300) the citizens organized themselves into a commune or corporation, elected 4 syndics, and showed their independent position by causing a seal for the city to be prepared. The bishop was thus threatened on two sides by foes of whom the influence was rising, and against whom his struggles were of no avail. In 1365 the count obtained from the emperor the office of imperial vicar over Geneva, but the next bishop William of Marcossay (1366-1377: he began the construction of a new wall round the greatly extended city, a process not completed till

1428) secured the withdrawal of this usurpation (1366-1367), which the count finally renounced (1371). One of that bishop's successors, Adhémar Fabri (1385-1388) codified and confirmed all the franchises, rights and privileges of the citizens (1387), this grant being the *Magna Carta* of the city of Geneva. In 1401 Amadeus VIII. of Savoy bought the county of the Genevois, as the dynasty of its rulers had become extinct. Geneva was now surrounded on all sides by the dominions of the house of Savoy.

Amadeus did homage, in 1405, to the bishop for those of the newly acquired lands which he held from the bishop. But, after his power had been strengthened by his elevation (1417) by the emperor to the rank of a duke, and by his succession to the principality of Piedmont (1418, long held by a cadet branch of his house), Amadeus tried to purchase Geneva from its bishop, John of Pierre-Scisé or Rochetaillée (1418-1422). This offer was refused both by the bishop and by the citizens, while in 1420 the emperor Sigismund declared that he alone was the suzerain of the city, and forbade any one to attack it or harm it in any fashion. Oddly enough Amadeus did in the end get hold of the city, for, having been elected pope under the name of Felix V., he named himself to the vacant see of Geneva (1444), and kept it, after his resignation of the Papacy in 1449, till his death in 1451. For the most part of this period he resided in Geneva. From 1451 to 1522 the see was almost continuously held by a cadet of the house of Savoy, which thus treated it as a kind of appange.

Most probably Geneva would soon have become an integral part of the realms of the house of Savoy had it not been for the appearance of a new protector on the scene—the Swiss confederation. In the early 15th century the town of Fribourg made an alliance with Geneva for commercial purposes (the cloth warehouses of Fribourg at Geneva being enlarged in 1432 and 1465), as the cloth manufactured at Fribourg found a market in the fairs of Geneva (which are mentioned as early as 1262, and were at the height of their prosperity about 1450). The duke, however, was no better inclined towards the Swiss than towards Geneva. He struck a blow at both, when, in 1462-1463, he induced his son-in-law, Louis XI. of France, to forbid French merchants to attend the fairs of Geneva, altering also the days of the fairs at Lyons (established in 1420 and increased in number in 1463) so as to make them clash with those fixed for the fairs of Geneva. This nearly ruined Geneva, which, too, in 1477 had to pay a large indemnity to the Swiss army that, after the defeat of Charles the Bold, duke of Burgundy, advanced to take vengeance on the dominions of his ally, Yolande, dowager duchess of Savoy and sister of Louis XI., as well as on the bishop of Geneva, her brother-in-law. But, after this payment, the bishop made an alliance with the Swiss. A prolonged attempt was made (1517-1530) by the reigning duke of Savoy, Charles III. (1504-1553), to secure Geneva for his family, at first with the help of his bastard cousin John (1513-1522), the last of his house to hold the see. In this struggle the syndic, Philibert Berthelier, succeeded in concluding (1519) an alliance with Fribourg, which, however, had to be given up almost immediately. It split the citizens into two parties; the *Eidgenots* relying on the Swiss, while the *Mamelus* (mamelukes) supported the duke. Berthelier was executed in 1519, and Amé Lévrier in 1524, but Bezanson Hugues (d. 1532) took their place, and in 1526 succeeded in renewing the alliance with Fribourg and adding to it one with Bern. This much enraged the duke, who took active steps against the citizens, and tried (1527) to carry off the bishop, Pierre de la Baume (1522-1544), who soon found it best to make his submission.

The Genevese, thus abandoned by their natural protector, looked to the Swiss for help. They sent (October 1530) a considerable army to save the city. This armed intervention compelled the duke to sign the treaty of St Julien (19th October) by which he engaged not to trouble the Genevese any more, agreeing that if he did so the two towns of Fribourg and Bern should have the right to occupy his barony of Vaud. The two towns also, by the decision given as arbitrators at Payerne (30th December 1530), upheld their alliance with Geneva, condemned the duke to pay all the expenses of the war, and confirmed the clause as to their right to occupy Vaud; they also surrounding the exercise of the powers of *vidomne* by the duke with so many restrictions that in 1532 the duke, after much resistance, formally agreed to recognize the alliance of Geneva with the two towns and not to annoy the Genevese any more. Thus a legal tie between Geneva and two of the Swiss cantons was established, while the duke did not any longer venture to annoy the Genevese, as he clung to his fine barony of Vaud. In the course of this struggle (and especially after the last episcopal *vidomne* had left the town in 1526) the municipal authorities of the city greatly developed, a *grand conseil* of 200 members being set up in imitation of those at Bern and at Fribourg, while within the larger assembly there was a *petit conseil* of 60 members for more confidential business. Thus 1530 marks the date at which Geneva became its own mistress within, while allied externally with the Swiss confederation. But hardly had this settlement been reached when a fresh element of discord threatened to wholly upset matters—the adoption of Protestant principles by the city. Just before this event, however, the fortifications were once more (1534) rebuilt (bits still remain) and extended so as to take in several new suburbs, including that of St Gervais on the right bank of the Rhone which, till then, seems to have been unenclosed (1511-1527).

In 1532 William Farel, a Protestant preacher from Dauphiné, who had converted Vaud, &c. to the new belief, first came to Geneva and settled there in 1533. But although Bern supported the Reform, Fribourg did not, and in 1534 withdrew from its alliance with Geneva, while directly afterwards the duke of Savoy made a fresh attempt to seize the city. On the 10th of August 1535 the Protestant faith was formally adopted by Geneva, but an offer of help from France having been refused, as the city was unwilling to give up any of its sovereign rights, the duke's party continued its intrigues. Finally Bern, fearing that Geneva might fall to France instead of to itself, sent an army to protect the city (January 1536), but, not being able to persuade the citizens to give up their freedom, had to content itself with the conquest of the barony of Vaud and of the bishopric of Lausanne, thus acquiring rich territories, while becoming close neighbours of Geneva (January and March 1536). Meanwhile Farel had been advancing the cause of religious reform, which was definitively adopted on the 21st of May 1536. In July 1536 a French refugee, John Calvin (*q.v.*), came to Geneva for a night, but was detained by Farel who found in him a powerful helper. The opposition party of the *Libertins* succeeded in getting them both exiled in 1538, but, in September 1541, Calvin was recalled (Farel spending the rest of his life at Neuchâtel, where he died 1565) to Geneva. Born in 1509, he was then about 32 years of age. He set up this theocracy in Geneva, and ruled the reorganized republic with a strong hand till his death in 1564, when he was succeeded by the milder Théodore de Beza (1519-1605).

The great blot on Calvin's rule was his intolerance of other thinkers, as exemplified by his burning of Gruet (1547) and of Servetus (1553). But, on the other hand, he founded (1559) the Academy, which, originally meant as a seminary for his preachers, later greatly extended its scope, and in 1873 assumed the rank of a University. The strict rule of Calvin drove out many old Genevese families, while he caused to be received as citizens many French, Italian and English refugees, so that Geneva became not merely the "Protestant Rome" but also quite a cosmopolitan little city. The Bernese often interfered with the internal affairs of Geneva (while Calvin, a Frenchman, naturally looked towards France), and refused to allow the city to conclude any alliances save with itself. That alliance was finally renewed in 1558, while in 1560 the Romanist cantons made one with the duke of Savoy, a zealous supporter of the old faith. In 1564, after long negotiations, Bern restored to the duke part of its

conquests of 1536, viz. Gex, the Genevois and the Chablais, Geneva being thus once more placed amid the dominions of the duke; though by the same treaty (that of Lausanne, October 1564, Calvin having died the preceding May) the alliance of Bern with Geneva was maintained. In 1579 Geneva was included in the alliance concluded by France with Bern and Soleure, while in 1584 Zürich joined Bern in another alliance with Geneva. The struggle widened as Geneva became a pawn in the great attempt of the duke of Savoy to bring back his subjects to the old faith, his efforts being seconded by François de Sales, the "apostle of the Chablais." But the king of France, for political reasons, opposed Savoy, with whom, however, he made peace in 1601. In December 1602 François de Sales was consecrated bishop of Geneva (since 1535 the bishops had lived at Annecy), and a few days later the duke of Savoy made a final attempt to get hold of the city by a surprise attack in the night of 11-12th December 1602 (Old Style), known in history as the "Escalade," as ladders were used to scale the city walls. It was successfully repelled, over 200 of the foe being slain, while 17 Genevese only perished. Filled with joy at their rescue from this attack, the citizens crowded to their cathedral, where Beza (then 83 years of age) bid them to sing the 124th Psalm which has ever since been sung on the anniversary of this great delivery. The peace of St Julien (21st of July 1603) marked the final defeat of the duke of Savoy in the long struggle waged (since 1290) by his house against the city of Geneva.

In the charter of 1387 we hear only of the *conseil général* (composed of all male heads of families) which acted as the legislature, and elected annually the executive of 4 syndics; no doubt this form of rule existed earlier than 1387. Even before 1387 there was also the *petit conseil* or *conseil ordinaire* or *conseil étroit*, a body not recognized by the law, though it became very powerful; it was composed of the 4 syndics, with several other counsellors, and acted originally as the adviser of the syndics who were legally responsible for the rule of the city. In 1457 we first hear of the Council of the Fifty (re-established in 1502 and later known as the Sixty), and in 1526 of the Council of the Two Hundred (established in imitation of those of Bern and Fribourg), both being summoned in special cases of urgency. The members of both were named by the *petit conseil*, of which, in turn, the members were confirmed or not by the Two Hundred. By the Constitution of 1543 the *conseil général* had only the right of choosing the 4 syndics out of a list of 8 presented by the *petit conseil* and the Two Hundred, which therefore really elected them, subject to a formal approbation on the part of the larger body. This system was slightly modified in 1568, the constitution of that date lasting till 1794. The *conseil général* fell more and more into the background, the members of the other councils gradually obtained the privilege of being irremovable, and the system of co-optation resulted in the creation of a close monopoly of political offices in the hands of a few leading families.

During the 17th and 18th centuries, while the Romanist majority of the Swiss cantons steadily refused to accept Geneva as even a subordinate member of the Confederation, the city itself was distracted on several occasions by attempts of the citizens, as a whole, to gain some share in the aristocratic government of the town, though these attempts were only partially successful. But the last half of the 18th century marks the most brilliant period in the literary history of Geneva, whether as regards natives or resident foreigners, while in the succeeding half century the number of Genevese scientific celebrities is remarkable. In 1794 the effects of the French Revolution were shown in the more liberal constitution granted by the city government. But in 1798 the city was annexed to France and became the capital of the French department of Léman (to be carefully distinguished from the Swiss *canton* of Léman, that is Vaud, of the Helvetic Republic, also set up in 1798), while in 1802, by the Concordat, the ancient bishopric of Geneva was suppressed. On the fall of Napoleon (1813) the city recovered its independence, and finally, in 1815, was received as the junior member of the Swiss confederation, several bits of French and Savoyard territory (as pointed out above) being added to the narrow bounds of the old Genevese Republic in order to give the town some protection against its non-Swiss neighbours.

The constitution of 1814 set up a common form of government for the city and the canton, the city not obtaining its municipal independence till the constitution of 1842. From 1535 to 1798 public worship according to the Romanist form had been strictly forbidden. In 1799 already the first attempts were made to reestablish it, and in 1803 the church of St Germain was handed over to the Romanists. The constitution of 1814, looking forward to the annexation of Romanist districts to the city territory to form the new canton, guaranteed to that body the freedom of worship, at any rate in these newly gained districts. In 1819 the canton (the new portions of which were inhabited mainly by Romanists) was annexed to the bishopric of Lausanne, the bishop in 1821 being authorized to add "and of Geneva" to his episcopal style. After the adventure of the "Escalade" the fortifications were once more strengthened and extended, these works being completed about 1726. But, in 1822, some of the bastions were converted into promenades, while in 1849 the rest of the fortifications were pulled down so as to allow the city to expand and gradually assume its present aspect.

When Geneva recovered its political independence in 1814 a new constitution was drawn up, but it was very reactionary, for there is no mention in it of the sovereignty of the people. It set up a *conseil représentatif* or legislature of 250 members, which named the *conseil d'état* or executive, while it was itself elected by a limited class, for the electoral qualification was the annual payment of direct taxes to the amount of 20 Swiss livres or about 23 shillings. It was not till 1842 that this system, though much criticized, was modified. In the early part of 1841 the "Third of March Association" was formed to watch over the interests of the citizens, and in November of that year the government was forced by a popular demonstration to summon an *assemblée constituante*, which in 1842 elaborated a new constitution that was accepted by the citizens. Besides bestowing on the city a government distinct from that of the canton, it set up for the latter a *grand conseil* or legislature, and a conseil *d'état* or executive of 13 members, both elected for the term of 4 years. But this constitution did not seem liberal enough to many citizens, so that in 1846 the government gave way to the Radicals, led by James Fazy (1794-1878), who drew up a constitution that was accepted by a popular vote on the 21st of May 1847. It was much more advanced than that of 1842, and in its main features still prevails. From that date till 1864 the Radicals ruled the state, their head, Fazy, being an able man, though extravagant and inclined to absolutism. Under his sway the town was modernized and developed, but the finances were badly administered, and Fazy became more and more a radical dictator. "On voudrait faire de Genève," sighed the conservative, de la Rive, "la plus petite des grandes villes, et pour moi je préfère qu'elle reste la plus grande des petites villes." In 1861 and in 1864 Fazy failed to secure his re-election to the *conseil d'état*, riots followed his defeat, and the Federal troops were forced to intervene so as to restore order.

The Democratic party (liberal-conservative) ruled from 1865 to 1870, and did much to improve the finances of the state. In 1870 the Radicals regained the supremacy under their new chief, Antoine Carteret (1813-1889) and kept it till 1878. This was a period of religious strife, due to the irritation caused by the Vatican council, and the pope's attempt to revive the bishopric of Geneva. Gaspard Mermillod (1824-1891) was named in 1864 *curé* of Geneva, and made bishop of Hebron *in partibus*, acting as the helper of the bishop of Lausanne. Early in 1873 the pope named him "vicar apostolic of Geneva," but he was expelled a few weeks later from Switzerland, not returning till 1883, when he became bishop of Lausanne, being made cardinal in 1890. The Radical government enacted severe laws as

to the Romanists in Geneva, and gave privileges to the Christian Catholic Church, which, organized in 1874 in Switzerland, had absorbed the community founded at Geneva by Père Hyacinthe, an ex-Carmelite friar. The Romanists therefore were no longer recognized by the state, and were persecuted in divers ways, though the tide afterwards turned in their favour. The Democrats ruled from 1878 to 1880, and introduced the "Referendum" (1879) into the cantonal constitution, but, their policy of the separation of church and state having been rejected by the people at a vote, they gave way to the Radicals. The Radicals went out in 1889, and the Democrats held the reins of power till 1897, their leader being Gustave Ador. In 1891 they introduced the "Initiative" into the cantonal constitution, and in 1892 the principle of proportional representation so far as regards the *grand conseil*, while Th. Turrettini did much to increase the economical prosperity of the city. In 1897 the Radicals came in again, their leaders being first Georges Favon (1843-1902) till his death, and then Henri Fazy, a distant relative of James and an excellent historian. They attempted to rule by aid of the Socialists, but their power fluctuated as the demands of the Socialists became greater. On the 30th of June 1907 the Genevese, by a popular vote, decided on the separation of Church and State.

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GENEVA CONVENTION, an international agreement for the purpose of improving the condition of wounded soldiers of armies in the field, originally adopted at an international conference held at Geneva, Switzerland, in 1864, and afterwards replaced by the convention of July 6, 1906, also adopted at Geneva. This later agreement is the one now known as the Geneva Convention. The conference of 1864 was the result of a movement which sprang from the publication in 1862 of a book entitled *Un Souvenir de Solférino* by Henri Dunant, a Genevese philanthropist, in which he described the sufferings of the wounded at the battle of Solférino with such vivid effect that the subject became forthwith one of public interest. It was energetically taken up by M. Gustave Moynier, whose agitation led to an unofficial congress being held at Geneva in October 1863. This was followed by an official one at Geneva, called by the Swiss government in 1864. The convention which was there signed (22nd August 1864) on behalf of the states represented, afterwards received the adherence of every civilized power.

At a second conference on the same subject, held at Geneva in 1868, a supplementary convention was drawn up, consisting of fourteen additional articles, five of which related to war on land and nine to naval warfare. The additional articles were not, however, ratified by the chief states, and never became operative. The Brussels International Conference (1874) for the codification of the law and customs of war occupied itself with the Geneva Convention and again drew up a number of articles which were submitted to the interested governments. But, as in the case of the additional articles of 1868, no effect was ever given to them.

At the Peace Conference of 1899 Great Britain withdrew her objections to the application of the convention to maritime warfare, and agreed to the adoption of a special convention "adapting to Maritime warfare the principles of the Geneva Convention." A *voeu* was also adopted by the conference expressing the wish that a special conference should be held as soon as possible for the purpose of revising the convention of 1864.

In deference to the above *voeu* the Swiss government in 1901 sounded the other parties to the convention of 1864 as to whether the time had not come to call the proposed special conference, but the replies received did not give much encouragement and the matter was dropped for the time being. By a circular note of the 17th of February 1903, the Swiss government invited all the states which had signed or adhered to the Geneva Convention to send representatives to a conference to be held at Geneva in the following September. Some governments did not accept the invitation in time and the conference had to be postponed. At the beginning of 1904, there being no apparent obstacle, the Swiss government again invited the powers to send delegates to a conference in the following May. Meanwhile war broke out between Russia and Japan and there was again an adjournment. At length in March 1906 an invitation was accepted by thirty-five states, only Turkey, Salvador, Bolivia, Venezuela, Nicaragua and Colombia abstaining and the conference was held at Geneva in July 1906, when a full revised convention was adopted, which now takes the place of that of 1864.[1] The adoption of the new Geneva Convention entailed a revision of the above-mentioned Hague Convention and a new edition of the latter is one of the documents adopted at the Peace Conference of 1907.

The new Geneva Convention consists of thirty-three articles divided into the following chapters, (i.) the wounded

and sick; (ii.) medical units and establishments; (iii.) personnel; (iv.) material; (v.) convoys of evacuation; (vi.) the distinctive emblem; (vii.) application and carrying out of the Convention; (viii.) prevention of abuses and infractions; (ix.) general provisions.

The essential parts of the new Hague Convention of 1907 (18th of October) adapting the above conventions to maritime warfare as follows: (N.B. The alterations are in italics. The parts of the older convention of 1899 which have been suppressed are in brackets).

i. Military hospital-ships, that is to say, ships constructed or assigned by states specially and solely for the purpose of assisting the wounded, sick or shipwrecked, and the names of which shall have been communicated to the belligerent powers at the commencement or during the course of hostilities, and in any case before they are employed, shall be respected and cannot be captured while hostilities last.

These ships, moreover, are not on the same footing as men-of-war as regards their stay in a neutral port.

ii. Hospital-ships, equipped wholly or in part at the cost of private individuals or officially-recognized Relief Societies, shall likewise be respected and exempt from capture, provided the belligerent power to whom they belong has given them an official commission and has notified their names to the hostile power at the commencement of or during hostilities, and in any case before they are employed.

These ships should be furnished with a certificate from the competent authorities, declaring that they had been under their control while fitting out and on final departure.

iii. Hospital-ships, equipped wholly or in part at the cost of private individuals or officially-recognized Societies of neutral countries shall be respected and exempt from capture [if the neutral power to whom they belong has given them an official commission and notified their names to the belligerent powers at the commencement of or during hostilities, and in any case before they are employed] *on condition that they are placed under the orders of one of the belligerents, with the previous consent of their own Government and with the authorization of the belligerent, and on condition that the latter shall have notified their names to the enemy at the commencement or during the course of hostilities, in any event, before they are employed.*

iv. The ships mentioned in Articles i., ii. and iii. shall afford relief and assistance to the wounded, sick and shipwrecked of the belligerents independently of their nationality.

The governments engage not to use these ships for any military purpose.

These ships must not in any way hamper the movements of the combatants.

During and after an engagement they will act at their own risk and peril.

The belligerents will have the right to control and visit them; they can refuse to help them, order them off, make them take a certain course, and put a commissioner on board; they can even detain them, if important circumstances require it.

As far as possible the belligerents shall inscribe in the sailing papers of the hospital-ships the orders they give them.

v. The military hospital-ships shall be distinguished by being painted white outside with a horizontal band of green about a metre and a half in breadth.

The ships mentioned in Articles ii. and iii. shall be distinguished by being painted white outside with a horizontal band of red about a metre and a half in breadth.

The boats of the ships above mentioned, as also small craft which may be used for hospital work, shall be distinguished by similar painting.

All hospital-ships shall make themselves known by hoisting, together with their national flag, the white flag with a red cross provided by the Geneva Convention, *and, in addition, if they belong to a neutral State, by hoisting on the mainmast the national flag of the belligerent under whose direction they are placed.*

Hospital-ships which, under the terms of Article iv., are detained by the enemy, must lower the national flag of the belligerent under whom they were acting.

The above-mentioned vessels and boats, desiring at night-time to ensure the respect due to them, shall, with the consent of the belligerent whom they are accompanying, take the necessary steps that the special painting denoting them shall be sufficiently conspicuous.

vi. [Neutral merchantmen, yachts or vessels, having, or taking on board, sick, wounded or shipwrecked of the belligerents, cannot be captured for so doing, but they are liable to capture for any violation of neutrality they may have committed.]

The distinctive signs provided by Article v. can only be used, whether in time of peace or in time of war, to protect ships therein mentioned.

vii. *In the case of a fight on board a war-ship, the hospitals shall be respected and shall receive as much consideration as possible.*

These hospitals and their belongings are subject to the laws of war, but shall not be employed for any other purpose so long as they shall be necessary for the sick and wounded.

Nevertheless, the commander who has them under his orders, may make use of them in case of important military necessity, but he shall first ensure the safety of the sick and wounded on board.

viii. *The protection due to hospital-ships and to hospitals on board war-ships shall cease if they are used against the enemy.*

The fact that the crew of hospital-ships, and attached to hospitals on war-ships, are armed for the maintenance of order and for the defence of the sick or wounded, and the existence of a radio-telegraphic installation on board, is not considered as a justification for withdrawing the above-mentioned protection.

ix. *Belligerents may appeal to the charitable zeal of commanders of neutral merchant vessels, yachts or other craft, to take on board and look after the sick and wounded.*

Ships having responded to this appeal, as well as those who have spontaneously taken on board sick, wounded or shipwrecked men, shall have the advantage of a special protection and of certain immunities. In no case shall they be liable to capture on account of such transport; but subject to any promise made to them they are liable to

capture for any violation of neutrality they may have committed.

[vii.] x. The religious, medical or hospital staff of any captured ship is inviolable, and its members cannot be made prisoners of war. On leaving the ship they take with them the objects and surgical instruments which are their own private property.

This staff shall continue to discharge its duties while necessary, and can afterwards leave when the commander-in-chief considers it possible.

The belligerents must guarantee to the staff that has fallen into their hands [the enjoyment of their salaries intact] *the same allowances and pay as those of persons of the same rank in their own navy*.

[viii.] xi. Sailors and soldiers, *and other persons officially attached to navies or armies*, who are taken on board when sick or wounded, to whatever nation they belong, shall be [protected] respected and looked after by the captors.

xii. *Every vessel of war of a belligerent party may claim the return of the wounded, sick or shipwrecked who are on board military hospital-ships, hospital-ships of aid societies or of private individuals, merchant ships, yachts or other craft, whatever be the nationality of these vessels.*

xiii. *If the wounded, sick or shipwrecked are received on board a neutral ship of war, it shall be provided, as far as possible, that they may take no further part in war operations.*

xiv. The shipwrecked, wounded or sick of one of the belligerents who fall into the hands of the other, are prisoners of war. The captor must decide, according to circumstances, if it is best to keep them or send them to a port of his own country, to a neutral port, or even to a hostile port. In the last case, prisoners thus repatriated cannot serve as long as the war lasts.

xv. The shipwrecked, wounded or sick who are landed at a neutral port with the consent of the local authorities, must, failing a contrary arrangement between the neutral State and the belligerents, be guarded by the neutral State, so that they may not be again able to take part in the military operations.

The expenses of hospital treatment and internment shall be borne by the State to which the shipwrecked, wounded or sick belong.

(T. Ba.)

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1 Another International Conference held in December 1904 at the Hague dealt with the status of hospital-ships in time of war. Great Britain did not take part in this Conference. Her abstention, however, was not owing to any objection of principle, but purely to considerations of domestic legislation.

GENEVA, LAKE OF, the largest lake of which any portion belongs to Switzerland, and indeed in central Europe. It is called *Lacus Lemannus* by the old Latin and Greek writers, in 4th century A.D. *Lacus Lausonius* or *Losanetes*, in the middle ages generally *Lac de Lausanne*, but from the 16th century onwards *Lac de Genève*, though from the end of the 18th century the name *Lac Léman* was revived—according to Prof. Forel *Le Léman* is the proper form. Its area is estimated at 223 sq. m. (Swiss Topographical Bureau) or 225½ sq. m. (Forel), of which about 140 sq. m. (134½ sq. m. Forel) are politically Swiss (123½ sq. m. belonging to the canton of Vaud, 11½ sq. m. to that of Geneva, and 5 sq. m. to that of the Valais), the remainder (83 sq. m.) being French since the annexation of Savoy in 1860—the entire lake is included in the territory (Swiss or Savoyard) neutralized by the congress of Vienna in 1815. The French part takes in nearly the whole of the south shore, save its western and eastern extremities, which belong respectively to Geneva and to the Valais.

The lake is formed by the Rhone, which enters it at its east end, between Villeneuve (E.) and St Gingolph (W.), and quits it at its west end, flowing through the city of Geneva. The only important tributaries are the Drance (S.), the Venoge (N.) and the Veveyse (N.). The form of the lake is that of a crescent, of which the east end is broad and rounded, while the west end tapers towards the city of Geneva. The bird's eye length of the whole lake, from Chillon to Geneva, is 39½ m., but along its axis 45 m. The coast-line of the north shore is 59 m. in length and that of the south shore 44¾ m. The maximum depth is 1015½ ft., but the mean depth only 500 ft. The surface is 1231¼ ft. (Swiss Topog. Bureau) or 1220 ft. (Forel) above sea-level. The greatest width (between Morges and Amphion) is 8½ m., but the normal width is 5 m. The lake forms two well-marked divisions, separated by the strait of Promenthoux, which is 216½ ft. in depth, as a bar divides the Grand Lac from the Petit Lac. The *Grand Lac* includes the greater portion of the lake, the *Petit Lac* (to the west of the strait or bar) being the special Genevese portion of the lake, and having an area of but 30½ sq. m. The unusual blueness of the waters has long been remarked, and the transparency increases the farther we get from the point where the Rhone enters it, the deposits which the river brings down from the Alps gradually sinking to the bottom of the lake. At Geneva we recall Byron's phrase, "the blue rushing of the arrowy Rhone" (*Childe Harold*, canto iii. stanza 71). The limit of visibility of a white disk is 33 ft. in winter (in February 1891 Prof. Forel observed an extreme of 70½ ft.) and 21¼ ft. in summer. Apart from the seasonal changes in the level of the lake (which is highest in summer, no doubt because of the melting of the Alpine snows that feed the Rhone), there are also the remarkable temporary disturbances of level known as the *seiches*, in which the whole mass of water in the lake rhythmically swings from shore to shore. According to Prof. Forel there are both longitudinal and transverse *seiches*. The effect of the longitudinal *seiches* at Geneva is four times as great as at Chillon, at the other end of the lake, while the extreme duration of this phenomenon is 73 minutes for the uninodal longitudinal *seiches* (35½ minutes for the binodal) and 10 minutes for the transverse *seiches* (5 minutes for the binodal). The maximum height of a recorded *seiche* at Geneva is rather over 6 ft. (October 1841). The currents in the water itself are irregular. The principal winds that blow over the lake are the *bise* (from the N.E.), the *vaudaire* or *Föhn* (from the S.E.), the *sudois* or *vent de pluie* (from the S.W.) and the *joran* (from the N.W.). The storm winds are the *molan* (from the Arve valley towards Geneva) and the *bornan* (from the Drance valley towards the central portion of the lake). The lake is not as rich in fish as the other Swiss lakes, one reason being the obstacle opposed by the Perte du Rhône to fish seeking to ascend that river. Prof. Forel knows of but twenty indigenous species (of which the *Féra*, or *Coregonus fera*, is the principal) and six that have been introduced by man in the 19th century. A number of lake dwellings, of varying dates, have been found on the shores of the lake. The first steamer placed on the lake was the "Guillaume Tell," built in 1823 at Geneva by an Englishman named Church, while in 1873 the present Compagnie générale de navigation sur le lac Léman was formed, and in 1875 constructed the first saloon steamer, the "Mont Blanc." But despite this service and the railways along each shore, the red lateen sails of minor

craft still brighten the landscape. The railway along the northern shore runs from Geneva past Nyon, Rolle, Morges, Ouchy (the port of Lausanne), Vevey and Montreux to Villeneuve (56½ m.). That on the south shore gains the edge of the lake at Thonon only (22¼ m. from Geneva), and then runs past Evian and St Gingolph to Le Bouveret (20 m. from Thonon). In the harbour of Geneva two erratic boulders of granite project above the surface of the water, and are named *Pierres du Niton* (supposed to be altars to Neptune). The lower of the two, which is also the farthest from the shore, has been taken as the basis of the triangulation of Switzerland: the official height is 376.86 mètres, which in 1891 was reduced to 373.54 mètres, though 376.6 mètres is now said to be the real figure. Of course the heights given on the Swiss Government map vary with these different estimates of the point taken as basis.

For all matters relating to the lake, see Prof. F.A. Forel's monumental work, *Le Léman* (3 vols. Lausanne, 1892-1904); also (with fine illustrations) G. Fatio and F. Boissonnas, *Autour du lac Léman* (Geneva, 1902).

(W. A. B. C.)

GENEVIÈVE, or Genovefa, **ST** (*c.* 422-512), patroness of Paris, lived during the latter half of the 5th century. According to tradition, she was born about 422 at Nanterre near Paris; her parents were called Severus and Gerontia, but accounts differ widely as to their social position. According to the legend, she was only in her seventh year when she was induced by St Germain, bishop of Auxerre, to dedicate herself to the religious life. On the death of her parents she removed to Paris, where she distinguished herself by her benevolence, as well as by her austere life. She is said to have predicted the invasion of the Huns; and when Attila with his army was threatening the city, 594 she persuaded the inhabitants to remain on the island and encouraged them by an assurance, justified by subsequent events, that the attack would come to nothing (451). She is also said to have had great influence over Childeric, father of Clovis, and in 460 to have caused a church to be built over the tomb of St Denis. Her death occurred about 512 and she was buried in the church of the Holy Apostles, popularly known as the church of St Geneviève. In 1793 the body was taken from the new church, built in her honour by Louis XV., when it became the Panthéon, and burnt on the Place de Grève; but the relics were enshrined in a chapel of the neighbouring church of St Étienne du Mont, where they still attract pilgrims; her festival is celebrated with great pomp on the 3rd of January. The frescoes of the Panthéon by Puvis de Chavannes are based upon the legend of the saint.

Bibliography.—The main source is the anonymous *Vita s. Genovefae virginis Parisiorum*, published in 1687 by D.P. Charpentier. The genuineness of this life was attacked by B. Krusch (*Neues Archiv*, 1893 and 1894) and defended by L. Duchesne, *Bibliothèque de l'École des Chartes* (1893), *Bulletin critique* (1897), p. 473. Krusch continued to hold that the life was an 8th-century forgery (*Scriptores rer. Merov.* iii. 204-238). See A. Potthast, *Bibliotheca medii aevi* (1331, 1332), and G. Kurth, *Clovis*, ii. 249-254. The legends and miracles are given in the Bollandists' *Acta Sanctorum*, January 1st; there is a short sketch by Henri Lesetre, *Ste Geneviève*, in "Les Saints" series (Paris, 1900).

GENEVIÈVE, Genoveva or Genovefa, **OF BRABANT**, heroine of medieval legend. Her story is a typical example of the widespread tale of the chaste wife falsely accused and repudiated, generally on the word of a rejected suitor. Genovefa of Brabant was said to be the wife of the palatine Siegfried of Treves, and was falsely accused by the majordomo Golo. Sentenced to death she was spared by the executioner, and lived for six years with her son in a cave in the Ardennes nourished by a roe. Siegfried, who had meanwhile found out Golo's treachery, was chasing the roe when he discovered her hiding-place, and reinstated her in her former honour. Her story is said to rest on the history of Marie of Brabant, wife of Louis II., duke of Bavaria, and count-palatine of the Rhine, who was tried by her husband and beheaded on the 18th of January 1256, for supposed infidelity, a crime for which Louis afterwards had to do penance. The change in name may have been due to the cult of St Geneviève, patroness of Paris. The tale first obtained wide popularity in *L'Innocence reconnue, ou vie de Sainte Geneviève de Brabant* (pr. 1638) by the Jesuit René de Cérisier (1603-1662), and was a frequent subject for dramatic representation in Germany. With Genovefa's history may be compared the Scandinavian ballads of *Ravengaard og Memering*, which exist in many recensions. These deal with the history of Gunild, who married Henry, duke of Brunswick and Schleswig. When Duke Henry went to the wars he left his wife in charge of Ravengaard, who accused her of infidelity. Gunild is cleared by the victory of her champion Memering, the "smallest of Christian men." The Scottish ballad of Sir Aldingar is a version of the same story. The heroine Gunhilda is said to have been the daughter of Canute the Great and Emma. She married in 1036 King Henry, afterwards the emperor Henry III., and there was nothing in her domestic history to warrant the legend, which is given as authentic history by William of Malmesbury (*De gestis regum Anglorum*, lib. ii. § 188). She was called Cunigund after her marriage, and perhaps was confused with St Cunigund, the wife of the emperor Henry II. In the *Karlamagnus-saga* the innocent wife is Oliva, sister of Charlemagne and wife of King Hugo, and in the French Carolingian cycle the emperor's wife Sibille (*La Reine Sibille*) or Blanchefleur (*Macaire*). Other forms of the legend are to be found in the story of Doolin's mother in *Doon de Mayence*, the English romance of *Sir Triamour*, in the story of the mother of Octavian in *Octavian the Emperor*, in the German folk book *Historie von der geduldigen Königin Crescentia*, based on a 12th-century poem to be found in the *Kaiserchronik*; and the English *Erl of Toulouse* (*c.* 1400). In the last-named romance it has been suggested that the story gives the relations between Bernard I. count of Toulouse, son of the Guillaume d'Orange of the Carolingian romances, and the empress Judith, second wife of Louis the Pious.

See F.J. Child, *English and Scottish Popular Ballads*, vol. ii. (1886), art. "Sir Aldingar"; S. Grundtvig, *Danske Kaempeviser* (Copenhagen, 1867); "Sir Triamore," in *Bishop Percy's Folio MS.*, ed. Hales and Furnivall, vol. ii. (London, 1868); *The Romance of Octavian*, ed. E.M. Goldsmid (Aungervyle Soc., Edinburgh, 1882); *The Erl of Toulous and the Emperes of Almayn*, ed. G. Lüdtke (Berlin, 1881); B. Seuffert, *Die Legende von der Pfalzgräfin Genovefa* (Würzburg, 1877); B. Golz, *Pfalzgräfin Genovefa in der deutschen Dichtung* (Leipzig, 1897); R. Köhler, "Die deutschen Volksbücher von der Pfalzgräfin Genovefa," in *Zeitschr. für deutsche Philologie* (1874).

GENGA, GIROLAMO (*c.* 1476-1551), Italian painter and architect, was born in Urbino about 1476. At the age of ten he was apprenticed to the woollen trade, but showed so much inclination for drawing that he was sent to study under an obscure painter, and at thirteen under Luca Signorelli, with whom he remained a considerable while, frequently painting the accessories of his pictures. He was afterwards for three years with Pietro Perugino, in company with Raphael. He next worked in Florence and Siena, along with Timoteo della Vite; and in the latter city he painted various compositions for Pandolfo Petrucci, the leading local statesman. Returning to Urbino, he was employed by Duke Guidobaldo in the decorations of his palace, and showed extraordinary aptitude for theatrical adornments. Thence he went to Rome; and in the church of S. Caterina da Siena, in that capital, is one of his most distinguished works, “The Resurrection,” remarkable both for design and for colouring. He studied the Roman antiquities with zeal, and measured a number of edifices; this practice, combining with his previous mastery of perspective, qualified him to shine as an architect. Francesco Maria della Rovere, the reigning duke of Urbino, recalled Genga, and commissioned him to execute works in connexion with his marriage-festivities. This prince being soon afterwards expelled by Pope Leo X., Genga followed him to Mantua, whence he went for a time to Pesaro. The duke of Urbino was eventually restored to his dominions; he took Genga with him, and appointed him the ducal architect. As he neared the close of his career, Genga retired to a house in the vicinity of Urbino, continuing still to produce designs in pencil; one, of the “Conversion of St Paul,” was particularly admired. Here he died on the 11th of July 1551. Genga was a sculptor and musician as well as painter and architect. He was jovial, an excellent talker, and kindly to his friends. His principal pupil was Francesco Menzocchi. His own son Bartolommeo (1518-1558) became an architect of celebrity. In Genga’s paintings there is a great deal of freedom, and a certain peculiarity of character consonant with his versatile, lively and social temperament. One of his leading works is in the church of S. Agostino in Cesena—a triptych in oil-colours, representing the “Annunciation,” “God the Father in Glory,” and the “Madonna and Child.” Among his architectural labours are the church of San Giovanni Battista in Pesaro; the bishop’s palace at Sinigaglia; the façade of the cathedral of Mantua, ranking high among the productions of the 16th century; and a new palace for the duke of Urbino, built on the Monte Imperiale. He was also concerned in the fortifications of Pesaro.

GENISTA, in botany, a genus of about eighty species of shrubs belonging to the natural order Leguminosae, and natives of Europe, western Asia and North Africa. Three are native in Britain. *G. anglica* is the needle-furze or petty whin, found on heaths and moist moors, a spinous plant with slender spreading branches 1 to 2 ft. long, very small leaves and short racemes of small yellow papilionaceous flowers. The pollen is emitted in a shower when an insect alights on it. *G. tinctoria*, dyer’s green-weed, the flowers of which yield a yellow dye, has no spines. Other species are grown on rock-work or as greenhouse plants.

GENIUS (from Lat. *genere*, *gignere*), a term which originally meant, in Roman mythology, a generative and protecting spirit, who has no exact parallel in Greek religion, and at least in his earlier aspect is of purely Italian origin as one of the deities of family or household. Every man has his genius, who is not his creator, but only comes into being with him and is allotted to him at his birth. As a creative principle the genius is restricted to man, his 595
place being taken by a Juno (cp. Juno Lucina, the goddess of childbirth) in the case of women. The male and female spirit may thus be distinguished respectively as the protector of generation and of parturition (*tutela generandi, pariendi*), although the female appears less prominent. It is the genius of the *paterfamilias* that keeps the marriage bed, named after him *lectus genialis* and dedicated to him, under his special protection. The genius of a man, as his higher intellectual self, accompanies him from the cradle to the grave. In many ways he exercises a decisive influence on the man’s character and mode of life (Horace, *Epistles*, ii. 2. 187). The responsibility for happiness or unhappiness, good or bad fortune, lay with the genius; but this does not suppose the existence of two genii for man, the one good and the other bad (ἀγαθοδαίμων, κακοδαίμων), an idea borrowed from the Greek philosophers. The Roman genius, representing man’s natural optimism, always endeavoured to guide him to happiness; that man was intended to enjoy life is shown by the fact that the Roman spoke of indulging or cheating his genius of his due according as he enjoyed himself or failed to do so, when he had the opportunity. A man’s birthday was naturally a suitable occasion for honouring his genius, and on that occasion offerings of incense, wine, garlands, and cakes were made (Tibullus ii. 2; Ovid, *Tristia*, iii. 13. 18). As the representative of a man’s higher self and participating in a divine nature, the genius could be sworn by, and a person could take an oath by his own or some one else’s genius. When under Greek influence the Roman idea of the gods became more and more anthropomorphized, a genius was assigned to them, not however as a distinct personality. Thus we hear of the genius of Jupiter (Jovis Genio, *C.I.L.* i. 603), Mars, Juno, Pluto, Priapus. In a more extended sense the genius is also the generator and preserver of human society, as manifested in the family, corporate unions, the city, and the state generally. Thus, the genius publicus Populi Romani—probably distinct from the genius Urbis Romae, to whom an old shield on the Capitol was dedicated, with an inscription expressing doubt as to the sex (*Genio ... sive mas sive femina*)—stood in the forum near the temple of Concord, in the form of a bearded man, crowned with a diadem, and carrying a cornu copiae and sceptre. It frequently appears on the coins of Trajan and Hadrian. Sacrifice, not confined to bloodless offerings like those of the genius of the house, was offered to him annually on the 8th of October. There were genii of cities, colonies, and even of provinces; of artists, business people and craftsmen; of cooks, gladiators, standard-bearers, a legion, a century, and of the army generally (*genius sanctus castrorum peregrinorum totiusque exercitus*). In imperial times the genius of Augustus and of the reigning emperor, as part of the sacra of the imperial family, were publicly worshipped. It was a common practice (often compulsory) to swear by the genius of the emperor, and any one who swore falsely was flogged. Localities also, such as theatres, baths, stables, streets, and markets, had their own genius. The word thus gradually lost its original meaning; the nameless local genii became an expression for the universality of the *divinum numen* and were sometimes identified with the higher gods. The local genius was usually represented by a snake, the symbol of the fruitfulness of the earth and of perpetual youth. Hence snakes were usually kept in houses (Virgil, *Aen.* v. 95; Persius i. 113), their death in which was considered a bad omen. The personal genius usually appeared as a handsome youth in a toga, with head sometimes veiled and

sometimes bare, carrying a drinking cup and cornu copiae, frequently in the position of one offering sacrifice.

See W.H. Roscher, *Lexikon der Mythologie*, and article by J.A. Hild in Daremberg and Saglio, *Dictionnaire des antiquités*, where full references to ancient and modern authorities are given; L. Preller, *Römische Mythologie*, 3rd ed., by H. Jordan; G. Wissowa, *Religion und Kultur der Römer*.

Apart from the Latin use of the term, the plural "genii" (with a singular "genie") is used in English, as equivalent to the Arabic *jinn*, for a class of spirits, good or bad, such as are described, for instance, in *The Arabian Nights*. But "genius" itself has become the regular English word for the highest conceivable form of original ability, something altogether extraordinary and beyond even supreme educational prowess, and differing, in kind apparently, from "talent," which is usually distinguished as marked intellectual capacity short only of the inexplicable and unique endowment to which the term "genius" is confined. The attempt, however, to define either quality, or to discriminate accurately between them, has given rise to continual controversy, and there is no agreement as to the nature of either; and the commonly quoted definitions of genius—such as Carlyle's "transcendant capacity of taking trouble, first of all,"[1] in which the last three words are usually forgotten—are either admittedly incomplete or are of the nature of epigrams. Nor can it be said that any substantial light has been thrown on the matter by the modern physiological school, Lombroso and others, who regard the eccentricity of genius as its prime factor, and study it as a form of mental derangement. The error here is partly in ignoring the history of the word, and partly in misrepresenting the nature of the fact. There are many cases, no doubt, in which persons really insane, of one type or another, or with a history of physical degeneration or epilepsy, have shown remarkable originality, which may be described as genius, but there are at least just as many in whom no such physical abnormality can be observed. The word "genius" itself however has only gradually been used in English to express the degree of original greatness which is beyond ordinary powers of explanation, *i.e.* far beyond the capacity of the normal human being in creative work; and it is a convenient term (like Nietzsche's "superman") for application to those rare individuals who in the course of evolution reveal from time to time the heights to which humanity may develop, in literature, art, science, or administrative life. The English usage was originally derived, naturally enough, from the Roman ideas contained in the term (with the analogy of the Greek δαίμων), and in the 16th and 17th centuries we find it equivalent simply to "distinctive character or spirit," a meaning still commonly given to the word. The more modern sense is not even mentioned in Johnson's *Dictionary*, and represents an 18th-century development, primarily due to the influence of German writers; the meaning of "distinctive natural capacity or endowment" had gradually been applied specially to creative minds such as those of poets and artists, by contrast with those whose mental ability was due to the results of education and study, and the antithesis has extended since, through constant discussions over the attempt to differentiate between the real nature of genius and that of "talent," until we now speak of the exceptional person not merely as having genius but as "a genius." This phraseology appears to indicate some reversion to the original Roman usage, and the identification of the great man with a generative spirit.

Modern theories on the nature of "genius" should be studied with considerable detachment, but there is much that is interesting and thought-provoking in such works as J.F. Nisbet's *Insanity of Genius* (1891), Sir Francis Galton's *Hereditary Genius* (new ed., 1892), and C. Lombroso's *Man of Genius* (Eng. trans., 1891).

1 *Frederick the Great*, iv. iii. 1407.

GENUS, STÉPHANIE-FÉLICITÉ DU CREST DE SAINT-AUBIN, Comtesse de (1746-1830), French writer and educator, was born of a noble but impoverished Burgundian family, at Champcéry, near Autun, on the 25th of January 1746. When six years of age she was received as a canoness into the noble chapter of Alix, near Lyons, with the title of Madame la Comtesse de Lancy, taken from the town of Bourbon-Lancy. Her entire education, however, was conducted at home. In 1758, in Paris, her skill as a harpist and her vivacious wit speedily attracted admiration. In her sixteenth year she was married to Charles Brûlart de Genlis, a colonel of grenadiers, who afterwards became marquis de Sillery, but this was not allowed to interfere with her determination to remedy her incomplete education, and to satisfy a taste for acquiring and imparting knowledge. Some years later, through the influence of her aunt, Madame de Montesson, who had been clandestinely married to the duke of Orleans, she entered the Palais Royal as lady-in-waiting to the duchess of Chartres (1770). She acted with great energy and zeal as governess to the daughters of the family, and was in 1781 appointed by the duke of Chartres to the responsible office of *gouverneur* of his sons, a bold step which led to the resignation of all the tutors as well as to much social scandal, though there is no reason to suppose that the intellectual interests of her pupils suffered on that account. The better to carry out her ingenious theories of education, she wrote several works for their use, the best known of which are the *Théâtre d'éducation* (4 vols., 1779-1780), a collection of short comedies for young people, *Les Annales de la vertu* (2 vols., 1781) and *Adèle et Théodore* (3 vols., 1782). Sainte-Beuve tells how she anticipated many modern methods of teaching. History was taught with the help of magic lantern slides and her pupils learnt botany from a practical botanist during their walks. In 1789 Madame de Genlis showed herself favourable to the Revolution, but the fall of the Girondins in 1793 compelled her to take refuge in Switzerland along with her pupil Mademoiselle d'Orléans. In this year her husband, the marquis de Sillery, from whom she had been separated since 1782, was guillotined. An "adopted" daughter, Pamela,[1] had been married to Lord Edward Fitzgerald (*q.v.*) in the preceding December.

In 1794 Madame de Genlis fixed her residence at Berlin, but, having been expelled by the orders of King Frederick William, she afterwards settled in Hamburg, where she supported herself for some years by writing and painting. After the revolution of 18th Brumaire (1799) she was permitted to return to France, and was received with favour by Napoleon, who gave her apartments at the arsenal, and afterwards assigned her a pension of 6000 francs. During this period she wrote largely, and produced, in addition to some historical novels, her best romance, *Mademoiselle de Clermont* (1802). Madame de Genlis had lost her influence over her old pupil Louis Philippe, who visited her but seldom, although he allowed her a small pension. Her government pension was discontinued by Louis XVIII., and she supported herself largely by her pen. Her later years were occupied largely with literary quarrels, notably with that which arose out of the publication of the *Dîners du Baron d'Holbach* (1822), a volume in which she set forth with a good deal of sarcastic cleverness the intolerance, the fanaticism, and the eccentricities of the "philosophes" of the 18th century. She survived until the 31st of December 1830, and saw her former pupil, Louis Philippe, seated on the throne of France.

The numerous works of Madame de Genlis (which considerably exceed eighty), comprising prose and poetical compositions on a vast variety of subjects and of various degrees of merit, owed much of their success to adventitious causes which have long ceased to operate. They are useful, however (especially the voluminous *Mémoires inédits sur le XVIII^e siècle*, 10 vols., 1825), as furnishing material for history. Most of her writings were translated into English almost as soon as they were published. A list of her writings with useful notes is given by Quérard in *La France littéraire*. Startling light was thrown on her relations with the duc de Chartres by the publication (1904) of her correspondence with him in *L'Idylle d'un "gouverneur"* by G. Maugras. See also Sainte-Beuve, *Causeries du lundi*, vol. iii.; H. Austin Dobson, *Four Frenchwomen* (1890); L. Chabaud, *Les Précurseurs du féminisme* (1901); W. de Chabreul, *Gouverneur de princes, 1737-1830* (1900); and *Lettres inédites à ... Casimir Baecker, 1802-1830* (1902), edited by Henry Lapauze.

1 See Gerald Campbell, *Edward and Pamela Fitzgerald* (1905).

GENNA, a word of obscure origin borrowed from the Assamese, and used technically by anthropologists to describe a class of social and religious ordinances based on sanctions which derive their validity from a vague sense of mysterious danger which results from disobedience to them. These prohibitions—or system of things forbidden—affect the relations, permanent and temporary, of individuals (either as members of a tribe, village, clan or household, or as occupying an official position in the village or clan) towards other persons or groups of persons and towards material objects which possess intrinsic sanctity. The term is extended to the communal rites performed by the village, clan or household, either as magical ceremonies or as prophylactics on special occasions when the social, commensal, conjugal and alimentary relations of the group affected are subjected to temporary modifications. These practices and beliefs are observed among the hill tribes of Assam from the Abors and Mishmis on the north to the Lusheis on the south, all linguistically members of the Tibeto-Burman group, and among the Khasis, members of the Mon-Khmer group. Genna and taboo (*q.v.*) are products of an identical level of culture and similar psychological processes, and provide the mechanism of the social and religious systems.

Permanent Gennas.—The only universal *genna* is that which forbids the intermarriage of members of the same clan. In some cases in Manipur animals are *genna* to the tribe—*i.e.* they must not be killed or eaten—but tribal differentiation is, in practice, based on dialectical distinctions rather than on tribal *gennas*. The village as such possesses no permanent *gennas*, but the clans, as the units of marriage under the law of exogamy, have distinct elementary *gennas*, especially the clan to which the priest-chief belongs. The most important individual *gennas* are those which protect the priest-chief from impurity or contact with "sacred" substances such as the flesh of animals used in sacrifices. He may neither eat in a strange house, nor utter words of abuse, nor take an oath in a dispute, except in his representative capacity on behalf of his village. The first-fruits are *genna* to the village until he eats, thus establishing an opposition between him and his co-villagers. Married and unmarried women are subject to alimentary *gennas*; thus unmarried girls are forbidden the flesh of any male animal or of any female animal dying gravid.

Ritual Gennas.—Ritual *gennas* are held annually to foster the rice crops, all other industries and activities being *genna* (forbidden) during the cultivating season, to secure good hunting, to avert sickness, especially epidemics, to take omens, and to lay finally to rest the ghosts of all that have died within the year. The village gates are closed, men and women eat apart, and conjugal relations are suspended. Special village *gennas* are held when rain is needed, when a villager dies in any manner out of the ordinary, as women in childbirth, when an animal gives birth to still-born offspring, and when any permanent genna has been violated. Clan *gennas* are held for all ordinary cases of death. Household *gennas* are held on the occasions of birth (when the aliment and conduct of the father are specially regulated), naming, ear-piercing, the first hair-cutting, sickness, and, in certain areas, tattooing. Individuals are subjected to temporary *gennas* as warriors both before and after a head-hunting raid, pregnant women, married persons at the beginning of their married life, the wives of the priest-chief, and those who from ambition or pride of wealth seek to perpetuate their names by erecting a stone monument, an act which confers the right to wear the distinctive clothes of the priest-chief which otherwise are *genna* to the whole village. Ritual *gennas* are of varying duration. Some last for a month while others are complete in two days. As religious or magical rites, they prevent danger or establish and restore normal relations with powers which are potentially harmful or require placation.

Authorities.—Official records of the government of India, Nos. 23 (1855), 27 (1859), 68 (1870); Colonel T.H. Lewin, *Hill Tracts of Chittagong; Report on the Census of Assam* (1891), vol. i. Report, note by A.W. Davis, p. 237 seq.; Major P.R.T. Gurdon, *The Khasis* (1907); T.C. Hodson, *Journal of the Royal Anthropological Institute*, vol. xxxvi. (1906).

(T. C. H.)

GENNADIUS II. [as layman Georgios Scholarios] (d. *c.* 1468), patriarch of Constantinople from 1454 to 1456, philosopher and theologian, was one of the last representatives of Byzantine learning. Extremely little is known of his life, but he appears to have been born at Constantinople about 1400 and to have entered the service of the emperor John VII. Paleologus as imperial judge or counsellor. Georgios first appears conspicuously in history as present at the great council held in 1438 at Ferrara and Florence with the object of bringing about a union between the Greek and Latin Churches. At the same council was present the celebrated Platonist, Gemistus Pletho, the most powerful opponent of the then dominant Aristotelianism, and consequently the special object of reprobation to Georgios. In church matters, as in philosophy, the two were opposed,—Pletho maintaining strongly the principles of the Greek Church, and being unwilling to accept union through compromise, while Georgios, more politic and cautious, pressed the necessity for union and was instrumental in drawing up a form which from its vagueness and ambiguity might be accepted by both parties. He was at a disadvantage because, being a layman, he could not directly take part in the discussions of the council. But on his return to Greece his views changed, and he violently and obstinately opposed the union he had previously urged. In 1448 he became a monk at Pantokrator and took the

name Gennadius. In 1453, after the capture of Constantinople by the Turks, Mahommed II., finding that the patriarchal chair had been vacant for some time, resolved to elect some one to the office, and the choice fell on Gennadius. While holding the episcopal office Gennadius drew up, apparently for the use of Mahommed, a lucid confession or exposition of the Christian faith, which was translated into Turkish by Ahmed, judge of Beroea, and first printed by A. Brassicanus at Vienna in 1530. After a couple of years Gennadius found the position of patriarch under a Turkish sultan so irksome that he retired to the monastery of John the Baptist near Serrae in Macedonia, where he died about 1468. About one hundred of his alleged writings exist, the majority in manuscript and of doubtful authenticity.

The fullest account of his writings is given in Gass, *Gennadius and Pletho* (Berlin, 1844), the second part of which contains Pletho's *Contra Gennadium*. See also F. Schultze, *Gesch. der Phil. d. Renaissance*, i. (1874). A list of the known writings of Gennadius is given in Fabricius, *Bibliotheca Graeca*, ed. Harles, vol. xi., and what has been printed is to be found in Migne, *Patrol. Gr.* vol. clx.

GENOA (anc. *Genua*, Ital. *Genova*, Fr. *Gênes*), the chief port of Liguria, Italy, and capital of the province of Genoa, 119 m. N.W. of Leghorn by rail. Pop. (1906) 255,294 (town); 267,248 (commune). The town is situated on the Gulf of Genoa, and is the chief port and commercial town of Italy, the seat of an archbishop and a university, the headquarters of the IV. Italian army corps, and a strong fortress. The city, as seen from the sea, is "built nobly," and deserves the title it has acquired or assumed of the Superb. Finding only a small space of level ground along the shore, it has been obliged to climb the lower hills of the Ligurian Alps, which afford many a coign of vantage for the effective display of its architectural magnificence. The original nucleus of the city is that portion which lies to the east of the port in the neighbourhood of the old pier (Molo Vecchio). In the 10th century it began to feel a lack of room within the limits of its fortifications; and accordingly, in the middle of the 12th century, it was found necessary to extend the line of circumvallation. Even this second circuit, however, was of small compass, and it was not till 1320-1330 that a third line took in the greater part of the modern site of the city proper. This presented about 3 m. of rampart towards the land side, and can still be easily traced from point to point through the city, though large portions, especially towards the east, have been dismantled. The present line of circumvallation dates from 1626-1632, the period when the independence of Genoa was threatened by the dukes of Savoy. From the mouth of the Bisagno in the east, and from the lighthouse point in the west, it stretches inland over hill and dale to the great fort of Sperone, *i.e.* the Spur, on the summits of Monte Peraldo at a height of 1650 ft.,—the circuit being little less than 12 m., and all the important points along the line being defended by forts or batteries.

A portion of the enclosed area is open country, dotted only here and there with houses and gardens. There are eight gates, the more important being Porta Pila and Porta Romana towards the east, and the Porta Lanterna or Lighthouse Gate to the west. The main architectural features of Genoa are its medieval churches, with striped façades of black and white marble, and its magnificent 16th-century palaces. The earlier churches of Genoa show a mixture of French Romanesque and the Pisan style—they are mostly basilicas with transepts, and as a rule a small dome; the pillars are sometimes ancient columns, and sometimes formed of alternate layers of black and white marble. The façades are simple, without galleries, having only pilasters projecting from the wall, and are also alternately black and white. This style continued in Gothic times also. The oldest is S. Maria di Castello (11th century), the columns and capitals of which are almost all antique. S. Cosma, S. Donato (with remains of the 10th-century building) and others belong to the 12th century, and S. Giovanni di Prè, S. Agostino (with a fine campanile), S. Stefano, S. Matteo and others to the 13th. The famous painting of the martyrdom of S. Stephen, by Giulio Romano, carried off by Napoleon in 1811, was restored to S. Stefano in 1815. S. Matteo, the church of the D'Oria or Doria family, was founded in 1126 by Martino Doria. The façade dates from 1278, and the interior of the edifice dates in the main from 1543. In the crypt is the tomb of Andrea Doria by Montorsoli, and above the main altar hangs the dagger presented to the doge by Pope Paul III. To the left of the church is an exquisite cloister of 1308 with double columns, in which a number of inscriptions relating to the Doria family and also the statue of Andrea Doria by Montorsoli are preserved. The little square in front of the church is surrounded by Gothic palaces of the Doria family. Of the churches the principal is the comparatively small cathedral of S. Lorenzo. Tradition makes its first foundation contemporary with St Lawrence himself; and a document of 987 implies that it was even then the metropolitan church. Reconstructed about the end of the 11th and beginning of the 12th century, it was formally consecrated by Pope Gelasius II. on the 18th of October 1118; and since then it has undergone a large number of extensive though partial renovations. The façade, with its three elaborate doorways, belongs to the 14th century and is a copy of French models of the 13th. The two side portals with Romanesque sculptures belong to the 12th-14th centuries. Some pagan reliefs are built into the tower. The interior was rebuilt in 1307, the old columns being used. The belfry, which rises above the right-hand doorway, was erected about 1520 by the doge, Ottaviano da Campofragoso, and the cupola was erected after the designs of the architect Galeazzo Alessi in 1567. The fine Early Renaissance (1448) sculptural decorations of the chapel of S. John the Baptist were due to Domenico Gagini of Bissone on the Lake of Lugano, who later transferred his activities to Naples and Palermo, and other Lombard masters. An edict of Innocent VIII. forbids women to enter the chapel except on one day in the year. In the treasury of the cathedral is a magnificent silver monstrance dating from 1553, and an octagonal bowl, the Sacro Catino, brought from Caesarea in 1101, which corresponds to the descriptions given of the Holy Grail, and was long regarded as an emerald of matchless value, but was found when broken at Paris, whither it had been carried by Napoleon I., to be only a remarkable piece of ancient glass. The choir-stalls are a very fine work of the 15th century and later, with intarsias. Near the cathedral is a small 12th-century (?) cloister.

Of older date than the cathedral is the church of S. Ambrose and S. Andrew, if its first foundation be correctly assigned to the Milanese bishop Honoratus of the 6th century; but the present edifice is due to the Society of Jesus, who obtained possession of the church in 1587. The interior is richly decorated and contains the "Circumcision" and "St Ignatius" by Rubens, and the "Assumption" of Guido Reni. The Annunziata del Guastato is one of the largest churches in the city, erected in 1587. It is a cruciform structure, with a dome, and the central nave is supported by fourteen Corinthian columns of white marble. To the otherwise unfinished brick façade a portal borne by marble columns was added in 1843. The interior is covered with gilding and frescoes of the 17th century, and is somewhat overloaded with rich decoration, while a range of white marble columns supports the nave. Santa Maria delle Vigne probably dates from the 9th century, but the present structure was erected in 1586. The campanile, however, is a remarkable work of the 13th century. Adjoining the church is a ruined cloister of the 11th century. San Siro,

originally the “Church of the Apostles” and the cathedral of Genoa, was rebuilt by the Benedictines in the 11th century, and restored and enlarged by the Theatines in 1576, the façade being added in 1830; in this church in 1339 Simone Boccanera was elected first doge of Genoa. Santa Maria di Carignano, or more correctly Santa Maria Assunta e SS. Fabiano e Sebastiano, belongs mainly to the 16th century, and was designed by Galeazzo Alessi, in imitation of Bramante’s plan for S. Peter’s at Rome, as it was then being executed by Michelangelo. The interior is fine, harmonious and restrained, painted in white and grey, while the colouring of the exterior is less pleasing. From the highest gallery of the dome—368 ft. above the sea-level, and 194 ft. above the ground—a magnificent view is obtained of the city and the neighbouring coast.

Buildings of the 15th century do not occupy an important place in Genoa, but there are some small private houses and remains of sculptural decoration of the Early Renaissance to be seen in the older portions of the town. The palaces of the Genoese patricians, famous for their sumptuous architecture, their general effectiveness (though the architectural details are often faulty if closely examined), and their artistic collections, were many of them built in the latter part of the 16th century by Galeazzo Alessi, a pupil of Michelangelo, whose style is of an imposing and uniform character and displays marvellous ingenuity in using a limited or unfavourable site to the greatest advantage. Several of the villas in the vicinity of the city are also his work. The Via Garibaldi is flanked by a succession of magnificent palaces, chief among which is the Palazzo Rosso, so called from its red colour. Formerly the palace of the Brignole-Sale family, it was presented by the duchess of Galliera to the city in 1874, along with its valuable contents, its library and picture gallery, which includes fine examples of Van Dyck and Paris Bordone. The Palazzo Municipale, built by Rocco Lurago at the end of the 16th century, once the property of the dukes of Turin, has a beautiful entrance court and a hanging terraced garden fronting a noble staircase of marble which leads to the spacious council chamber. In an adjoining room are preserved a bronze tablet dating from 117 B.C. (see below), two autograph letters of Columbus, and the violin of Paganini, also a native of Genoa. Opposite the Palazzo Rosso is the Palazzo Bianco, a palace full of art treasures bequeathed to the city by the duchess of Galliera upon her death in 1889, and subsequently converted into a museum. The Roman antiquities here preserved belong to other places—Luna, Libarna, &c. The Adorno, Giorgio Doria (both containing small but choice picture-galleries), Parodi and Serra and other palaces in this street are worthy of mention. The Via Balbi again contains a number of palaces. The Durazzo Pallavicini palace has a noble façade and staircase and a rich picture-gallery. The street takes its name, however, from the Palazzo Balbi-Senarega, which has Doric colonnades and a fine orangery. The Palazzo dell’ Università has an extremely fine court and staircase of the early 17th century. The Palazzo Reale is also handsome but somewhat later. The Palazzo Doria in the Piazza del Principe, presented to Andrea Doria by the Genoese in 1522, is on the other hand earlier; it was remodelled in 1529 by Montorsoli and decorated with fine frescoes by Perino del Vaga. The old palace of the doges, originally a building of the 13th century, to which the tower alone belongs, the rest of the building having been remodelled in the 16th century and modernized after a fire in 1777, stands in the Piazza Umberto Primo near the cathedral, and now contains the telegraph and other government offices. Another very fine building is the Gothic Palazzo di S. Giorgio, near the harbour, dating from about 1260, occupied from 1408 to 1797 by the Banca di S. Giorgio, and now converted into a produce exchange. The Campo Santo or Cimitero di Staglieno, about 1½ m. from the city on the banks of the Bisagno, is one of the chief features of Genoa; its situation is of great natural beauty and it is remarkable for its sepulchral monuments, many of which have been executed by the foremost sculptors of modern Italy. The university, founded in 1471, is a flourishing institution with faculties in law, medicine, natural science, engineering and philosophy. Attached to it are a library, an observatory, a botanical garden, and a physical and natural history museum. Genoa is also well supplied with technical schools and other institutions for higher education, while ample provision is made for primary education. The hospitals and the asylum for the poor are among the finest institutions of their kind in Italy. Mention must also be made of the Academy of Fine Arts, the municipal library, the great Teatro Carlo Felice and the Verdi Institute of Music.

The irregular relief of its site and its long confinement within the limits of fortifications, which it had outgrown, have both contributed to render Genoa a picturesque confusion of narrow streets, lanes and alleys, varied with stairways climbing the steeper slopes and bridges spanning the deeper valleys. Large portions of the town are inaccessible to ordinary carriages, and many of the important streets have very little room for traffic. In modern times, however, a number of fine streets and squares with beautiful gardens have been laid out. The Piazza Ferrari, a large irregular space, is the chief focus of traffic and the centre of the Genoese tramway system; it is embellished with a fine equestrian statue of Garibaldi, unveiled in 1893, which stands in front of the Teatro Carlo Felice. Leading from this piazza is the Via Venti Settembre, a broad, handsome street laid out since 1887, leading south-east to the Ponte Pila, the central bridge over the Bisagno. The street is itself spanned by an elegant bridge carrying the Corso Andrea Podesta, a modern avenue on the heights above. Adjoining the church of the Madonna della Consolazione is the new market, a building of no little beauty. The Via Roma, another important centre of traffic which gives on to the Via Carlo Felice near the Piazza Ferrari, leads to the Piazza Corvetto, in the centre of which stands the colossal equestrian statue of Victor Emmanuel II. To the left is the Villetta Dinegro, a beautiful park belonging to the city, decorated with cascades and a number of statues and busts of prominent statesmen and citizens. To the right is another park, the Acquasola, laid out in 1837 on the site of the old ramparts. In the west of the city, in front of the principal station, is the Piazza Acquaverde. On the north side, embowered in palm trees, is a great statue of Columbus, at whose feet kneels the figure of America. Opposite is the Palazzo Faraggiana, with scenes from the life of Columbus in relief on its marble pediment. Among other modern thoroughfares, the Via di Circonvallazione a Monte, laid out since 1876 on the hills at the back of the town, leads by many curves from the Piazza Manin along the hill-tops westward, and finally descends into the Piazza Acquaverde; its entire length is traversed by an electric tramway, and it commands magnificent views of the town. A similar road, the Via di Circonvallazione a Mare, was laid out in 1893-1895 on the site of the outer ramparts, and skirts the sea-front from the Piazza Cavour to the mouth of the Bisagno, thence ascending the right bank to the Ponte Pila. Genoa is remarkably well served with electric tramways, which are found in all the wider streets, and run, often through tunnels, into the suburbs and to the surrounding country on the east as far as Nervi and to Pegli oh the west. Three funicular railways from different points of the city give access to the highest parts of the hills behind the town.

Though its existence as a maritime power was originally due to its port, it is only since 1870 that Genoa has provided the conveniences necessary for the modern development of its trade, the duke of Galliera’s gift of £800,000 to the city in 1875 being devoted to this purpose. A further enlargement of the harbour was necessitated upon the opening of the St Gotthard tunnel in 1882, which extended the commercial range of the port through Switzerland into Germany. The old harbour is semi-circular in shape, 232 acres in area, with numerous quays, and protected by moles from southern and south-westerly winds. An outer harbour, 247 acres in area, has been constructed in front of this by extending the Molo Nuovo by the Molo Duca di Galliera, and another basin, the Vittorio Emanuele III., for coal vessels, with an area of 96 acres, is in course of construction to the west of this,

between it and the lofty lighthouse which rises on the promontory at the south-west extremity of the harbour. This basin is to be entered from both the east and the west, and allows for a future extension in front of San Pier d'Arena as far as the mouth of the river Polcevera. The port administration was placed under an autonomous harbour board (*consorzio*) in 1903. The largest ships can enter the harbour, which has a minimum depth of 30 ft.; it has two dry docks, a graving dock and a floating dry dock. Very large warehouses have been constructed. The exports are olive oil, hemp, flax, rice, fruit, wine, hats, cheese, steel, velvets, gloves, flour, paper, soap and marble, while the main imports are coal, cotton, grain, machinery, &c. Genoa has a large emigrant traffic with America, and a large general passenger steamer traffic both for America and for the East.

The development of industry has kept pace with that of the harbour. The Ansaldo shipbuilding yards construct armoured cruisers both for the Italian navy and for foreign governments, The Odero yards, for the construction of merchant and passenger steamers, have been similarly extended, and the Foce yard is also important. A number of foundries and metallurgical works supply material for repairs and shipbuilding. The sugar-refining industry has been introduced by two important companies, and most of the capital employed in sugar-refining in other parts of Italy has been subscribed at Genoa, where the administrative offices of the principal companies and individual refiners are situated. The old industries of macaroni and cognate products maintain their superiority. Tanneries and cotton-spinning and weaving mills have considerably extended throughout the province. Cement works have acquired an extension previously unknown, more than thirty firms being now engaged in that branch of industry. The manufactures of crystallized fruits and of filigree silver-work may also be mentioned. The trade of the port increased from well under 1,000,000 tons in 1876 to 6,164,873 metric tons in 1906 (the latter figure, however, includes home trade in a proportion of about 12%). Of this large total 5,365,544 tons are imports and only 799,319 tons are exports, and, comparing 1906 with 1905, we have a decrease of 34,355 tons on the exports, and an increase of 436,123 tons on the imports. The effect upon the railway problem is of course very great, inasmuch as, while the supply of trucks required per day in 1906 was from 1000 to 1200, about 80% of these had to be sent down empty to the harbour. Of the four main lines which centre on Genoa—(1) to Novi, which is the junction for Alessandria, where lines diverge to Turin and France via the Mont Cenis, and to Novara and Switzerland and France via the Simplon, and for Milan; (2) to Acqui and Piedmont; (3) to Savona, Ventimiglia and the French Riviera, along the coast; (4) to Spezia and Pisa—the first line has to take no less than 78% of the traffic. It has indeed two alternative double lines for the passage over the Apennines, but one of them has a maximum gradient of 1 : 18 and a tunnel over 2 m. long, and the other has a maximum gradient of 1 : 62, and a tunnel over 5 m. long. A marshalling station costing some £800,000, connected directly with the harbour by tunnels, with 31 m. of rails, capable of taking 2000 trucks, was constructed at Campasso in 1906 north of San Pier d'Arena (through which till then the traffic of the first three lines, representing 95% of the total, had to pass). It is computed that some 40% of the total commerce of Italy passes through Genoa; it is indeed the most important harbour in the western Mediterranean, with the exception of Marseilles, with which it carries on a keen rivalry. Genoa has in the past been somewhat handicapped in the race by the insufficiency of railway communication, which, owing to the mountains which encircle it, is difficult to secure, many tunnels being necessary. The general condition of the Italian railways has also affected it, and the increased traffic has not always found the necessary facilities in the way of a proper amount of trucks to receive the goods discharged, leading to considerable encumbrance of the port and consequent diversion of a certain amount of trade elsewhere, and besides this to serious temporary deficiencies in the coal supply of northern Italy.

The imports of Genoa are divided into four main classes: about 50% of the total weight is coal, grain about 12%, cotton about 6%, and miscellaneous about 34%. Of the coal imports the great bulk is from British ports: about half comes from Cardiff and Barry, one-tenth from other Welsh ports, one-fifth from the Tyne ports. The amount shows an almost continued increase from 617,798 tons in 1881 to 2,737,919 in 1906. The total of shipping entered in 1906 was 6586 vessels with a tonnage of 6,867,442, while that cleared was 6611 vessels with a tonnage of 6,682,104.

History.—Genoa, being a natural harbour of the first rank, must have been in use as a seaport as early as navigation began in the Tyrrhenian Sea. We hear nothing from ancient authorities of its having been visited or occupied by the Greeks, but the discovery of a Greek cemetery of the 4th century B.C.[1] proves it. The construction of the Via Venti Settembre gave occasion for the discovery of a number of tombs, 85 in all, the bulk of which dated from the end of the 5th and the 4th centuries B.C. The bodies had in all cases been cremated, and were buried in small shaft graves, the interment itself being covered by a slab of limestone. The vases were of the last red figure style, and were mostly imported from Greece or Magna Graecia, while the bronze objects came from Etruria, and the brooches (*fibulae*) from Gaul. This illustrates the early importance of Genoa as a trading port, and the penetration of Greek customs, inhumation being the usual practice of the Ligurians. Genoa is believed to derive its name from the fact that the shape of this portion of the coast resembles that of a knee (*genu*).

We hear of the Romans touching here in 216 B.C., and of its destruction by the Carthaginians in 209 B.C. and immediate restoration by the Romans, who made it and Placentia their headquarters against the Ligurians. It was reached from Rome by the Via Aurelia, which ran along the north-west coast, and its prolongation, which later acquired the name of the Via Aemilia (Scauri); for the latter was only constructed in 109 B.C., and there must have been a coast-road long before, at least as early as 148 B.C., when the Via Postumia was built from Genua through Libarna (mod. Serravalle, where remains of an amphitheatre and inscriptions have been found), Dertona, Iria, Placentia, Cremona, and thence eastwards. We also have an inscription of 117 B.C. (now preserved in the Palazzo Municipale at Genoa) giving the text of the decision given by the *patroni*, Q. and M. Minucius, of Genua, in accordance with a decree of the Roman senate, in a controversy between the people of Genua and the Langenses or Langates (also known as the Viturii), the inhabitants of a neighbouring hill-town, which was included in the territory of Genua. But none of the other inscriptions found in Genoa or existing there at the present day, which are practically all sepulchral, can be demonstrated to have belonged to the ancient city; it is equally easy to suppose that they were brought from elsewhere by sea (Mommsen in *Corp. Inscr. Lat.* v. p. 884). It is only from inscriptions of other places that we know that it had municipal rights, and we do not know at what period it obtained them. Classical authors tell us but little of it. Strabo (iv. 6. 2, p. 202) states that it exported wood, skins and honey, and imported olive oil and wine, though Pliny speaks of the wine of the district as the best of Liguria (*H.N.* xiv. 67.)

The history of Genoa during the dark ages, throughout the Lombard and Carolingian periods, is but the repetition of the general history of the Italian communes, which succeeded in snatching from contending princes and barons the first charters of their freedom. The patriotic spirit and naval prowess of the Genoese, developed in their defensive wars against the Saracens, led to the foundation of a popular constitution, and to the rapid growth of a powerful marine. From the necessity of leaguing together against the common Saracen foe, Genoa united with Pisa early in the 11th century in expelling the Moslems from the island of Sardinia, but the Sardinian territory thus acquired soon furnished occasions of jealousy to the conquering allies, and there commenced between the two republics the long naval wars destined to terminate so fatally for Pisa. With not less adroitness than Venice, Genoa saw and secured all the advantages of the great carrying trade which the crusades created between Western

Europe and the East. The seaports wrested at the same period from the Saracens along the Spanish and Barbary coasts became important Genoese colonies, whilst in the Levant, on the shores of the Black Sea, and along the banks of the Euphrates were erected Genoese fortresses of great strength. No wonder if these conquests generated in the minds of the Venetians and the Pisans fresh jealousy against Genoa, and provoked fresh wars; but the struggle between Genoa and Pisa was brought to a disastrous conclusion for the latter state by the battle of Meloria in 1284.

The commercial and naval successes of the Genoese during the middle ages were the more remarkable because, unlike their rivals, the Venetians, they were the unceasing prey to intestine discord—the Genoese commons and nobles fighting against each other, rival factions amongst the nobles themselves striving to grasp the supreme power in the state, nobles and commons alike invoking the arbitration and rule of some foreign captain as the sole means of obtaining a temporary truce. From these contests of rival nobles, in which the names of Spinola and Doria stand forth with greatest prominence, Genoa was soon drawn into the great vortex of the Guelph and Ghibelline factions; but its recognition of foreign authority—successively German, Neapolitan and Milanese—gave way to a state of greater independence in 1339, when the government assumed a more permanent form with the appointment of the first doge, an office held at Genoa for life, in the person of Simone Boccanera. Alternate victories and defeats of the Venetians and Genoese—the most terrible being the defeat sustained by the Venetians at Chioggia in 1380—ended by establishing the great relative inferiority of the Genoese rulers, who fell under the power now of France, now of the Visconti of Milan. The Banca di S. Giorgio, with its large possessions, mainly in Corsica, formed during this period the most stable element in the state, until in 1528 the national spirit appeared to regain its ancient vigour when Andrea Doria succeeded in throwing off the French domination and restoring the old form of government. It was at this very period—the close of the 15th and commencement of the 16th century—that the genius and daring of a Genoese mariner, Christopher Columbus, gave to Spain that new world, which might have become the possession of his native state, had Genoa been able to supply him with the ships and seamen which he so earnestly entreated her to furnish. The government as restored by Andrea Doria, with certain modifications tending to impart to it a more conservative character, remained unchanged until the outbreak of the French Revolution and the creation of the Ligurian republic. During this long period of nearly three centuries, in which the most dramatic incident is the conspiracy of Fieschi, the Genoese found no small compensation for their lost traffic in the East in the vast profits which they made as the bankers of the Spanish crown and outfitters of the Spanish armies and fleets both in the old world and the new, and Genoa, more fortunate than many of the other cities of Italy, was comparatively immune from foreign domination. 600

At the end of the 17th century the city was bombarded by the French, and in 1746, after the defeat of Piacenza, surrendered to the Austrians, who were, however, soon driven out. A revolt in Corsica, which began in 1729, was suppressed with the help of the French, who in 1768 took possession of the island for themselves (see Corsica: *History*).

The short-lived Ligurian republic was soon swallowed up in the French empire, not, however, until Genoa had been made to experience, by the terrible privations of the siege when Masséna held the city against the Austrians (1800), all that was meant by a participation in the vicissitudes of the French Revolution. In 1814 Genoa rose against the French, on the assurance given by Lord William Bentinck that the allies would restore to the republic its independence. It had, however, been determined by a secret clause of the treaty of Paris that Genoa should be incorporated with the dominions of the king of Sardinia. The discontent created at the time by the provision of the treaty of Paris as confirmed by the congress of Vienna had doubtless no slight share in keeping alive in Genoa the republican spirit which, through the influence of a young Genoese citizen, Joseph Mazzini, assumed forms of permanent menace not only to the Sardinian monarchy but to all the established governments of the peninsula. Even the material benefits accruing from the union with Sardinia and the constitutional liberty accorded to all his subjects by King Charles Albert were unable to prevent the republican outbreak of 1848, when, after a short and sharp struggle, the city, momentarily seized by the republican party, was recovered by General Alfonzo La Marmora.

Among the earlier Genoese historians the most important are Bartolommeo Fazio and Jacopo Bracelli, both of the 15th century, and Paolo Partenopeo, Jacopo Bonfadio, Oberto Foglietta and Agostino Giustiniano of the 16th. Paganetti wrote the ecclesiastical history of the city; and Accinelli and Gaggero collected material for the ecclesiastical archaeology. The memoirs of local writers and artists were treated by Soprani and Ratti. Among more general works are Bréquigny, *Histoire des révolutions de Gênes jusqu'en 1748*; Serra, *La Storia dell' antica Liguria e di Genova* (Turin, 1834); Varesi, *Storia della repubblica di Genova sino al 1814* (Genoa, 1835-1839); Canale, *Storia dei Genovesi* (Genoa, 1844-1854), *Nuova istoria della repubblica di Genova* (Florence, 1858), and *Storia della rep. di Genova dall' anno 1528 al 1550* (Genoa, 1874); Blumenthal, *Zur Verfassungs- und Verwaltungsgeschichte Genua's im 12ten Jahrhundert* (Kalbe an der Saale, 1872); Malleson, *Studies from Genoese History* (London, 1875). The *Liber jurium reipublicae Genuensis* was edited by Ricotti in the 7th, 8th and 9th volumes of the *Monumenta historiae patriae* (Turin, 1854-1857). A great variety of interesting matter will be found in the *Atti della Società Ligure di storia patria* (1861 sqq.), and in the *Giornale Ligustico di archeologia, storia, e belle arti*. The history of the university has been written by Lorenzo Isnardi, and continued by Em. Celesia (2 vols., Genoa).

(T. As.)

1 See *Notizie degli scavi* (1898), 395 (A. d'Andrade), 464 (G. Ghirardini).

GENOVESI, ANTONIO (1712-1769), Italian writer on philosophy and political economy, was born at Castiglione, near Salerno, on the 1st of November 1712. He was educated for the church, and, after some hesitation, took orders in 1736 at Salerno, where he was appointed professor of eloquence at the theological seminary. During this period of his life he began the study of philosophy, being especially attracted by Locke. Dissatisfied with ecclesiastical life, Genovesi resigned his post, and qualified as an advocate at Rome. Finding law as distasteful as theology, he devoted himself entirely to philosophy, of which he was appointed extraordinary professor in the university of Naples. His first works were *Elementa Metaphysicae* (1743 et seq.) and *Logica* (1745). The former is divided into four parts, Ontosophy, Cosmosophy, Theosophy, Psychosophy, supplemented by a treatise on ethics and a dissertation on first causes. The *Logic*, an eminently practical work, written from the point of view of Locke, is in five parts, dealing with (1) the nature of the human mind, its faculties and operations; (2) ideas and their kinds;

(3) the true and the false, and the various degrees of knowledge; (4) reasoning and argumentation; (5) method and the ordering of our thoughts. If Genovesi does not take a high rank in philosophy, he deserves the credit of having introduced the new order of ideas into Italy, at the same time preserving a just mean between the two extremes of sensualism and idealism. Although bitterly opposed by the partisans of scholastic routine, Genovesi found influential patrons, amongst them Bartolomeo Intieri, a Florentine, who in 1754 founded the first Italian or European chair of political economy (commerce and mechanics), on condition that Genovesi should be the first professor, and that it should never be held by an ecclesiastic. The fruit of Genovesi's professorial labours was the *Lezioni di Commercio*, the first complete and systematic work in Italian on economics. On the whole he belongs to the "Mercantile" school, though he does not regard money as the only form of wealth. Specially noteworthy in the *Lezioni* are the sections on human wants as the foundation of economical theory, on labour as the source of wealth, on personal services as economic factors, and on the united working of the great industrial functions. He advocated freedom of the corn trade, reduction of the number of religious communities, and deprecated regulation of the interest on loans. In the spirit of his age he denounced the relics of medieval institutions, such as entails and tenures in mortmain. Gioja's more important treatise owes much to Genovesi's lectures. Genovesi died on the 22nd of September 1769.

See C. Ugoni, *Della letteratura italiana nella seconda metà del secolo XVIII* (1820-1822); A. Fabroni, *Vitae Italorum doctrina excellentium* (1778-1799); R. Bobba, *Commemorazione di A. Genovesi* (Benevento, 1867).

GENSONNÉ, ARMAND (1758-1793), French politician, the son of a military surgeon, was born at Bordeaux on the 10th of August 1758. He studied law, and at the outbreak of the Revolution was an advocate of the parlement of Bordeaux. In 1790 he became *procureur* of the Commune, and in July 1791 was elected by the newly created department of the Gironde a member of the court of appeal. In the same year he was elected deputy for the department to the Legislative Assembly. As reporter of the diplomatic committee, in which he supported the policy of Brissot, he proposed two of the most revolutionary measures passed by the Assembly: the decree of accusation against the king's brothers (January 1, 1792), and the declaration of war against the king of Bohemia and Hungary (April 20, 1792). He was vigorous in his denunciations of the intrigues of the court and of the "Austrian committee"; but the violence of the extreme democrats, culminating in the events of the 10th of August, alarmed him; and when he was returned to the National Convention, he attacked the Commune of Paris (October 24 and 25). At the trial of Louis XVI. he supported an appeal to the people, but voted for the death sentence. As a member of the Committee of General Defence, and as president of the Convention (March 7-21, 1793), he shared in the bitter attacks of the Girondists on the Mountain; and on the fatal day of the 2nd of June his name was among the first of those inscribed on the prosecution list. He was tried by the Revolutionary Tribunal on the 24th of October 1793, condemned to death and guillotined on the 31st of the month, displaying on the scaffold a stoic fortitude. Gensonné was accounted one of the most brilliant of the little band of brilliant orators from the Gironde, though his eloquence was somewhat cold and he always read his speeches.

GENTIAN, botanically *Gentiana*, a large genus of herbaceous plants belonging to the natural order Gentianaceae. The genus comprises about 300 species,—most of them perennial plants with tufted growth, growing in hilly or mountainous districts, chiefly in the northern hemisphere, some of the blue-flowered species ascending to a height of 16,000 ft. in the Himalaya Mountains. The leaves are opposite, entire and smooth, and often strongly ribbed. The flowers have a persistent 4- to 5-lobed calyx and a 4- to 5-lobed tubular corolla; the stamens are equal in number to the lobes of the corolla. The ovary is one-celled, with two stigmas, either separate and rolled back or contiguous and funnel-shaped. The fruit when ripe separates into two valves, and contains numerous small seeds. The majority of the genus are remarkable for the deep or brilliant blue colour of their blossoms, comparatively few having yellow, white, or more rarely red flowers; the last are almost exclusively found in the Andes.

Only a few species occur in Britain. *G. amarella* (felwort) and *G. campestris* are small annual species growing on chalky or calcareous hills, and bear in autumn somewhat tubular pale purple flowers; the latter is most easily distinguished by having two of the lobes of the calyx larger than the other two, while the former has the parts of the calyx in fives, and equal in size. Some intermediate forms between these two species occur, although rarely, in England; one of these, *G. germanica*, has larger flowers of a bluer tint, spreading branches, and a stouter stem. Some of these forms flower in spring. *G. pneumonanthe*, the Calathian violet, is a rather rare perennial species, growing in moist heathy places from Cumberland to Dorsetshire. Its average height is from 6 to 9 in. It has linear leaves, and a bright blue corolla 1½ in. long, marked externally with five greenish bands, is without hairs in its throat, and is found in perfection about the end of August. It is the handsomest of the British species; two varieties of it are known in cultivation, one with spotted and the other with white flowers. *G. verna* and *G. nivalis* are small species with brilliant blue flowers and small leaves. The former is a rare and local perennial, occurring, however, in Teesdale and the county of Clare in Ireland in tolerable abundance. It has a tufted habit of growth, and each stem bears only one flower. It is sometimes cultivated as an edging for flower borders. *G. nivalis* in Britain occurs only on a few of the loftiest Scottish mountains. It differs from the last in being an annual, and having a more isolated habit of growth, and in the stem bearing several flowers. On the Swiss mountains these beautiful little plants are very abundant; and the splendid blue colour of masses of gentian in flower is a sight which, when once seen, can never be forgotten. For ornamental purposes several species are cultivated. The great difficulty of growing them successfully renders them, however, less common than would otherwise be the case; although very hardy when once established, they are very impatient of removal, and rarely flower well until the third year after planting. Of the ornamental species found in British gardens some of the prettiest are *G. acaulis*, *G. verna*, *G. pyrenaica*, *G. bavarica*, *G. septemfida* and *G. gelida*. Perhaps the handsomest and most easily grown is the first named, often called *Gentianella*, which produces its large intensely blue flowers early in the spring.

All the species of the genus are remarkable for possessing an intense but pure bitter taste and tonic properties. About forty species are used in medicine in different parts of the world. The name of felwort given to *G. amarella*,

but occasionally applied to the whole genus, is stated by Dr Prior to be given in allusion to these properties—*fel* meaning gall, and *wort* a plant. In the same way the Chinese call *G. asclepiadea*, and the Japanese *G. Buergeri*, "dragon's gall plants," in common with several other very bitter plants whose roots they use in medicine. *G. campestris* is sometimes used in Sweden and other northern countries as a substitute for hops.

By far the most important of the species used in medicine is *G. lutea*, a large handsome plant 3 or 4 ft. high, growing in open grassy places on the Alps, Apennines and Pyrenees, as well as on some of the mountainous ranges of France and Germany, extending as far east as Bosnia and the Danubian principalities. It has large oval strongly-ribbed leaves and dense whorls of conspicuous yellow flowers. Its use in medicine is of very ancient date. Pliny and Dioscorides mention that the plant was noticed by Gentius, a king of the Illyrians, living 180-167 B.C., from whom the name *Gentiana* is supposed to be derived. During the middle ages it was much employed in the cure of disease, and as an ingredient in counter-poisons. In 1552 Hieronymus Bock (Tragus) (1498-1554), a German priest, physician and botanist, mentions the use of the root as a means of dilating wounds.

The root, which is the part used in medicine, is tough and flexible, scarcely branched, and of a brownish colour and spongy texture. It has a pure bitter taste and faint distinctive odour. The bitter principle, known as *gentianin*, is a glucoside, soluble in water and alcohol. It can be decomposed into glucose and gentiopicrin by the action of dilute mineral acids. It is not precipitated by tannin or subacetate of lead. A solution of caustic potash or soda forms with gentianin a yellow solution, and the tincture of the root to which either of these alkalis has been added loses its bitterness in a few days. Gentian root also contains *gentianic acid* ($C_{14}H_{10}O_5$), which is inert and tasteless. It forms pale yellow silky crystals, very slightly soluble in water or ether, but soluble in hot strong alcohol and in aqueous alkaline solutions. This substance is also called *gentianin*, *gentisin* and *gentisic acid*.

The root also contains 12 to 15% of an uncrystallizable sugar called gentianose, of which fact advantage has long been taken in Switzerland and Bavaria for the production of a bitter cordial spirit called *Enzianbranntwein*. The use of this spirit, especially in Switzerland, has sometimes been followed by poisonous symptoms, which have been doubtfully attributed to inherent narcotic properties possessed by some species of gentian, the roots of which may have been indiscriminately collected with it; but it is quite possible that it may be due to the contamination of the root with that of *Veratrum album*, a poisonous plant growing at the same altitude, and having leaves extremely similar in appearance and size to those of *G. lutea*.

Gentian is one of the most efficient of the class of substances which act upon the stomach so as to invigorate digestion and thereby increase the general nutrition, without exerting any direct influence upon any other portion of the body than the alimentary canal. Having a pleasant taste and being non-astringent (owing to the absence of tannic acid), it is the most widely used of all bitter tonics. The British Pharmacopoeia contains an aqueous extract (dose, 2-8 grains), a compound infusion with orange and lemon peel (dose, ½-1 ounce), and a compound tincture with orange peel and cardamoms (dose ½-1 drachm). It is used in dyspepsia, chlorosis, anaemia and various other diseases, in which the tone of the stomach and alimentary canal is deficient, and is sometimes added to purgative medicines to increase and improve their action. In veterinary medicine it is also used as a tonic, and enters into a well-known compound called *diapente* as a chief ingredient.

GENTIANACEAE (the gentian family), in botany, an order of Dicotyledons belonging to the sub-class Sympetalae or Gamopetalae, and containing about 750 species in 64 genera. It has a world-wide distribution, and representatives adapted to very various conditions, including, for instance, alpine plants, like the true gentians (*Gentiana*), meadow plants such as the British *Chlora perfoliata* (yellow-wort) or *Erythraea Centaurium* (centaury), marsh plants such as *Menyanthes trifoliata* (bog-bean), floating water plants such as *Limnanthemum*, or steppe and sea-coast plants such as *Cicendia*. They are annual or perennial herbs, rarely becoming shrubby, and generally growing erect, with a characteristic forked manner of branching; the Asiatic genus *Crawfurdia* has a climbing stem; they are often low-growing and caespitose, as in the alpine gentians.

The leaves are in decussating pairs (that is, each pair is in a plane at right angles to the previous or succeeding pair), except in *Menyanthes* and a few allied aquatic or marsh genera, where they are alternate or radical. Several genera, chiefly American, are saprophytes, forming slender low-growing herbs, containing little or no chlorophyll and with leaves reduced to scales; such are *Voyria* and *Leiphaimos*, mainly tropical American. The inflorescence is generally cymose, often dichasial, recalling that of Caryophyllaceae, the lateral branches often becoming monochasial; it is sometimes reduced to a few flowers or one only, as in some gentians. The flowers are hermaphrodite, and regular with parts in 4's and 5's, with reduction to 2 in the pistil; in *Chlora* there are 6 to 8 members in each whorl. The calyx generally forms a tube with teeth or segments which usually overlap in the bud. The corolla shows great variety in form; thus among the British genera it is rotate in *Chlora*, funnel-shaped in *Erythraea*, and cylindrical, bell-shaped, funnel-shaped or salver-shaped in *Gentiana*; the segments are generally twisted to the right in the bud; the throat is often fimbriate or bears scales. The stamens, as many as, and alternating with, the corolla-segments, are inserted at very different heights on the corolla-tube; the filaments are slender, the anthers are usually attached dorsally, are versatile, and dehisce by two longitudinal slits; after escape of the pollen they sometimes become spirally twisted as in *Erythraea*. Dimorphic flowers are frequent, as in the bog-bean (*Menyanthes*). There is considerable variation in the size, shape and external markings of the pollen grains, and a division of the order into tribes and subtribes based primarily on pollen characters has been proposed. The form of the honey-secreting developments of the disk at the base of the ovary also shows

considerable variety. The superior ovary is generally one-chambered, with two variously developed parietal placentas, which occasionally meet, forming two chambers; the ovules are generally very numerous and anatropous or half-anatropous in form. The style, which varies much in length, is simple, with an undivided or bilobed or bipartite stigma. The fruit is generally a membranous or leathery capsule, splitting septicidally into two valves; the seeds are small and numerous, and contain a small embryo in a copious endosperm.

The brilliant colour of the flowers, often occurring in large numbers (as in the alpine gentians), the presence of honey-glands and the frequency of dimorphy and dichogamy, are adaptations for pollination by insect visitors. In the true gentians (*Gentiana*) the flowers of different species are adapted for widely differing types of insect visitors. Thus *Gentiana lutea*, with a rotate yellow corolla and freely exposed honey, is adapted to short-tongued insect visitors; *G. Pneumonanthe*, with a long-tubed, bright blue corolla, is visited by bumble bees; and *G. verna*, with a still longer narrower tube, is visited by Lepidoptera.

Gentiana, the largest genus, contains nearly three hundred species, distributed over Europe (including arctic), five being British, the mountains of Asia, south-east Australia and New Zealand, the whole of North America and along the Andes to Cape Horn; it does not occur in Africa. Bitter principles are general in the vegetative parts, especially in the rhizomes and roots, and have given a medicinal value to many species, *e.g. Gentiana lutea* and others.

Central figure and figs. 1-4 after Curtis, *Flora Londinensis*.

Gentiana Amarella.

1, A small form, natural size.
2, Calyx and protruding style.
3, Corolla, laid open.
4, Capsule, bursting into two valves, and showing the seeds attached to their margins.
5, Floral diagram.

GENTILE, in the English Bible, the term generally applied to those who were not of the Jewish race. It is an adaptation of the Lat. *gentilis*, of or belonging to the same *gens*, the clan or family; as defined in Paulus ex Festo "gentilis dicitur et ex eodem genere ortus et is qui simili nomine; ut ait Cincius, gentiles mihi sunt, qui meo nomine appellantur." In post-Augustan Latin *gentilis* became wider in meaning, following the usage of *gens*, in the sense of race, nation, and meant "national," belonging to the same race. Later still the word came to mean "foreign," *i.e.* other than Roman, and was so used in the Vulgate, with *gentes*, to translate the Hebrew *goyyim*, nations, LXX. ἔθνη, the non-Israelitish peoples (see further Jews).

GENTILE DA FABRIANO (*c.* 1370-*c.* 1450), Italian painter, was born at Fabriano about 1370. He is said to have been a pupil of Allegretto di Nuzio, and has been supposed to have received most of his early instruction from Fra Angelico, to whose manner his bears in some respects a close similarity. About 1411 he went to Venice, where by order of the doge and senate he was engaged to adorn the great hall of the ducal palace with frescoes from the life of Barbarossa. He executed this work so entirely to the satisfaction of his employers that they granted him a pension for life, and accorded him the privilege of wearing the habit of a Venetian noble. About 1422 he went to Florence, where in 1423 he painted an "Adoration of the Magi" for the church of Santa Trinita, which is preserved in the Florence Accademia; this painting is considered his best work now extant. To the same period belongs a "Madonna and Child," which is now in the Berlin Museum. He had by this time attained a wide reputation, and was engaged to paint pictures for various churches, more particularly Siena, Perugia, Gubbio and Fabriano. About 1426 he was called to Rome by Martin V. to adorn the church of St John Lateran with frescoes from the life of John the Baptist. He also executed a portrait of the pope attended by ten cardinals, and in the church of St Francesco Romano a painting of the "Virgin and Child attended by St Benedict and St Joseph," which was much esteemed by Michelangelo, but is no longer in existence. Gentile da Fabriano died about 1450. Michelangelo said of him that his works resembled his name, meaning noble or refined. They are full of a quiet and serene joyousness, and he has a naïve and innocent delight in splendour and in gold ornaments, with which, however, his pictures are not overloaded.

GENTILESCHI, **ARTEMISIA** and **ORAZIO DE'**, Italian painters.

Orazio (*c.* 1565-1646) is generally named Orazio Lomi de' Gentileschi; it appears that De' Gentileschi was his correct surname, Lomi being the surname which his mother had borne during her first marriage. He was born at Pisa, and studied under his half-brother Aurelio Lomi, whom in course of time he surpassed. He afterwards went to Rome, and was associated with the landscape-painter Agostino Tasi, executing the figures for the landscape backgrounds of this artist in the Palazzo Rospigliosi, and it is said in the great hall of the Quirinal Palace, although by some authorities the figures in the last-named building are ascribed to Lanfranco. His best works are "Saints Cecilia and Valerian," in the Palazzo Borghese, Rome; "David after the death of Goliath," in the Palazzo Doria, Genoa; and some works in the royal palace, Turin, noticeable for vivid and uncommon colouring. At an advanced age Gentileschi went to England at the invitation of Charles I., and he was employed in the palace at Greenwich. Vandyck included him in his portraits of a hundred illustrious men. His works generally are strong in shadow and positive in colour. He died in England in 1646.

Artemisia (1590-1642), Orazio's daughter, studied first under Guido, acquired much renown for portrait-painting, and considerably excelled her father's fame. She was a beautiful and elegant woman; her likeness, limned by her own hand, is to be seen in Hampton Court. Her most celebrated composition is "Judith and Holofernes," in the Uffizi Gallery; certainly a work of singular energy, and giving ample proof of executive faculty, but repulsive and unwomanly in its physical horror. She accompanied her father to England, but did not remain there long; the best picture which she produced for Charles I. was "David with the head of Goliath." Artemisia refused an offer of marriage from Agostino Tasi, and bestowed her hand on Pier Antonio Schiattesi, continuing, however, to use her own surname. She settled in Naples, whither she returned after her English sojourn; she lived there in no little splendour, and there she died in 1642. She had a daughter and perhaps other children.

GENTILI, ALBERICO (1552-1608), Italian jurist, who has great claims to be considered the founder of the science of international law, second son of Matteo Gentili, a physician of noble family and scientific eminence, was born on the 14th of January 1552 at Sanginesio, a small town of the march of Ancona which looks down from the slopes of the Apennines upon the distant Adriatic. After taking the degree of doctor of civil law at the university of Perugia, and holding a judicial office at Ascoli, he returned to his native city, and was entrusted with the task of recasting its statutes, but, sharing the Protestant opinions of his father, shared also, together with a brother, Scipio, afterwards a famous professor at Altdorf, his flight to Carniola, where in 1579 Matteo was appointed physician to the duchy. The Inquisition condemned the fugitives as contumacious, and they soon received orders to quit the dominions of Austria.

Alberico set out for England, travelling by way of Tübingen and Heidelberg, and everywhere meeting with the reception to which his already high reputation entitled him. He arrived at Oxford in the autumn of 1580, with a commendatory letter from the earl of Leicester, at that time chancellor of the university, and was shortly afterwards qualified to teach by being admitted to the same degree which he had taken at Perugia. His lectures on Roman law soon became famous, and the dialogues, disputations and commentaries, which he published henceforth in rapid succession, established his position as an accomplished civilian, of the older and severer type, and secured his appointment in 1587 to the regius professorship of civil law. It was, however, rather by an application of the old learning to the new questions suggested by the modern relations of states that his labours have produced their most lasting result. In 1584 he was consulted by government as to the proper course to be pursued with Mendoza, the Spanish ambassador, who had been detected in plotting against Elizabeth. He chose the topic to which his attention had thus been directed as a subject for a disputation when Leicester and Sir Philip Sidney visited the schools at Oxford in the same year; and this was six months later expanded into a book, the *De legationibus libri tres*. In 1588 Alberico selected the law of war as the subject of the law disputations at the annual "Act" which took place in July; and in the autumn published in London the *De Jure Belli commentatio prima*. A second and a third *Commentatio* followed, and the whole matter, with large additions and improvements, appeared at Hanau, in 1598, as the *De Jure Belli libri tres*. It was doubtless in consequence of the reputation gained by these works that Gentili became henceforth more and more engaged in forensic practice, and resided chiefly in London, leaving his Oxford work to be partly discharged by a deputy. In 1600 he was admitted to be a member of Gray's Inn, and in 1605 was appointed standing counsel to the king of Spain. He died on the 19th of June 1608, and was buried, by the side of Dr Matteo Gentili, who had followed his son to England, in the churchyard of St Helen's, Bishopsgate. By his wife, Hester de Peigni, he left two sons, Robert and Matthew, and a daughter, Anna, who married Sir John Colt. His notes of the cases in which he was engaged for the Spaniards were posthumously published in 1613 at Hanau, as *Hispanicae advocationis libri duo*. This was in accordance with his last wishes; but his direction that the remainder of his MSS. should be burnt was not complied with, since fifteen volumes of them found their way, at the beginning of the 19th century, from Amsterdam to the Bodleian library.

The true history of Gentili and of his principal writings has only been ascertained in recent years, in consequence of a revived appreciation of the services which he rendered to international law. The movement to do him honour originated in 1875 in England, as the result of the inaugural lecture of Prof. T.E. Holland, and was warmly taken up in Italy. In spreading through Europe it encountered two curious cross-currents of opinion,—one the ultra-Catholic, which three centuries before had ordered his name to be erased from all public documents and placed his works in the *Index*; another the narrowly-Dutch, which is, it seems, needlessly careful of the supremacy of Grotius. These two currents resulted respectively in a bust of Garcia Moreno being placed in the Vatican, and in the unveiling in 1886, with much international oratory, of a fine statue of Grotius at Delft. The English committee, under the honorary presidency of Prince Leopold, in 1877 erected a monument to the memory of Gentili in St Helen's church, and saw to the publication of a new edition of the *De Jure Belli*. The Italian committee, of which Prince (afterwards King) Humbert was honorary president, was less successful. It was only in 1908, the tercentenary of the death of Alberico, that the statue of the great heretic was at length unveiled in his native city by the minister of public instruction, in the presence of numerous deputations from Italian cities and universities. Preceding writers had dealt with various international questions, but they dealt with them singly, and with a servile submission to the decisions of the church. It was left to Gentili to grasp as a whole the relations of states one to another, to distinguish international questions from questions with which they are more or less intimately connected, and to attempt their solution by principles entirely independent of the authority of Rome. He uses the reasonings of the

civil and even the canon law, but he proclaims as his real guide the *Jus Naturae*, the highest common sense of mankind, by which historical precedents are to be criticized and, if necessary, set aside.

His faults are not few. His style is prolix, obscure, and to the modern reader pedantic enough; but a comparison of his greatest work with what had been written upon the same subject by, for instance, Belli, or Soto, or even Ayala, will show that he greatly improved upon his predecessors, not only by the fulness with which he has worked out points of detail, but also by clearly separating the law of war from martial law, and by placing the subject once for all upon a non-theological basis. If, on the other hand, the same work be compared with the *De Jure Belli et Pacis* of Grotius, it is at once evident that the later writer is indebted to the earlier, not only for a large portion of his illustrative erudition, but also for all that is commendable in the method and arrangement of the treatise.

The following is probably a complete list of the writings of Gentili, with the places and dates of their first publication: *De juris interpretibus dialogi sex* (London, 1582); *Lectionum et epist. quae ad jus civile pertinent libri tres* (London, 1583-1584); *De legationibus libri tres* (London, 1585); *Legal. comitiorum Oxon. actio* (London, 1585-1586); *De divers. temp. appellationibus* (Hanau, 1586); *De nascendi tempore disputatio* (Witteb., 1586); *Disputationum decas prima* (London, 1587); *Conditionum liber singularis* (London, 1587); *De jure belli comm. prima* (London, 1588); *secunda, ib.* (1588-1589); *tertia* (1589); *De injustitia bellica Romanorum* (Oxon, 1590); *Ad tit. de Malef, et Math, de Prof. et Med.* (Hanau, 1593); *De jure belli libri tres* (Hanau, 1598); *De armis Romanis, &c.* (Hanau, 1599); *De actoribus et de abusu mendacii* (Hanau, 1599); *De ludis scenicis epist. duae* (Middleburg, 1600); *Ad I. Maccabaeorum et de linguarum mistura disp.* (Frankfurt, 1600); *Lectiones Virgilianae* (Hanau, 1600); *De nuptiis libri septem* (1601); *In tit. si quis principi, et ad leg. Jul. maiest.* (Hanau, 1604); *De latin, vet. Bibl.* (Hanau, 1604); *De libro Pyano* (Oxon, 1604); *Laudes Acad. Perus. et Oxon.* (Hanau, 1605); *De unione Angliae et Scotiae* (London, 1605); *Disputationes tres, de libris jur. can., de libris jur. civ., de latinitate vet. vers.* (Hanau, 1605); *Regales disput. tres, de pot. regis absoluta, de unione regnorum, de vi civium* (London, 1605); *Hispanicae advocationis libri duo* (Hanau, 1613); *In tit. de verb. signif.* (Hanau, 1614); *De legatis in test.* (Amsterdam, 1661). An edition of the *Opera omnia*, commenced at Naples in 1770, was cut short by the death of the publisher, Gravier, after the second volume. Of his numerous unpublished writings, Gentili complained that four volumes were lost "pessimo pontificiorum facinore," meaning probably that they were left behind in his flight to Carniola.

AUTHORITIES.—Several tracts by the Abate Benigni in Colucci, *Antichità Picene* (1790); a dissertation by W. Reiger annexed to the *Program of the Groningen Gymnasium* for 1867; an inaugural lecture delivered in 1874 by T.E. Holland, translated into Italian, with additions by the author, by A. Saffi (1884); the preface to a new edition of the *De jure belli* (1877) and *Studies in International Law* (1898) (which see, for details as to the family and MSS. of Gentili), by the same; works by Valdarnini and Foglietti (1875), Speranza and De Giorgi (1876), Fiorini (a translation of the *De jure belli*, with essay, 1877), A. Saffi (1878), L. Marson (1885), M. Thamm (1896), B. Brugi (1898), T.A. Walker (an analysis of the principal works of Gentili) in his *History of the Law of Nations*, vol. i.(1899); H. Nézarel, in Pillet's *Fondateurs de droit international* (1904); E. Agabiti (1908). See also E. Comba, in the *Rivista Christiana* (1876-1877); Sir T. Twiss, in the *Law Review* (1878); articles in the *Revue de droit international* (1875-1878, 1883, 1886, 1908); O. Scalvanti, in the *Annali dell' Univ. di Perugia*, N.S., vol. viii. (1898).

(T. E. H.)

GENTLE (through the Fr. *gentil*, from Lat. *gentilis*, belonging to the same *gens*, or family), properly an epithet of one born of a "good family"; the Latin *generosus*, "well born" (see GENTLEMAN), contrasted with "noble" on the one side and "simple" on the other. The word followed the wider application of the word "gentleman"; implying the manners, character and breeding proper to one to whom that name could be applied, courteous, polite; hence, with no reference to its original meaning, free from violence or roughness, mild, soft, kind or tender. With a physical meaning of soft to the touch, the word is used substantively of the maggot of the bluebottle fly, used as a bait by fishermen. At the end of the 16th century the French *gentil* was again adapted into English in the form "gentile," later changed to "genteel." The word was common in the 17th and 18th centuries as applied to behaviour, manner of living, dress, &c., suitable or proper to persons living in a position in society above the ordinary, hence polite, elegant. From the early part of the 19th century it has also been used in an ironical sense, and applied chiefly to those who pay an excessive and absurd importance to the outward marks of respectability as evidence of being in a higher rank in society than that to which they properly belong.

GENTLEMAN (from Lat. *gentilis*, "belonging to a race or *gens*," and "man"; Fr. *gentilhomme*, Span, *gentil hombre*, Ital. *gentil huomo*), in its original and strict signification, a term denoting a man of good family, the Lat. *generosus* (its invariable translation in English-Latin documents). In this sense it is the equivalent of the Fr. *gentilhomme*, "nobleman," which latter term has in Great Britain been long confined to the peerage (see NOBILITY); and the term "gentry" ("gentrice" from O. Fr. *genterise* for *gentelise*) has much of the significance of the Fr. *noblesse* or the Ger. *Adel*. This was what was meant by the rebels under John Ball in the 14th century when they repeated:

"When Adam delved and Eve span,
Who was then the gentleman?"

Selden (*Titles of Honor*, 1672), discussing the title "gentleman," speaks of "our English use of it" as "convertible with *nobilis*," and describes in connexion with it the forms of ennobling in various European countries. William Harrison, writing a century earlier, says "gentlemen be those whom their race and blood, or at the least their virtues, do make noble and known." But for the complete gentleman the possession of a coat of arms was in his time considered necessary; and Harrison gives the following account of how gentlemen were made in Shakespeare's day:

"... gentlemen whose ancestors are not known to come in with William duke of Normandy (for of the Saxon races yet remaining we now make none accompt, much less of the British issue) do take their beginning in England after

this manner in our times. Who soever studieth the laws of the realm, who so abideth in the university, giving his mind to his book, or professeth physic and the liberal sciences, or beside his service in the room of a captain in the wars, or good counsel given at home, whereby his commonwealth is benefited, can live without manual labour, and thereto is able and will bear the port, charge and countenance of a gentleman, he shall for money have a coat and arms bestowed upon him by heralds (who in the charter of the same do of custom pretend antiquity and service, and many gay things) and thereunto being made so good cheap be called master, which is the title that men give to esquires and gentlemen, and reputed for a gentleman ever after. Which is so much the less to be disallowed of, for that the prince doth lose nothing by it, the gentleman being so much subject to taxes and public payments as is the yeoman or husbandman, which he likewise doth bear the gladlier for the saving of his reputation. Being called also to the wars (for with the government of the commonwealth he medleth little) what soever it cost him, he will both array and arm himself accordingly, and show the more manly courage, and all the tokens of the person which he representeth. No man hath hurt by it but himself, who peradventure will go in wider buskins than his legs will bear, or as our proverb saith, now and then bear a bigger sail than his boat is able to sustain."[1]

In this way Shakespeare himself was turned, by the grant of his coat of arms, from a "vagabond" into a gentleman.

The fundamental idea of "gentry," symbolized in this grant of coat-armour, had come to be that of the essential superiority of the fighting man; and, as Selden points out (p. 707), the fiction was usually maintained in the granting of arms "to an ennobled person though of the long Robe wherein he hath little use of them as they mean a shield." At the last the wearing of a sword on all occasions was the outward and visible sign of a "gentleman"; and the custom survives in the sword worn with "court dress." This idea that a gentleman must have a coat of arms, and that no one is a "gentleman" without one is, however, of comparatively late growth, the outcome of the natural desire of the heralds to magnify their office and collect fees for registering coats; and the same is true of the conception of "gentlemen" as a separate class. That a distinct order of "gentry" existed in England very early has, indeed, been often assumed, and is supported by weighty authorities. Thus, the late Professor Freeman (*Ency. Brit.* xvii. p. 540 b, 9th ed.) said: "Early in the 11th century the order of 'gentlemen' as a separate class seems to be forming as something new. By the time of the conquest of England the distinction seems to have been fully established." Stubbs (*Const. Hist.*, ed. 1878, iii. 544, 548) takes the same view. Sir George Sitwell, however, has conclusively proved that this opinion is based on a wrong conception of the conditions of medieval society, and that it is wholly opposed to the documentary evidence. The fundamental social cleavage in the middle ages was between the *nobiles*, *i.e.* the tenants in chivalry, whether earls, barons, knights, esquires or franklins, and the *ignobiles*, *i.e.* the villeins, citizens and burgesses;[2] and between the most powerful noble and the humblest franklin there was, until the 15th century, no "separate class of gentlemen." Even so late as 1400 the word "gentleman" still only had the sense of *generosus*, and could not be used as a personal description denoting rank or quality, or as the title of a class. Yet after 1413 we find it increasingly so used; and the list of landowners in 1431, printed in *Feudal Aids*, contains, besides knights, esquires, yeomen and husbandmen (*i.e.* householders), a fair number who are classed as "gentilman."

Sir George Sitwell gives a lucid explanation of this development, the incidents of which are instructive and occasionally amusing. The immediate cause was the statute I Henry V. cap. v. of 1413, which laid down that in all original writs of action, personal appeals and indictments, in which process of outlawry lies, the "estate degree or mystery" of the defendant must be stated, as well as his present or former domicile. Now the Black Death (1349) had put the traditional social organization out of gear. Before that the younger sons of the *nobiles* had received their share of the farm stock, bought or hired land, and settled down as agriculturists in their native villages. Under the new conditions this became increasingly impossible, and they were forced to seek their fortunes abroad in the French wars, or at home as hangers-on of the great nobles. These men, under the old system, had no definite status; but they were *generosi*, men of birth, and, being now forced to describe themselves, they disdained to be classed with franklins (now sinking in the social scale), still more with yeomen or husbandmen; they chose, therefore, to be described as "gentlemen." On the character of these earliest "gentlemen" the records throw a lurid light. According to Sir George Sitwell (p. 76), "the premier gentleman of England, as the matter now stands, is 'Robert Erdeswyke of Stafford, gentilman,'" who had served among the men-at-arms of Lord Talbot at Agincourt (*ib.* note). He is typical of his class. "Fortunately—for the gentle reader will no doubt be anxious to follow in his footsteps—some particulars of his life may be gleaned from the public records. He was charged at the Staffordshire Assizes with housebreaking, wounding with intent to kill, and procuring the murder of one Thomas Page, who was cut to pieces while on his knees begging for his life." If any earlier claimant to the title of "gentleman" be discovered, Sir George Sitwell predicts that it will be within the same year (1414) and in connexion with some similar disreputable proceedings.[3]

From these unpromising beginnings the separate order of "gentlemen" was very slowly evolved. The first "gentleman" commemorated on an existing monument was John Daundelyon of Margate (d. c. 1445); the first gentleman to enter the House of Commons, hitherto composed mainly of "valets," was "William Weston, gentylman"; but even in the latter half of the 15th century the order was not clearly established. As to the connexion of "gentilesse" with the official grant or recognition of coat-armour, that is a profitable fiction invented and upheld by the heralds; for coat-armour was but the badge assumed by gentlemen to distinguish them in battle, and many gentlemen of long descent never had occasion to assume it, and never did. This fiction, however, had its effect; and by the 16th century, as has been already pointed out, the official view had become clearly established that "gentlemen" constituted a distinct order, and that the badge of this distinction was the heralds' recognition of the right to bear arms. It is unfortunate that this view, which is quite unhistorical and contradicted by the present practice of many undoubtedly "gentle" families of long descent, has of late years been given a wide currency in popular manuals of heraldry.

In this narrow sense, however, the word "gentleman" has long since become obsolete. The idea of "gentry" in the continental sense of *noblesse* is extinct in England, and is likely to remain so, in spite of the efforts of certain enthusiasts to revive it (see A.C. Fox-Davies, *Armorial Families*, Edinburgh, 1895). That it once existed has been sufficiently shown; but the whole spirit and tendency of English constitutional and social development tended to its early destruction. The comparative good order of England was not favourable to the continuance of a class, developed during the foreign and civil wars of the 14th and 15th centuries, for whom fighting was the sole honourable occupation. The younger sons of noble families became apprentices in the cities, and there grew up a new aristocracy of trade. Merchants are still "citizens" to William Harrison; but he adds "they often change estate with gentlemen, as gentlemen do with them, by a mutual conversion of the one into the other." A frontier line between classes so indefinite could not be maintained, especially as in England there was never a "nobiliary prefix" to stamp a person as a gentleman by his surname, as in France or Germany.[4] The process was hastened, moreover,

by the corruption of the Heralds' College and by the ease with which coats of arms could be assumed without a shadow of claim; which tended to bring the "science of armory" into contempt. The word "gentleman" as an index of rank had already become of doubtful value before the great political and social changes of the 19th century gave to it a wider and essentially higher significance. The change is well illustrated in the definitions given in the successive editions of the *Encyclopaedia Britannica*. In the 5th edition (1815) "a gentleman is one, who without any title, bears a coat of arms, or whose ancestors have been freemen." In the 7th edition (1845) it still implies a definite social status: "All above the rank of yeomen." In the 8th edition (1856) this is still its "most extended sense"; "in a more limited sense" it is defined in the same words as those quoted above from the 5th edition; but the writer adds, "By courtesy this title is generally accorded to all persons above the rank of common tradesmen when their manners are indicative of a certain amount of refinement and intelligence." The Reform Bill of 1832 has done its work; the "middle classes" have come into their own; and the word "gentleman" has come in common use to signify not a distinction of blood, but a distinction of position, education and manners. The test is no longer good birth, or the right to bear arms, but the capacity to mingle on equal terms in good society. In its best use, moreover, "gentleman" involves a certain superior standard of conduct, due, to quote the 8th edition once more, to "that self-respect and intellectual refinement which manifest themselves in unrestrained yet delicate manners." The word "gentle," originally implying a certain social status, had very early come to be associated with the standard of manners expected from that status. Thus by a sort of punning process the "gentleman" becomes a "gentle-man." Chaucer in the *Meliboeus* (*c.* 1386) says: "Certes he sholde not be called a gentil man, that ... ne dooth his diligence and bisynesse, to kepen his good name"; and in the *Wife of Bath's Tale*:

> "Loke who that is most vertuous alway
> Prive and apert, and most entendeth ay
> To do the gentil dedes that he can
> And take him for the gretest gentilman,"

and In the *Romance of the Rose* (*c.* 1400) we find "he is gentil bycause he doth as longeth to a gentilman." This use develops through the centuries, until in 1714 we have Steele, in the *Tatler* (No. 207), laying down that "the appellation of Gentleman is never to be affixed to a man's circumstances, but to his Behaviour in them," a limitation over-narrow even for the present day. In this connexion, too, may be quoted the old story, told by some—very improbably—of James II., of the monarch who replied to a lady petitioning him to make her son a gentleman, "I could make him a nobleman, but God Almighty could not make him a gentleman." Selden, however, in referring to similar stories "that no Charter can make a Gentleman, which is cited as out of the mouth of some great Princes that have said it," adds that "they without question understood Gentleman for *Generosus* in the antient sense, or as if it came from *Gentilis* in that sense, as *Gentilis* denotes one of a noble Family, or indeed for a Gentleman by birth." For "no creation could make a man of another blood than he is." The word "gentleman," used in the wide sense with which birth and circumstances have nothing to do, is necessarily incapable of strict definition. For "to behave like a gentleman" may mean little or much, according to the person by whom the phrase is used; "to spend money like a gentleman" may even be no great praise; but "to conduct a business like a gentleman" implies a standard at least as high as that involved in the phrase "noblesse oblige." In this sense of a person of culture, character and good manners the word "gentleman" has supplied a gap in more than one foreign language.

The evolution of this meaning of "gentleman" reflects very accurately that of English society; and there are not wanting signs that the process of evolution, in the one as in the other, is not complete. The indefinableness of the word mirrors the indefinite character of "society" in England; and the use by "the masses" of "gentleman" as a mere synonym for "man" has spread *pari passu* with the growth of democracy. It is a protest against implied inferiority, and is cherished as the modern French *bourgeois* cherishes his right of duelling with swords, under the *ancien régime* a prerogative of the *noblesse*. Nor is there much justification for the denunciation by purists of the "vulgarization" and "abuse" of the "grand old name of gentleman." Its strict meaning has now fallen completely obsolete. Its current meaning varies with every class of society that uses it. But it always implies some sort of excellency of manners or morals. It may by courtesy be over-loosely applied by one common man to another; but the common man would understand the reproach conveyed in "You're no gentleman."

AUTHORITIES.—Selden, *Titles of Honor* (London, 1672); William Harrison, *Description of England*, ed. G.F.J. Furnivall for the New Shakspere Soc. (London, 1877-1878); Sir George Sitwell, "The English Gentleman," in the *Ancestor*, No. 1 (Westminster, April 1902); *Peacham's Compleat Gentleman* (1634), with an introduction by G.S. Gordon (Oxford, 1906); A. Smythe-Palmer, D.D., *The Ideal of a Gentleman, or a Mirror for Gentlefolk: A Portrayal in Literature from the Earliest Times* (London, 1908), a very exhaustive collection of extracts from authors so wide apart as Ptah-hotep (3300 B.C.) and William Watson, arranged under headings: "The Historical Idea of a Gentleman," "The Herald's Gentleman," "The Poet's Gentleman," &c.

(W. A. P.)

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1 *Description of England*, bk. ii. ch. v. p. 128. Henry Peacham, in his *Compleat Gentleman* (1634), takes this matter more seriously. "Neither must we honour or esteem," he writes, "those ennobled, or made gentle in blood, who by mechanic and base means have raked up a mass of wealth ... or have purchased an ill coat (of arms) at a good rate; no more than a player upon the stage, for wearing a lord's cast suit: since nobility hangeth not upon the airy esteem of vulgar opinion, but is indeed of itself essential and absolute" (Reprint, p. 3). Elsewhere (p. 161) he deplores the abuse of heraldry, which had even in his day produced "all the world over such a medley of coats" that, but for the commendable activity of the earls marshals, he feared that yeomen would soon be "as rare in *England* as they are in *France*." See also an amusing instance from the time of Henry VIII., given in "The Gentility of Richard Barker," by Oswald Barron, in the *Ancestor*, vol. ii. (July 1902).

2 Even this classification would seem to need modifying. For certain of the great patrician families of the cities were certainly *nobiles*.

3 The designation "gentilman" is, indeed, found some two centuries earlier. In the *Inquisitio maneriorum Ecclesiae S. Pauli Londin.* of A.D. 1222 (W.A. Hale, *Domesday of St Paul's*, Camden Soc., 1858, p. 80) occurs the entry: *Adam gentilmā dimi acrā, p' iii. d.* This is probably the earliest record of the "grand old name of gentleman"; but Adam, who held half an acre at a rent of three pence—less by half than that held by "Ralph the bondsman" (Rad' le bunde) in the same list—was certainly not a "gentleman." "Gentilman" here was a nickname, perhaps suggested by Adam's name, and thus in some sort anticipating the wit of the famous couplet repeated by John Ball's rebels.

4 The prefix "de" attached to some English names is in no sense "nobiliary." In Latin documents *de* was the equivalent of the English "of," as *de la* of "at" (so de la Pole for Atte Poole, cf. such names as Attwood, Attwater). In English this "of" was in the 15th century dropped; *e.g.* the grandson of Johannes de Stoke (John of Stoke) in a 14th-century document becomes John Stoke. In modern times, under the influence of romanticism, the prefix "de" has been in some cases "revived" under a misconception, *e.g.* "de Trafford," "de Hoghton." Very rarely it is correctly retained as derived from a foreign place-name,

e.g. de Grey.

GENTZ, FRIEDRICH VON (1764-1832), German publicist and statesman, was born at Breslau on the 2nd of May 1764. His father was an official, his mother an Ancillon, distantly related to the Prussian minister of that name. On his father's transference to Berlin, as director of the mint, the boy was sent to the Joachimsthal gymnasium there; his brilliant talents, however, did not develop until later, when at the university of Königsberg he fell under the influence of Kant. But though his intellect was sharpened and his zeal for learning quickened by the great thinker's influence, Kant's "categorical imperative" did not prevent him from yielding to the taste for wine, women and high play which pursued him through life. When in 1785 he returned to Berlin, he received the appointment of secret secretary to the royal *Generaldirectorium*, his talents soon gaining him promotion to the rank of councillor for war (*Kriegsrath*). During an illness, which kept him virtuous by confining him to his room, he studied French and English, gaining a mastery of these languages which, at that time exceedingly rare, opened up for him opportunities for a diplomatic career.

His interest in public affairs was, however, first aroused by the outbreak of the French Revolution. Like most quick-witted young men, he greeted this at first with enthusiasm; but its subsequent developments cooled his ardour and he was converted to more conservative counsels by Burke's *Essay on the French Revolution*, a translation of which into German (1794) was his first literary venture. This was followed, next year, by translations of works on the Revolution by Mallet du Pan and Mounier, and at this time he also founded and edited a monthly journal, the *Neue deutsche Monatsschrift*, in which for five years he wrote, mainly on historical and political questions, maintaining the principles of British constitutionalism against those of revolutionary France. The knowledge he displayed of the principles and practice of finance was especially remarkable. In 1797, at the instance of English statesmen, he published a translation of a history of French finance by François d'Ivernois (1757-1842), an eminent Genevese exile naturalized and knighted in England, extracts from which he had previously given in his journal. His literary output at this time, all inspired by a moderate Liberalism, was astounding, and included an essay on the results of the discovery of America, and another, written in French, on the English financial system (*Essai sur l'état de l'administration des finances de la Grande-Bretagne*, London, 1800). Especially noteworthy, however, was the *Denkschrift* or *Missive* addressed by him to King Frederick William III. on his accession (1797), in which, *inter alia*, he urged upon the king the necessity for granting freedom to the press and to commerce. For a Prussian official to venture to give uncalled-for advice to his sovereign was a breach of propriety not calculated to increase his chances of favour; but it gave Gentz a conspicuous position in the public eye, which his brilliant talents and literary style enabled him to maintain. Moreover, he was from the first aware of the probable developments of the Revolution and of the consequences to Prussia of the weakness and vacillations of her policy. Opposition to France was the inspiring principle of the *Historisches Journal* founded by him in 1799-1800, which once more held up English institutions as the model, and became in Germany the mouthpiece of British policy towards the revolutionary aggressions of the French republic. In 1801 he ceased the publication of the *Journal*, because he disliked the regularity of journalism, and issued instead, under the title *Beiträge zur Geschichte*, &c., a series of essays on contemporary politics. The first of these was *Über den Ursprung und Charakter des Krieges gegen die französische Revolution* (1801), by many regarded as Gentz's masterpiece; another important brochure, *Von dem politischen Zustande von Europa vor und nach der Revolution*, a criticism of Hauterive's *De l'état de la France à la fin de l'an VIII*, appeared the same year.

This activity gained him recognition abroad and gifts of money from the British and Austrian governments; but it made his position as an official in Berlin impossible, for the Prussian government had no mind to abandon its attitude of cautious neutrality. Private affairs also combined to urge Gentz to leave the Prussian service; for, mainly through his own fault, a separation with his wife was arranged. In May 1802, accordingly, he took leave of his wife and left with his friend Adam Müller for Vienna. In Berlin he had been intimate with the Austrian ambassador, Count Stadion, whose good offices procured him an introduction to the emperor Francis. The immediate result was the title of imperial councillor, with a yearly salary of 4000 gulden (December 6th, 1802); but it was not till 1809 that he was actively employed. Before returning to Berlin to make arrangements for transferring himself finally to Vienna, Gentz paid a visit to London, where he made the acquaintance of Pitt and Granville, who were so impressed with his talents that, in addition to large money presents, he was guaranteed an annual pension by the British government in recognition of the value of the services of his pen against Bonaparte. From this time forward he was engaged in a ceaseless polemic against every fresh advance of the Napoleonic power and pretensions; with matchless sarcasm he lashed "the nerveless policy of the courts, which suffer indignity with resignation"; he denounced the recognition of Napoleon's imperial title, and drew up a manifesto of Louis XVIII. against it. The formation of the coalition and the outbreak of war for a while raised his hopes, in spite of his lively distrust of the competence of Austrian ministers; but the hopes were speedily dashed by Austerlitz and its results. Gentz used his enforced leisure to write a brilliant essay on "The relations between England and Spain before the outbreak of war between the two powers" (Leipzig, 1806); and shortly afterwards appeared *Fragmente aus der neuesten Geschichte des politischen Gleichgewichts in Europa* (translated *s.t. Fragments on the Balance of Power in Europe*, London, 1806). This latter, the last of Gentz's works as an independent publicist, was a masterly exposé of the actual political situation, and at the same time prophetic in its suggestions as to how this should be retrieved: "Through Germany Europe has perished, through Germany it must rise again." He realized that the dominance of France could only be broken by the union of Austria and Prussia, acting in concert with Great Britain. He watched with interest the Prussian military preparations, and, at the invitation of Count Haugwitz, he went at the outset of the campaign to the Prussian headquarters at Erfurt, where he drafted the king's proclamation and his letter to Napoleon. The writer was known, and it was in this connexion that Napoleon referred to him as "a wretched scribe named Gentz, one of those men without honour who sell themselves for money." In this mission Gentz had no official mandate from the Austrian government, and whatever hopes he may have cherished of privately influencing the situation in the direction of an alliance between the two German powers were speedily dashed by the campaign of Jena.

The downfall of Prussia left Austria the sole hope of Germany and of Europe. Gentz, who from the winter of 1806 onwards divided his time between Prague and the Bohemian watering-places, seemed to devote himself wholly to the pleasures of society, his fascinating personality gaining him a ready reception in those exalted circles which were to prove of use to him later on in Vienna. But, though he published nothing, his pen was not idle, and he was

occupied with a series of essays on the future of Austria and the best means of liberating Germany and redressing the balance of Europe; though he himself confessed to his friend Adam Müller (August 4th, 1806) that, in the miserable circumstances of the time, his essay on "the principles of a general pacification" must be taken as a "political poem."

In 1809, on the outbreak of war between Austria and France, Gentz was for the first time actively employed by the Austrian government under Stadion; he drafted the proclamation announcing the declaration of war (15th of April), and during the continuance of hostilities his pen was ceaselessly employed. But the peace of 1810 and the fall of Stadion once more dashed his hopes, and, disillusioned and "hellishly blasé," he once more retired to comparative inactivity at Prague. Of Metternich, Stadion's successor, he had at the outset no high opinion, and it was not till 1812 that there sprang up between the two men the close relations that were to ripen into life-long friendship. But when Gentz returned to Vienna as Metternich's adviser and henchman, he was no longer the fiery patriot who had sympathized and corresponded with Stein in the darkest days of German depression and in fiery periods called upon all Europe to free itself from foreign rule. Disillusioned and cynical, though clear-sighted as ever, he was henceforth before all things an Austrian, more Austrian on occasion even than Metternich; as, *e.g.*, when, during the final stages of the campaign of 1814, he expressed the hope that Metternich would substitute "Austria" for "Europe" in his diplomacy and—strange advice from the old hater of Napoleon and of France—secure an Austro-French alliance by maintaining the husband of Marie Louise on the throne of France.

For ten years, from 1812 onward, Gentz was in closest touch with all the great affairs of European history, the assistant, confidant, and adviser of Metternich. He accompanied the chancellor on all his journeys; was present at all the conferences that preceded and followed the war; no political secrets were hidden from him; and his hand drafted all important diplomatic documents. He was secretary to the congress of Vienna (1814-1815) and to all the congresses and conferences that followed, up to that of Verona (1822), and in all his vast knowledge of men and affairs made him a power. He was under no illusion as to their achievements; his memoir on the work of the congress of Vienna is at once an incisive piece of criticism and a monument of his own disillusionment. But the Liberalism of his early years was gone for ever, and he had become reconciled to Metternich's view that, in an age of decay, the sole function of a statesman was to "prop up mouldering institutions." It was the hand of the author of that offensive *Missive* to Frederick William III., on the liberty of the press, that drafted the Carlsbad decrees; it was he who inspired the policy of repressing the freedom of the universities; and he noted in his diary as "a day more important than that of Leipzig" the session of the Vienna conference of 1819, in which it was decided to make the convocation of representative assemblies in the German states impossible, by enforcing the letter of Article XIII. of the Act of Confederation.

As to Gentz's private life there is not much to be said. He remained to the last a man of the world, though tormented with an exaggerated terror of death. His wife he had never seen again since their parting at Berlin, and his relations with other women, mostly of the highest rank, were too numerous to record. But passion tormented him to the end, and his infatuation for Fanny Elssler, the celebrated *danseuse*, forms the subject of some remarkable letters to his friend Rahel, the wife of Varnhagen von Ense (1830-1831). He died on the 9th of June 1832.

Gentz has been very aptly described as a mercenary of the pen, and assuredly no other such mercenary has ever carved out for himself a more remarkable career. To have done so would have been impossible, in spite of his brilliant gifts, had he been no more than the "wretched scribe" sneered at by Napoleon. Though by birth belonging to the middle class in a country of hide-bound aristocracy, he lived to move on equal terms in the society of princes and statesmen; which would never have been the case had he been notoriously "bought and sold." Yet that he was in the habit of receiving gifts from all and sundry who hoped for his backing is beyond dispute. He notes that at the congress of Vienna he received 22,000 florins through Talleyrand from Louis XVIII., while Castlereagh gave him £600, accompanied by *les plus folles promesses*; and his diary is full of such entries. Yet he never made any secret of these gifts; Metternich was aware of them, and he never suspected Gentz of writing or acting in consequence against his convictions. As a matter of fact, no man was more free or outspoken in his criticism of the policy of his employers than this apparently venal writer. These gifts and pensions were rather in the nature of subsidies than bribes; they were the recognition by various powers of the value of an ally whose pen had proved itself so potent a weapon in their cause.

It is, indeed, the very impartiality and objectivity of his attitude that make the writings of Gentz such illuminating documents for the period of history which they cover. Allowance must of course be made for his point of view, but less so perhaps than in the case of any other writer so intimately concerned with the policies which he criticizes. And, apart from their value as historical documents, Gentz's writings are literary monuments, classical examples of nervous and luminous German prose, or of French which is a model for diplomatic style.

A selection of Gentz's works (*Ausgewählte Schriften*) was published by Weick in 5 vols. (1836-1838); his lesser works (Mannheim, 1838-1840) in 5 vols. and *Mémoires et lettres inédites* (Stuttgart, 1841) were edited by G. Schlesier. Subsequently there have appeared *Briefe an Chr. Garve* (Breslau, 1857); correspondence (*Briefwechsel*) with Adam Müller (Stuttgart, 1857); *Briefe an Pilat* (2 vols., Leipzig, 1868); *Aus dem Nachlass Friedrichs von Gentz* (2 vols.), edited by Count Anton Prokesch-Osten (Vienna, 1867); *Aus der alten Registratur der Staats-Kanzlei: Briefe politischen Inhalts von und an Friedrich von Gentz*, edited by C. von Klinkowström (Vienna, 1870); *Dépêches inédites du chev. de Gentz aux Hospodars de Valachie 1813-1828* (a correspondence on current affairs commissioned by the Austrian government), edited by Count Anton von Prokesch-Osten the younger (3 vols., Paris, 1876), incomplete, but partly supplemented in *Österreichs Teilnahme an den Befreiungskriegen* (Vienna, 1887), a collection of documents of the greatest value; *Zur Geschichte der orientalischen Frage: Briefe aus dem Nachlass Friedrichs von Gentz* (Vienna, 1877), edited by Count Prokesch-Osten the younger. Finally Gentz's diaries, from 1800 to 1828, an invaluable mine of authentic material, were edited by Varnhagen von Ense and published after his death under the title *Tagebücher*, &c. (Leipzig, 1861; new ed., 4 vols., *ib.* 1873). Several lives of Gentz exist. The latest is by E. Guglia, *Friedrich von Gentz* (Vienna, 1901).

(W. A. P.)

GEOCENTRIC, referred to the centre of the earth (Gr. γῆ) as an origin; a term designating especially the co-ordinates of a heavenly body referred to this origin.

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