

having been taken in hand by so able and accurate a chemist as Gay-Lussac.

The year 1815 saw the completion of the research on cyanogen already referred to, and with it concludes the period of Gay-Lussac's most important discoveries. Having now attained a leading if not the foremost place among the scientific men in the French capital, his advice was often required on important questions. His attention was thus turned in part from purely scientific subjects to points of practical interest. In these new fields, however, he displayed the same powers which he had exercised so sedulously in the pursuit of scientific truth; in fact he was now to introduce and establish scientific accuracy where there had been previously only practical approximations. The most important of these later discoveries were the method of estimating the amount of real alkali in potash and soda by the volume of standard acid required for neutralization; the method of estimating the amount of 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 commission of the Institute appointed to report on it, as displaying all the accuracy and exhaustive treatment of the author; and lastly, the perfecting of the method of assaying silver by a standard solution of common salt, a volume on which was published in 1833. This last has superseded the old method of assaying silver by cupellation, as being more rapid, more accurate, and easier of execution; and indeed all these processes are so complete and satisfactory, and are besides so identified with their author's name, that his reputation is secured by them, quite independently of his earlier work. In what has been said above, only the more important of Gay-Lussac's discoveries have been alluded to. To enter into an account, however brief, of all his labours, would occupy more space than can be allowed here. Indeed the list of his papers in the Royal Society's catalogue amounts to 148, besides those of which he was joint-author with Von Humboldt, Thénard, Welter, and Liebig; and they embrace every department of the science as cultivated fifty years ago. Among his later researches may be mentioned those on fermentation, and those executed by Liebig in conjunction with him, after the young German chemist had gained the coveted admission to Gay-Lussac's private laboratory during the years 1823-24. The latter include improvements on organic analysis, and the examination of fulminic acid. Gay-Lussac continued his work, and published the results in the *Annales de Chimie*, of which he had been joint-editor for some thirty years, up till almost his death, which took place at Paris on May 9, 1850.

Some of the appointments he held have been already referred to. After having acted as Fourcroy's demonstrator, he was made professor of chemistry at the École Polytechnique. From 1808 to 1832 he was professor of physics at the Sorbonne, and he only resigned that office when he was made professor of chemistry at the Jardin des Plantes. Besides being on the commission of arts and manufactures, and the "administration" of gunpowder and nitre, he was appointed assayer for the mint in 1829. In 1831 he was elected to the chamber of deputies as member for Haute Vienne, and finally, in 1839, entered the chamber of peers.

Gay-Lussac's scientific work is remarkable not only for its range but for its intrinsic worth, its accuracy of detail, its experimental ingenuity, its descriptive clearness, and the soundness of its inferences. He did not hesitate to criticize his own results, and replace them by others more accurate either of his own or of another's discovery; he improved and invented physical and chemical apparatus: the barometer, thermometer, cathetometer, alcoholometer, and the

burette, which still bears his name, all bear witness to his ingenuity and practical skill. He devised new analytical methods; he discovered new substances, such as fluoride of boron, and iodic, hydrosulphocyanic, dithionic, and hyposulphurous acids; he enlarged and corrected the knowledge of those already discovered; he examined the physical conditions of chemical action; he searched into the causes of chemical combination and chemical change. That he had the power of grasping the law underlying a few facts is nowhere more evident than in the memoir on gaseous combination, his most important contribution to science. That he missed the opportunity of assigning the chief limit to Lavoisier's hypothesis, must be ascribed partly at least to the influence of others. Authority decided it, perhaps against his secret convictions.

From Arago's and other notices one gathers that Gay-Lussac was reticent, 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 equally so in defence and support of his friends. His earliest childish adventures, as told by Arago, herald the fearless aeronaut and undaunted investigator of volcanic eruptions. The endurance he exhibited under the laboratory accidents which befell him shows the power of will with which he could face the prospect of becoming blind and useless for the prosecution of the science which was his very life, and of which he is one of the most distinguished ornaments. It was only at the very end, when the disease from which he suffered left him no hope, that he complained with some bitterness of the hardship of leaving this world when so many discoveries were making, and when so many more were likely to be made.

The more important of Gay-Lussac's papers are scattered through journals difficult of access. The most complete list of them is contained in the Royal Society's catalogue of scientific papers; lists are also given at the end of Hofer's article in the *Biographie Générale*, and in Poggenorff's *Biographisch-literarisches Handwörterbuch*, Leipzig, 1863. Accounts of various portions of Gay-Lussac's discoveries and views will be found in such works as Thomson's *History of Chemistry*, vol. ii., London, 1830; Kopp's *Geschichte der Chemie*, Brunswick, 1843-47; Kopp's *Entwicklung der Chemie*, Munich, 1871; Dumas, *Leçons sur la Philosophie Chimique*, Paris, 1837, and reprinted Paris, 1878; Ladenburg, *Vorträge über die Entwicklungsgeschichte der Chemie*, Brunswick, 1869; Forbes, *A Review of the Progress of Mathematical and Physical Science in more recent times*, Edinburgh, 1858. The chief authorities for the life of Gay-Lussac are Arago (*Ceuvres*, Paris, 1855, t. iii.); Biot (*Abstracts, Royal Society*, vol. v., 1848-50, p. 1013); P. A. Cap (*Le Muséum d'Histoire Naturelle*, Paris, 1854, pt. 1, p. 137). (J. F.)

GAZA, an ancient city of Philistia, close to the sea and to the south boundary of the Holy Land. The Hebrew is more correctly rendered in English as Azzah (Deut. ii. 23), and means "strong." The modern Arabic form of the name is Ghazze. The town stands on an isolated hill about 100 feet high, and has now a population of 1800 souls. It is divided into four quarters, the eastern suburb consisting entirely of mud houses. A magnificent grove of very ancient olives forms an avenue 4 miles long north of the city. On the south-east are a few palms. 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 miles 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

Majuma Gazæ 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. In the 7th century there were numerous families of Samaritans in Gaza, but they became extinct at the commencement of the present century. Hâshem, the father 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 Muntâr, "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. From the 5th to the 12th century Gaza was an episcopal see of the Latin Church, but even as late as the 4th century an idol named Marnas was worshipped in the town.

GAZA, THEODORUS (c. 1400-1478), one of the leaders of the revival of learning in the 15th century, was born at Thessalonica about the year 1400. On the capture of his native city by the Turks in 1430 he removed to Mantua, where he rapidly acquired a competent knowledge of Latin under the teaching of Victorino de Feltre, supporting himself meanwhile by giving lessons in Greek, and by copying manuscripts of the ancient classics. About 1440 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 Ferrara (1438), Florence (1439), and Siena (1440), with the object of bringing about a reconciliation between the Greek and Latin Churches; and in 1450, responding to 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. From 1456 to 1458 he lived at Naples under the patronage of Alphonso the Magnanimous; and shortly after the latter date he was appointed by Cardinal Bessarion to a benefice in the south of Italy, where the later years of his life were spent, and where he died at an advanced age in 1478. 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 Greek (*γραμματικὴς εἰσαγωγὴς βιβλία δ*), first printed at Venice in 1495, and afterwards partially translated by Erasmus in 1521, although in many respects defective, especially in its syntax, has done good service in the cause of sound learning. His translations were very numerous, including the *Problemata*, *De Historia Animalium*, *De Partibus Animalium*, and *De Generatione Animalium* of Aristotle, the *Historia Plantarum* and *De Causis Plantarum* of Theophrastus, the *Problemata* of Alexander Aphrodisias, the *De Instruendis Aciebus* of Ælian, and some of the *Homilies* of 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*.

GAZELLE. See ANTELOPE.

GAZETTE, THE LONDON, is the official newspaper of the Government, and is published every Tuesday and Friday. It contains proclamations, orders, regulations, and other acts of state, and is received as evidence thereof in legal

proceedings. It also contains notices of proceedings in bankruptcy, dissolutions of partnership, &c. The Bankruptcy Act, 1869, requires the order of adjudication to be published in the *Gazette*, and makes the *Gazette* conclusive evidence of adjudication. Other statutes, dealing with special subjects, have similar provisions. Unless by virtue of such statutes, the *Gazette* is not evidence of anything but acts of state. The Scotch law of evidence would appear not to be so stringent. *Gazettes* are also published in Edinburgh and Dublin.

GEBER. After all the research and criticism that have been expended on this the first and most interesting personage in the modern history of chemistry, little is definitely known about him, and about the origin of the works which pass under his name. It has been a very general tradition to regard Geber as an Arabian, but until the publication in recent years by European scholars of the works of Arabian historians and bibliographers, the probable source of the tradition has not been known. It seems to be pretty generally believed that the Geber of Western Europe is the same as the person who is called in full Abu Musa Dschabir (or Jabir) Ben Haijan Ben Abdallah el-Sufi el-Tarsusi el-Kufi, who was reckoned the most illustrious of the alchemists by the Arabs, and who is mentioned in the *Kitab-al-Fihrist* (10th cent.), by Ibn Khallikan (13th cent.), by Haji Khalfa (17th cent.), and other writers. If this be correct, Geber must have flourished in the 8th century, for, according to Haji Khalfa, Dschabir Ben Haijan died in the 160th year of the Hegira, which corresponds with the year beginning October 19, 776 A.D. This date is incidentally confirmed by other writers, though there are difficulties arising from the date of his teacher Kalid Ben Jezid, and his patron Dschaafar ess-Sadik. His birthplace was Tarsus, or, as others say, Kufa; and he is said to have resided at Damascus and at Kufa. This account, though apparently the most trustworthy, does not agree with the statements of D'Herbelot, quoted seemingly from native sources, that Geber was born at Harran in Mesopotamia, was a Sabæan by religion, and lived in the 3d century of the Hegira. Nor does it agree with that of Leo Africanus, who in 1526 gave a description of the Alchemical Society of Fez, in Africa, and told how the chief authority of that society was a certain Geber, a Greek, that had apostatized to Mahometanism, and lived a century after Mahomet. Leo's story has circulated very widely, but its accuracy has been impugned by Reiske and Asseman, and the works of both Leo and D'Herbelot have been rejected as authorities by Wüstenfeld. Other writers have tried to show that Geber was a native of Spain, or at least lived at Seville, but this has probably arisen from confusing Geber the chemist with other persons of the same or similar name. From the doubt encircling the personality of Geber, some have gone the length of questioning whether such a person ever existed but in name, and this view has been again expressed by Steinschneider, who mentions "Abu Musa Dschabir Ben Haijan, commonly called Geber, an almost mythical person of the earliest period of Islam, renowned as an alchemist." While Steinschneider here exhibits notable scepticism with respect to Dschabir's very existence, he exhibits equal credulity in his belief that this mythical Dschabir is identical with Geber. In the present state of the question there is no alternative but to accept the account given in the *Fihrist*, and admit the possibility of Dschabir and Geber being one and the same. Confirmation of this view is to be sought in a comparison of the works ascribed to Geber with those bearing the name of Dschabir. The latter are divisible into two classes, those mentioned in Arabic bibliographies, and those existing in manuscript in European libraries. To Dschabir is assigned the authorship of an immense



number of works on chemistry and many other topics besides. Titles of 500 of these are given in the Fibris, and have been reproduced by Hammer-Purgstall, but nothing else is known about them. Haji Khalifa also enumerates the titles of several alchemical works by Dschabir, and other works are mentioned by other writers. Again Arabic MSS. on alchemy bearing the name of Dechabir Ben Haijan exist at Leyden, at Paris, in the British Museum, and elsewhere; but these have not been critically examined as to their date, age, authenticity, contents, &c. It is not known if they correspond with the lists already mentioned, or with the Latin MSS. or the printed versions. The Latin MSS. are contained in the Vatican, at Leyden, Oxford, and other places. Of these the Vatican MS. is the alleged basis of some of the printed editions; and the Bodleian MSS. have been described by W. H. Black, but no collation of the text of these writings for critical purposes has as yet been made. The oldest of the MSS. dates from the 14th century; but if the works ascribed to Roger Bacon, Albertus Magnus, and others be genuine, Geber's name and writings must have been known and esteemed at a still earlier period. The works which purport to have been written by Geber, and which have been printed, bear the following names:—*Summa perfectionis*; *Liber investigationis*, or *De investigatione perfectionis*; *De inventione veritatis*; *Liber Fornacum*; *Testamentum*. None of the editions appear to contain the whole of these tractates; there are usually found only two or three of them, but the English translation contains them all except the *Testament*, which is considered spurious by some writers. The printed editions of these works are very numerous, but they are all uncommon, and some of them are exceedingly rare. No approximately complete list is contained in any bibliography, and very few writers have seen more than half a dozen at most. The most complete catalogue from personal inspection is given by Beckmann. It contains twelve editions, but that does not comprise nearly all those which are known. While some of the editions correspond exactly, being merely reprints, there are important differences among others. What light these variations may throw upon the origin of the text has never been investigated. A critical edition of the works with the various readings would be necessary before deciding that what is found in them is really Geber's, and dates back eleven centuries. It may be that some of the knowledge of chemistry credited to Geber was really interpolated at a later date. It is quite possible that the account given of the various acids, salts, and metals, and of the apparatus and operations, may have been modified or extended. But, on the other hand, the general theory that runs through the whole of the writings is in all probability original. The theory is that the metals are composed of the same elements, and that by proper treatment the less perfect can be gradually developed into the more perfect metals. This theory is very clearly, and one may even say logically, worked out, and it was the leading idea in chemistry down to the 16th century at least. In carrying out this theory practically, certain materials were employed and were subjected to operations, and the knowledge acquired about them took shape by degrees. Though subsequent workers added to what was known, Geber's reputed works are so clear, so precise, so complete, that they differ in a most striking manner from the works of even the best writers in the later alchemical period, and make it difficult to account for their existence at all. Older writings there are none; subsequent writings as clear as Geber's do not appear until far more was known; the unsolved problem therefore remains, Who was Geber, and how does it happen that his works stand quite alone in chemical literature?

The following are a few of the authorities which may be consulted:—Abulfeda, *Annales Moslemici*, Copenhagen, 1790, with Reiske's note; Beckmann, *Geschichte der Erfindungen*, 1803, v. 272; Black, *Catalogue of MSS. bequeathed to the University of Oxford by Elias Ashmole*, 1845; D'Herbelot, *Bibliothèque Orientale*, Paris, 1697; Haji Khalifa, *Lexicon*, ed. Fluegel, London, 1835-58; Hammer-Purgstall, *Literaturgeschichte der Araber*, Vienna, 1850; Ibn-Khalkikan, *Biographical Dictionary*, by De Slane, Paris, 1843, vol. i. pp. 800-1; *Kutab-al-Fihrist*, ed. Fluegel, 1871-72; Kopp, *Beiträge zur Geschichte der Chemie*, Brunswick, 1875, part iii.; *Laboratory*, 1867, vol. i. pp. 71-76; Leo Africanus, *Africa Descriptio*, Leyden, 1632; Steinschneider, "Die toxicologischen Schriften der Araber," in *Virchow's Archiv*, Berlin, 1871, Bd. 52; Wüstenfeld, *Geschichte der Arabischen Ärzte*, Göttingen, 1840. See also article ALCHEMY. (J. F.)

GEBWEILER, in French *Guebwiller*, a town of the German imperial province of Alsace-Lorraine, in the district of Upper Alsace, situated about 13 miles south of Colmar, at the mouth of the Blumenthal or "Vale of Flowers." It communicates by a branch line with the railway between Strasburg and Basel. 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 spinning, weaving, bleaching, and dyeing of cotton is the chief industry, but woollen goods and silk ribbons, as well as machinery, are also manufactured. 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. At the French Revolution of 1789, however, the chapter house was laid in ruins, and though the archives were rescued and removed to Colmar, the library perished in the devastation. Population in 1871, 11,104; in 1875, 11,622.

GECKO, the common name applied to all the species of *Gekkotidae*, an extensive family of lizards belonging to the *Pachygllossæ*, or "thick-skinned" sub-order of Gray. The geckoes are small creatures, seldom exceeding 8 inches in



Leaf-tailed Gecko (*Phyllurus platurus*).

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 and worms, 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 those lizards forms their most characteristic anatomical feature. These organs are flattened out into broad discs, and are furnished with transverse lamellar plates, by means of which the geckoes are enabled to run with ease on the smoothest surface, and to imitate the fly in remaining suspended on ceilings or on the under surfaces of leaves. Most of the species have nails to their toes, and these in their sharpness and retractility bear considerable resemblance to the claws of feline animals. They are nocturnal in their habits; but when not exposed to the hot sunshine they are able to pursue their prey by day. They hibernate; and two fatty masses in front of the pubis are supposed to furnish the means of nourishment during this period. Many of the species possess to a limited extent the chameleon faculty of changing colour, while their colouring generally may be regarded as protective; a few Indian forms are said to become luminous in the dark. The geckoes form an extensive family, including 60 genera and 200 species, found throughout the warmer regions of the earth, two only being inhabitants of Europe, and even these occur also in the north of Africa. Unlike most lizards, they are found in the remotest oceanic islands, a fact which leads Mr Wallace (*Geographical Distribution of Animals*) to suppose that they possess exceptional means of distribution.

GED, WILLIAM (? -1749), the inventor of the art of stereotyping, was born at Edinburgh about the beginning of the 18th century. In 1725 he first put in practice the art which he had discovered; and some years later he entered into a partnership with a London capitalist, with a view to employing it on a great scale. The partnership, however, turned out very ill; and Ged, broken-hearted at his want of success, died at London, October 19, 1749. The only books which he produced by means of stereotyping were two prayer-books for the university of Cambridge, and an edition of Sallust. See *Life* by Nichols, 1781.

GEDDES, ALEXANDER (1737-1802), a learned theologian, biblical critic, and miscellaneous writer, was born at the farm of Arradoul, in the parish of Rathven, Banffshire, Scotland, on the 14th of September 1737. At the age of fourteen he entered the small Roman Catholic seminary at Sealan in a remote glen of the Banffshire highlands, where he remained till October 1758, when he was sent to the Scottish College in Paris for the further prosecution of his studies. Here to considerable acquisitions in biblical philology and school divinity he succeeded in adding a good knowledge of most of the literary languages of Europe. Returning to Scotland after an absence of six years, he for a short time officiated as a priest in Dundee, but in May 1765 received and accepted an invitation to become resident in the family of 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 extended over some months, and which was employed by him in reading and making extracts from rare books and manuscripts in the public libraries, he in 1769 was appointed to the charge of the Catholic congregation of Auchinhalrig in his native county. During the period of a ten years' incumbency there he displayed a liberality of spirit which caused considerable scandal to his stricter brethren; and the freedom with which he fraternized with his Protestant neighbours once and again called forth the rebuke of his bishop (Hay). Ultimately, on account of his occasional attendance at the parish church of Cullen, where his friend Buchanan 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, with the exception of a few weeks devoted to travel on the Continent. Before leaving Scotland he had received the honorary degree of LL.D. from the university of Aberdeen, a compliment seldom before paid to any Catholic, and had been made an honorary member of the Society of Antiquaries, in the institution of which he had taken a very active part. Shortly after his arrival in London Geddes received an appointment in connexion with the chapel of the imperial ambassador, which he held until the chaplaincy was suppressed some years afterwards. Having been introduced to Lord Petre, to whom he broached his long-cherished scheme for the publication of a new Catholic version of the Scriptures on the basis of the Vulgate, he met with every encouragement from that nobleman, who assigned to him an annual salary of £200, and, moreover, undertook to provide the needful books. Supported also by such scholars as Kennicott and Lowth, Geddes in 1786 published a *Prospectus of a new Translation of the Holy Bible, from corrected Texts of the Originals, compared with the ancient Versions, with various Readings, explanatory Notes, and critical Observations*, a considerable quarto volume, in which the defects of previous translations were fully pointed out, and the means were indicated by which these might be removed. It attracted considerable notice of a favourable kind, 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; or the Books accounted sacred by Jews and Christians; otherwise called the Books of the Old and New Covenants; 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 Houbigant, Kennicott, and 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, corresponding with a New Translation of the Bible, containing the Pentateuch*, of which it is enough to say that, while fully saturated with all the best learning of its time, it presented in a somewhat brusque and injudicious manner the then novel and startling views of Eichhorn and his school on the primitive history and early records of mankind. Dr Geddes was engaged on a critical translation of the Psalms, which he had completed down to the 118th, when he was seized with a lingering and painful illness which ultimately proved fatal on the 26th of February 1802. Although for many years he had been under ecclesiastical censures, he had never for a moment swerved from a consistent profession of faith as a Catholic; and on his death-bed he duly received the last rites of his communion. It would appear, however, that the report which gained currency that before his death he had made recantation of his "errors" was entirely destitute of foundation in fact. In his lifetime he enjoyed the friendship of several eminent Continental scholars, and his death was noticed as being a loss to science in the *Gelehrte Zeitung* of Gotha and in other foreign journals.



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 metrical translation and adaptation 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 Dr Mason Good appeared in 1803, and his unfinished work on the Psalms in 1807.

GEELONG, one of the leading towns in Victoria, coeval with Melbourne in the history of Australian settlement, is pleasantly situated on Corio Bay, an extensive western arm of Port Phillip, 45 miles S.W. of Melbourne, in 39° 8' S. lat. and 144° 21' E. long. The town slopes to the bay on the north side and to the Barwon river on the south, and its position in this respect, as well as the shelter it obtains from the Bellarine range of hills, renders it the healthiest town in the colony. Its streets are wide and laid out at right angles, and there are many handsome public and private buildings. It has a botanical garden, and two parks maintained by the municipality. The public buildings comprise a mechanics' institute (with a library containing nearly 12,000 volumes), a public library, a town hall, a fire-brigade establishment, a handsome and commodious hospital, a supreme court, and orphan and benevolent asylums. The town is supplied with water from large state-constructed reservoirs in the Brisbane ranges, some 25 miles distant. As a manufacturing centre Geelong is of considerable importance. It contains extensive woollen mills and tanneries on the Barwon river, and paper of good quality is largely made in the neighbourhood. Geelong harbour has area and depth enough to hold all the navies of the world. The bar at the entrance has been cut (at an expense of £6000) to admit vessels of heavy draught, and some of the largest wool ships are able to load at the wharves, which are connected by railway with all parts of the colony. The population of the city proper is a little over 12,000, but with the adjacent boroughs of Geelong West, Chilwell, and Newtown the total is increased to 24,000.

GEESTEMÜNDE, a seaport in the Prussian province of Hanover, in the district or *Landdrostei* of Stade, situated, as the name indicates, at the mouth of the Geeste, a right-hand affluent of the estuary of the Weser. It lies about 32 miles N. of Bremen, and is the terminus of a railway from that city. The interest of the place is purely naval and commercial, its origin dating no further back than 1857, when the construction of the harbour was commenced. The great basin opened in 1863 has a length of 1785 English feet, a breadth of 410, and a depth of nearly 23, and can accommodate 24 or 25 of the largest ships of the line; and the petroleum basin opened in 1874 has a length of 820 feet and a breadth of 147. To the left of the great basin lies a canal, which has a length of 13,380 feet and a breadth of 155; and from this canal there strikes off another of similar proportions. The whole port is protected by powerful fortifications, and it lies outside of the limit of the German customs. Since 1864 the trade has been almost trebled, the number of vessels being 617 sea-going ships entering in 1875 and upwards of 2000 river craft. Among the industrial establishments of the town are ship-building yards, foundries, engineering works, and steam mills. The population, exclusive of the garrison, was 3218 in 1871, and 3436 in 1875; and if the neighbouring commune of Geestendorf be included, the total for 1871 was 9148, and for 1875 10,425.

GEFLE, Latinized as *Gevalia*, a seaport town of Sweden, at the head of the Gefleborglän, about a mile from the shore of the gulf of Bothnia, near the mouth of the Gefle-Å, 50 miles E. of Fahlun, and about the same distance N. of Upsala. With the former city it has been connected by railway since 1859, and with the latter and Stockholm since 1874. As the river at that place is divided into three channels, the town consists of four portions, communicat-

with each other by wooden bridges. In 1869 it was almost destroyed by fire, but it has been rebuilt, and may still be reckoned one of the prettiest, as it is certainly one of the busiest, of Swedish towns. The principal buildings are the castle, originally founded in the 16th century by King John III., but rebuilt since its destruction by fire in 1727; a beautiful council-house erected by Gustavus III., who held a diet in the town in 1792; a hospital, an exchange, and a freemason's lodge in the Gothic style. An orphan asylum, a gymnasium, removed to Gefle from Stockholm in 1668, and a public library may also be mentioned. Possessing an excellent harbour, and recently restored wharves to which large vessels have easy access, Gefle is the great port for the Dalecarlian district, and thus ranks in Sweden next to Stockholm and Gottenburg. It has about 100 ships of its own, and carries on a good trade in the export of timber, tar, flax, and linen, and in the import of grain, salt, coal, &c. The manufactures of the town include sailcloth and linen, tobacco, leather, iron wares, and machinery. In 1873 the population was 16,265.

GEIGER, ABRAHAM (1810-1874), one of the ablest leaders of the modern Jewish school of theology and criticism, was born at Frankfort-on-the-Main, May 24, 1810. After receiving from his father and uncle the elements of an ordinary rabbinical education, he was in his eleventh year sent to the gymnasium, whence in 1829 he passed to the university of Heidelberg, which he soon afterwards exchanged for that of Bonn. As a student he greatly distinguished himself both in philosophy and in philology, and at the close of his course wrote on the relations of Judaism and Mahometanism a prize-essay which was afterwards published, in 1833, under the title *Was hat Mohammed aus dem Judenthum aufgenommen?* In November 1832 he went to Wiesbaden as rabbi of the synagogue there, and, still pursuing the line of scientific study upon which he had entered during his undergraduate course, became in 1835 one of the most active promoters of the *Zeitschrift für Jüdische Theologie*, which appeared from 1835 to 1839, and again from 1842 to 1847. In 1838 he removed to Breslau, where he continued to reside for the next twenty-five years, and where he wrote some of his most important works, including his *Lehr- und Lesebuch zur Sprache der Mischna* (1845), his *Studien von Maimonides* (1850), his translation into German of the poems of Juda ha-Levi (Abul Hassan) in 1851, and the *Urschrift und Uebersetzungen der Bibel in ihrer Abhängigkeit von der innern Entwicklung des Judenthums* (1857). The last-named work especially attracted much attention at the time of its appearance, and may be said to have marked a new departure in the methods of studying the records of Judaism. In 1863 Geiger became head of the synagogue of his native town, whence he removed in 1870 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 thoroughgoing application of its leading principles in an elaborate history of Judaism (*Das Judenthum u. seine Geschichte*) in 1865-71. Geiger also contributed frequently on Hebrew, Samaritan, and Syriac subjects to the *Zeitschrift der deutschen morgenländischen Gesellschaft*, and from 1862 until his death (which occurred on the 23d of October 1874) he was editor of a periodical entitled *Jüdische Zeitschrift für Wissenschaft und Leben*. He also published a Jewish prayer-book (*Israelitisches Gebetbuch*) which is well known in Germany, besides a variety of minor monographs on historical and literary subjects connected with the fortunes of his people. An *Allgemeine Einleitung* and five volumes of *Nachgelassene Schriften* were edited by his son L. Geiger in 1875.

GEIJER, ERIK GUSTAF (1783-1847), Sweden's greatest historian, was born at Ransäter in Värmland, January 12, 1783, of a family that had immigrated from Austria in the time of Gustavus Adolphus. At sixteen he left Carlstad gymnasium for the university of Upsala, where in 1803 he carried off the Swedish Academy's great prize for an *Äreminne öfver Riksförståndaren Sten Sture*. 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 eleven friends, he founded the "Gothic Society," to whose organ *Iduna* he contributed a number of prose essays and the songs *Manhem*, *Vikingen*, *Den siste kampen*, *Den siste skalden*, *Odalbonden*, *Kolar-gossen*, and others, whose simplicity and earnestness, warm feeling, and strong patriotic spirit are dearer to his nation for the fine melodies to which he set them. About the same time he issued a volume of hymns (1812), of which several are inserted in the Swedish Psalter. Geijer's lyric muse was soon after silenced by his call to be assistant to Fant, professor of history of Upsala (1815), whom he succeeded in that chair in 1817. In 1824 he was elected to the Swedish Academy. A single volume of a great projected work, *Svea Rikea 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* (1834). In 1832-36 he published three volumes of his *Svenska folkets historia*, a clear view of the political and social development of Sweden down to the close of Queen Christina's reign. The acute critical insight, just thought, and finished historical art of these two incomplete works of Geijer entitle him to the first place among Swedish historians. His chief other historical and political writings are his *Kort teckning af Sveriges tillstånd och af de förnämste handlande personer under tiden från Karl XII.'s död till Gustaf III.'s antråde af regeringen* (Stockh. 1838), and *Feodalism och republikanism, ett bidrag till Samhällsförhållningens historia* (1844), which led to a controversy with the historian Fryxell regarding the part played in history by the Swedish aristocracy. Geijer also edited, with the aid of Schröder, a continuation of Fant's *Scriptores svecicarum mediæ ævi* (1818-25), and, by himself, Thorild's *Samlade skrifter* (1819-25), and *Konung Gustaf III.'s efterlemnade Papper* (3 vols. 1843-45). 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, exercised a great influence over his students, who especially testified to their attachment after the failure of the prosecution for alleged anti-Trinitarian heresies in his *Thorild, tillika en filosofisk eller ophilosophisk bekännelse* (1820). A number of his extempore lectures, recovered from notes, were published by Ribbing in 1856. 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 23d April 1847. His *Samlade skrifter* (13 vols. 1849-55; new ed. 1873-75) include a large number of philosophical and political essays contributed to reviews, particularly to *Literaturbladet* (1838-39), 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 1828-30, when, as again in 1840-41, he represented Upsala university in the Swedish diet.

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. 1814-16). The development of freedom is the idea that gives unity to all his historical writings. This idea is not subjective; he traces it in the darkest annals of his country. Sweden, he repeats, is the only European land that has not been trod by foreign armies, that has never accepted the yoke of serfdom. There, on the whole, the king has ever been the people's faithfulest ally, and all his great designs for the country's external and internal gain have been carried out "by the help of God and Sweden." Throughout life Geijer was what he professed to be, a seeker; and to no philosophic system did he yield absolute allegiance. Yet his writings mark a new era in Swedish history, the rise of a "critical school" whose aim is to draw the truth without distortion, and present reality without a foil.

For Geijer's biography, see his own *Minnen* (1834), which contains copious extracts from his letters and diaries; Malmström, *Minnet af E. G. Geijer*, addressed to the Upsala students, June 6, 1848, and printed among his *Tal och estetiska afhandlingar* (1868), and *Grunddragen af Svenska vittnerhetens häfder* (1866-68); and S. A. Hollander, *Minne af E. G. Geijer* (1869).

GEIKIE, WALTER (1795-1837), a Scotch subject-painter, was born at Edinburgh, November 9, 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. His artistic talent was first manifested, while he was still very young, by attempts to cut out representations of objects in paper, and to draw figures with chalk on floors and walls. 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 Scotch manufactures, where he made very rapid progress in the use of the pencil. 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 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. The characteristics he depicts are somewhat obvious and superficial, but his humour is never coarse, and he is surpassed by few in the power of representing the broadly ludicrous and the plain and homely aspects of humble life. A series of etchings which exhibit very high excellence were published by him in 1829-31, 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), one of the greatest of the popular preachers of the 15th century, was born at Schaffhausen, March 16, 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 Sentences of Petrus Lombardus, the Commentaries of Alexander Halensis, and several of the works of Aristotle. A living interest in theological subjects, which had been awakened within him by the study of Gerson, led in 1471 to his removal to the university of Basel at that



period 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 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 Strasburg, where he continued to work with few interruptions until within a short time of his death, which occurred 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 Brandt, Beatus Renanus, Reuchlin, Melancthon, and others who survived him, abundantly show how powerful, how healthy, and how widespread had been the influence of his personal character. His sermons—bold, incisive, abounding in quaint illustrations, nor altogether wanting in instances of what would now be called bad taste—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 vollkommenen Tugenden*, and that entitled *Das irrig Schaf*. Of the rest, probably the best known is a series of lectures on his friend Seb. Brandt's well-known work the *Navicula* or *Speculum Fatorum*, of which an edition was published at Strasburg in 1511 under the following title:—*Navicula sive speculum factorum praestantissimi sacrarum literarum doctoris Joannis Geiler Keysersbergii concionatoris Argentiniensis in sermones juxta turmarum seriem divisa; suis figuris jam signata; atque a Jacobo Othero diligenter collecta. Compendiosa vitae ejusdem descriptio per Beatum Rhenanum Selestatinum.*

See Von Ammon, *Geiler's Leben, Lehren, und Predigten* (1826); Stöber, *Essai Historique et Littéraire sur la Vie et les Sermons de Geiler* (1834); and C. Schmidt in Herzog's *Real-Encycl.*, iv. 714 (1855).

GEISSLER, HEINRICH (1814–79), a distinguished practical physicist, was born at the village of Igelshieb in Saxe-Meiningen, Germany, where he was educated as a glass-blower. After many years spent in travelling from city to city in the exercise of his craft, he settled at Bonn, where he speedily gained a high reputation, not only for his surpassing skill and ingenuity of conception in the fabrication of physical apparatus, but for his comprehensive knowledge, acquired chiefly in later life, of the natural sciences. With Plücker, in 1852, by means of an ingeniously contrived instrument, in which mercury was made to compensate for the expansion of the glass, 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 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 (see *ELECTRICITY*, vol. viii. p. 64). Among other apparatus contrived by him are his vaporimeter, mercury air-pump, balances, normal thermometer, and areometer. From the university of Bonn, on the occasion of its jubilee, he received the honorary degree of doctor of philosophy. He died on the 24th of January 1879, in the sixty-fifth year of his age. See A. W. Hofmann, *Ber. d. deut. chem. Ges.*, 1879, p. 148.

GELA, an ancient city on the south coast of Sicily, on a river of the same name, near the site of the modern Terranuova between Girgenti and Camerina. Founded by a joint colony of Cretans and Rhodians (the latter mainly

from the city of Lindus), it soon rose to wealth and power, and by 582 B.C. it was able to become the mother-city of Agrigentum, by which it was however destined before long to be surpassed. The most important among its rulers were the following:—Cleander, who subverted the oligarchy and made himself despot (505–498 B.C.); Hippocrates, his brother, who raised Gela to its highest pitch of eminence (498–491 B.C.); Gelon, who immediately succeeded Hippocrates, and rapidly pursued the same career of aggrandizement till in 485 B.C. he got possession of Syracuse, and gave the first blow to his native city by removing the seat of government to his new conquest; and finally Hiero, the brother of Gelon, who succeeded to the sovereignty in 478 B.C. The decadent Gela was laid waste by Phalaris of Agrigentum, and in the time of Strabo it was nothing more than a heap of ruins. Æschylus died at Gela in 456 B.C.; and it was the birthplace of Apollodorus, a comic poet of note.

GELASIUS, the name of two popes.

GELASIUS I. succeeded Felix III. in 492, and 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 was also the first decidedly to assert the supremacy of the papal over the imperial power, and the superiority of the pope to the general councils. He is the author of *De duabus in Christo naturis adversus Eutychen et Nestorium*. Five of his letters have also come down to us, and he is most probably the author of *Liber Sacramentorum*, published at Rome in 1680; but the so-called *Decretum Gelasii de libris recipiendis et non recipiendis* is evidently a forgery. Gelasius died in 496, and was canonized, his day being the 18th November.

GELASIUS II. (Giovanni da Gaeta) was of noble descent, and was born at Gaeta about 1050. He received his theological education in the abbey of Monte Casino, and afterwards held the office of chancellor under Urban II., and of cardinal-deacon under Pascal II. On the death of Pascal II. he was elected pope by the cardinals, 18th January 1118, and when his person was seized by Cencius Frangipani, a partisan of the emperor Henry V., he was almost immediately set at liberty through the general uprising of the people in his behalf. The sudden appearance of the emperor, however, compelled him to leave Rome for Gaeta, and the imperial party chose an anti-pope, Burdinus, archbishop of Braga, under the name of Gregory VIII. Gelasius, at a council held at Capua, fulminated bulls of excommunication against his ecclesiastical rival and the emperor; and under the protection of the Norman princes he was able to return to Rome, where he stayed for a time in partial concealment, but having barely escaped capture by the Frangipani while celebrating mass in the church of St Praxede, he left the city, and after wandering through various parts of Italy and France died in the abbey of Clugny, January 19, 1119.

GELATIN. When intercellular connective tissue, as met with in skin, tendons, ligaments, and the fasciæ of the muscles, of which it forms the basis, is treated with water, preferably hot, or in presence of dilute acids, for some time, a solution is obtained which in cooling solidifies to a jelly. The dissolved substance bears the name of *Gelatin* or *Glutin*.

The same substance is obtained when the matrix of bones is submitted to similar treatment, after previous removal of the lime salts by means of mineral acids. Again, when unossified cartilage, as for instance the bone-cartilages of the vertebrate foetus, is treated with water or dilute acids, a solution is obtained which also gelatinizes on cooling. The coagulation in this case, however, is due, not to gelatin, but to a closely allied substance called chondrin. At one

time it was supposed that in each of these three cases the gelatinizing materials obtained were formed by the hydration or by a physical metamorphosis of a different substance pre-existing in the respective tissues, to which the names *collagen*, *ossein*, and *chondrogen* were given respectively—the two former yielding gelatin, and the last chondrin.

Further experiments have made it more probable that gelatin and chondrin do not differ essentially from their parent tissues, analyses of tendons and of gelatin or isinglass (a very fine form of gelatin obtainable from the sturgeon) agreeing within the range of experimental error. At the same time, as Foster observes in the case of chondrin, the fact that its extraction from cartilage requires an amount of boiling with water, much more than would be necessary to dissolve the same amount of dried product, points rather the other way. Most probably the change which occurs is of a purely physical character.

True gelatinous tissue occurs in all mature vertebrates, with the single exception, according to Hoppe-Seyler, of that in other respects anomalous vertebrate, *Amphioxus lanceolatus*. In the embryo it does not appear till late in foetal life, chondrin being found instead; and the change which brings gelatin into the place of chondrin is effected, not by a metamorphosis of the latter, but by its removal, and the independent formation of gelatin. The tissue in question was believed to be peculiar to *Vertebrata* until Hoppe-Seyler discovered it in the bodies of *Octopus* and *Sepiola*. By boiling these cephalopods with water he obtained large quantities of gelatin free from chondrin, but in an extension of his experiments to other invertebrates, as cockchafers and *Anodon* and *Unio*, no such tissue could be detected. Gelatin, as such, is not met with in any of the normal fluids of the body, but occurs in the blood in cases of *leukæmia*.

Various qualities of impure gelatin are prepared on the large scale by boiling up the hides of oxen, skins of calves, and spongy parts of horns; from any of the crude gelatins the pure substance may be obtained by bleaching with sulphurous acid and steeping repeatedly in warm water, when in the state of soft jelly.

Pure gelatin is an amorphous, brittle, nearly transparent substance, faintly yellow, tasteless, and inodorous, neutral to vegetable colours, and unaltered by exposure to dry air. Submitted to analysis it exhibits an elementary composition agreeing closely with that of chondrin, containing in round numbers C 50, H 7, N 18, O + S 24 per cent.; whilst chondrin contains about 3 per cent. less nitrogen and more oxygen.

Nothing is known with any certainty as to its chemical constitution, or of the mode in which it is formed from albuminoids. Besides a similarity in elementary constituents, 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 alkalies, 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 corrosive sublimate, strong alcohol, and tannic acid.

According to Wanklyn, gelatin is distinctly differentiated from such substances as *casein* and *albumin* by a marked difference in behaviour when treated successively with boiling potash and alkaline permanganate. All nitrogenous organic substances yield large quantities of ammonia when decomposed by boiling with these solutions; but whereas albuminoids give up their ammonia at two successive stages, one of which is achieved by the action of potash alone, the other on the subsequent addition of permanganate, gelatin yields the same amount after the action of permanganate

alone, as the total obtainable by the successive actions of the two reagents. Now, as there appear to be good grounds for believing the molecule of albuminoids to contain one or more urea-residues, and as urea, and presumably therefore a urea-residue, would yield its ammonia to potash alone, Wanklyn concludes that gelatin differs in constitution from albuminoids by containing no urea. On the other hand, as Foster observes, the behaviour of gelatin as a food (see below), in diminishing the amount of fat used by an animal fed partly on it, as well as the quantity of nitrogen abstracted from other sources, is readily intelligible on the hypothesis that it splits into a urea and a fat moiety.

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 (see below). 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 carbonate of lime. Gelatin so treated has been called *meiagelatin*.

Strange to say, 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 per cent. 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, as that of the water-bath, 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. 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 agrees with its near allies, chondrin and elastin, and differs from the great body of proteids, the characteristic solid products of the decomposition of which are leucin and tyrosin. At the same time the formation of glycocoll differentiates it from chondrin, from which, moreover, it can be readily distinguished by its non-precipitability by acetate of lead.

When it is mixed with copper sulphate a bright green liquid is formed, from which the copper cannot be thrown down free of organic matter. Addition of potash to the