Poland May 25, 1661. of French parents, who returned to their native country shortly after their son's birth. and settled at Rouen. He was educated at the Jesuits' college there, and was received into the order at the age of nineteen. Soon after his admission a dispute with the archbishop regarding certain points in theology compelled him to leave Rouen. He went to Rome, but did not long remain there; and on his return to France he retired to the college of the Jesuits at Paris, where he spent the rest of his life, studying and writing, and fulfilling with much success his duties as a college lecturer. He seems indeed to have been an admirable teacher, having, as his works show, a great power of lucid and precise exposition. Buffier's object in his *Traité des vérités premières*, his best known philosophical work, is to discover the ultimate principles upon which all knowledge is based, to lay down "propositions so clear and obvious that they can neither be proved nor refuted by other propositions of greater perspicuity." The basis of all human knowledge and the foundation of every other truth he finds in the sense we have of our own existence and of what we feel within ourselves. He thus takes as the foundation of his philosophy substantially the same ground as Descartes, *cogito ergo sum;* but the superstructure is reared on very different principles. Descartes tried to reach a knowledge of the not-self by an *a priori* or metaphysical proof of the divine existence. Buffier rejects this sort of evidence as useless. I want, he in effect says, to obtain a certain knowledge of what is distinct from myself, and this I can never do by mere metaphysical demonstration, which only gives me the hypothetical certainty of ideas logically connected together; in order to know what exists distinct from myself I must have recourse to "common sense." Common sense he defines to be "that disposition which nature has placed in all or most men, in order to enable them, when they have arrived at the age and use of reason, to form a common and uniform judgment with respect to objects different from the internal sentiment of their own perception, which judgment is not the consequence of any anterior principle." The truths which this "disposition of nature" obliges us to accept can neither be proved nor disproved; they are admitted in all countries and at all times; and they are practically followed by all men, even by those who reject them speculatively. But Buffier does not claim for the truths of common sense the same absolute certainty as characterizes either the knowledge we have of our own existence or the logical deductions we make from our thoughts; they possess merely the highest probability, and the man who rejects them is, as he pointedly puts it, to be considered a fool, but he is not in so doing guilty of a contradiction. The greater part of the *Traité* is devoted to an enumeration and examination of those truths. They are such as the following:—"There are other beings and other men in the world besides myself;" "All men have not combined to deceive me." But axioms like "2 + 2 = 4," or "the whole is greater than a part" are mere logical connections of ideas, not truths of common sense. Buffier's aversion to scholastic refinements and unmeaning definitions has not unfrequently given to his writings an appearance of shallowness and want of metaphysical insight; but his merit as one of the earliest to recognize the psychological as distinguished from the metaphysical side of Descartes's principle, and to use it, with no inconsiderable skill, as the basis of an analysis of the human mind, similar to that enjoined by Locke, will always be acknowledged. In this he has anticipated the spirit and method as well as many of the results of Reid and the Scotch school. The *Traité* appeared in 1717, and was followed in 1724 by the *Eléments de Métaphysique*. Buffier also wrote a "French Grammar on a new plan," and a number of historical essays. Most of his works appeared in a collected form in 1732, and an English translation of the *Traité* was published in 1780.

BUFFON, George Louis Leclerc, Comte de, was born on 7th September 1707, at Montbard, in Burgundy, and died at Paris on the 15th April 1788. His father, M. Leclerc de Buffon, was councillor of the Burgundian parliament, and his mother, Anne Christine Marlin, appears to have possessed considerable natural gifts. Buffon was the eldest of five children, and does not seem to have been in any way a precocious child. On the contrary, he seems from his earliest years to have been characterized more especially by great perseverance, patience, knowledge of the value of time, and exceptional powers of steady application and protracted labour. He was originally destined to his father's profession, and studied law at the college of Jesuits at Dijon; but he soon exhibited a marked predilection for the study of the physical sciences, and more particularly for mathematics. Whilst at Dijon he made the acquaintance of Lord Kingston, a young Englishman, who was at the time staying there along with his tutor, a man of ability and discernment. In this agreeable companionship, Buffon travelled through Italy, being then nineteen years of age. Returning to France, he commenced to study at Angers, still in company with Lord Kingston; but having quarrelled with a young Englishman at play, and subsequently wounded him, he was compelled to leave this town. He thereupon removed to Paris, and during his sojourn in the capital he translated Newton's *Fluxions* and Hales's *Vegetable Statics*, which he subsequently presented to the Academy of Sciences. From Paris he proceeded to England, where he remained three months; but his travels seem to have ended here. At twenty-five years of age he succeeded to a considerable property, inherited from his mother, and from this time onward his life was a completely independent one, and he was enabled to devote himself entirely to his scientific pursuits. He returned now to France, and lived partly at Montbard and partly at Paris.

Though loving pleasure, and not keeping himself free from the prevalent vices of the age in which he lived, Buffon spent the remainder of his life in regular scientific labour, employing an amanuensis, and thus securing a permanent record of his work. At first he directed his attention more especially to mathematics, physics, and agriculture, and his chief original papers are connected with these subjects. In the spring of 1739 he was elected a member of the Academy of Sciences; and at a later period of the same year he was appointed keeper of the *Jardin du Roi* and of the Royal Museum. This appears to have finally determined him to devote himself to the biological sciences in particular, and he commenced to collect materials for his *Natural History*. In the preparation of this voluminous work, he associated with himself Daubenton, to whom the descriptive and anatomical portions of the treatise were entrusted, and the first three volumes made their appearance in the year 1749. In the year 1752 (not in 1743 or 1760, as sometimes stated), he married Marie Françoise de Saint-Belin. He seems to have been fondly attached to her, and felt deeply her death, which took place at Montbard in 1769. The remainder of Buffon's life, as a private individual, presents nothing of special interest. He belonged to a very long-lived race, his father having attained the age of ninety-three, and his grandfather eighty-seven years. He died himself at the age of eighty-one, of vesical calculus, having refused to allow of any operation for his relief. He left one son, George Louis-Marie Leclerc, who was an officer in the French army, and who died by the guillotine, at the age of thirty, on the 10th July 1793 (22 Messidor, An II.), having espoused the party of the duke of Orleans.

Buffon was a member of the French Academy, perpetual treasurer of the Academy of Sciences, Fellow of the Royal Society of London, and member of the Academies of Berlin, St Petersburg, Dijon, and of most of the learned societies then existing in Europe. Of handsome person and noble presence, endowed with many of the external gifts of nature, and rejoicing in the social advantages of high rank and large possessions, he is mainly known by his published scientific writings. Without being a profound original investigator, in the modern sense of this term, Buffon possessed considerable power of generalization, along with the art of expressing his ideas in a clear and generally attractive form. His chief defects as a scientific writer are, that he was given to excessive and hasty generalization, so that his hypotheses, however seemingly brilliant, are often destitute of any sufficient basis in observed facts, whilst his literary style is not unfrequently theatrical and turgid, and a great want of method and order is commonly observable in his writings.

His great work is the *Histoire Naturelle, générale et particulière;* and it can undoubtedly claim the merit of having been the first work to present the previously isolated and apparently disconnected facts of natural history in a popular and generally intelligible form. The sensation which was made by its appearance in successive parts was very great, and it certainly effected much good in its time by generally diffusing a taste for the study of nature. For a work so vast, however—aiming, as it did, at being little less than a general encyclopædia of the sciences,—Buffon's capacities may, without disparagement, be said to have been insufficient, as is shown by the great weakness of parts of the work (such as that relating to mineralogy). The *Histoire Naturelle* passed through several editions, and was translated into various languages. The edition most highly prized by collectors, on account of the beauty of its plates, is the first, which was published in Paris (1749–1804) in forty-four quarto volumes, the publication extending over more than fifty years. In the preparation of the first fifteen volumes of this edition (1749–67) Buffon was assisted by Daubenton, and subsequently by Guéneau de Montbéliard, the Abbé Bexon, and Sonnini de Manoncourt. The following seven volumes form a supplement to the preceding, and appeared in 1774–89. These were succeeded by nine volumes on the Birds (1770–83), and these were followed by five volumes on Minerals (1783–88). The remaining eight volumes, which complete this edition, appeared after Buffon's death, and comprise Reptiles, Fishes, and Cetaceans. They were executed by Lacépède, and were published in successive volumes between 1788 and 1804. A second edition was commenced in 1774 and completed in 1804, in thirty-six volumes quarto. It is in most respects similar to the first edition, except that the anatomical descriptions are suppressed, and the supplement recast. Of the remaining editions of Buffon, the best is that which was commenced under the editorship of Lamouroux, and completed under that of Desmarets, in forty volumes octavo (1824–32). It is the only modern edition in which the anatomical descriptions of Daubenton are preserved. Though not without his enemies—scientific and clerical—Buffon had many warm friends, and his death was marked by the delivery of highly laudatory addressess, by Condorcet at the Academy of Sciences, Vicq-d'Azir at the Académie Française, and Bressonet before the Society of Agriculture. Extravagantly belauded by some, and vehemently attacked by others, we can recognize his merits without blinding ourselves to his defects.

This brief notice of his life may be fitly closed by the following quotation from Cuvier, in which the great French naturalist, whilst rejecting some speculations which recent science has generally accepted as probable, ascribes to Buffon the honour of being the first to clearly apprehend what is now admitted as the true principle of guidance in investigating the order of the universe:—"It is impossible to defend, in all their details, either the first or the second of Buffon's theories of the earth. This comet which strikes off portions of the sun, these vitrified and incandescent planets which refrigerate by degrees, some more rapidly than others, those organized beings which appear successively on the surface of the planets, as their temperature becomes sufficiently lowered, can only be regarded as flights of fancy. But Buffon has not less the merit of having been the first to point out clearly that the actual condition of the globe is the result of a succession of changes, of which we can find the evidences to-day; and it is he who first drew the observation of all investigators to the phenomena by which these changes can be unravelled." (H. A. N.)

BUG, a name common to all the species belonging to the *Cimicidæ*, a family of Hemipterous Insects, the best known example of which is the House Bug or Bed Bug (*Cimex lectularius*). This disgusting insect is of an oval shape, of a rusty red colour, and, in common with the whole tribe to which it belongs, gives off an offensive odour when touched; unlike the others, however, it is wingless. The bug is provided with a proboscis, which when at rest lies along the inferior side of the thorax, and through which it sucks the blood of man, the sole food of this species. It is nocturnal in its habits, remaining concealed by day in crevices of bed furniture, among the hangings, or behind the wall paper, and shows considerable activity in its nightly raids in search of food. The female deposits her eggs at the beginning of summer in crevices of wood and other retired situations, and in three weeks they emerge as small, white, and almost transparent larvæ. These change their skin very frequently before undergoing metamorphosis, which in their case is "incomplete," the pupa closely resembling the perfect insect, and attaining its full development in eleven weeks. Two centuries ago it was a rare insect in Britain, and probably owes its name, which is derived from a Celtic word signifying "ghost" or "goblin," to the terror which its attacks at first inspired. Other species of bugs suck the blood of many of the lower warm-blooded animals, but the majority, as in the genus *Tingis*, confine themselves to the juices of plants.

BUGENHAGEN, Johann (1485–1558), surnamed Pomeranus, a German Reformer, was born at Wollin, in Pomerania, on the 24th June 1485. He was educated at the university of Greifswald, and gained high distinction as a classical scholar. In 1505 he was made rector of a school at Treptow, and was soon afterwards selected by the abbot of a neighbouring convent as one of the lecturers to the monks. In 1520 he received a copy of Luther's work on the Babylonish captivity, which speedily wrought a change in his views. He warmly embraced the principles of the Reformation, and succeeded in bringing over the aged abbot and several others. He made his way to Wittenberg in the following year, was warmly received by Luther and Melanchthon, and quickly became a foremost man in the Reformation movement. He was specially qualified for organizing the new church, and his activity spread itself over a wide district. In 1528 he arranged the church affairs of Brunswick and Bamburg; in 1530 those of Lubeck and Pomerania. In 1537 he was invited to Denmark by king Christian III., and remained five years in that country, organizing the church and schools. He passed the remainder of his life at Wittenberg, braving all the perils of war and persecution rather than desert the place that was dear to him as the home of the Reformation. He died on the 20th April 1558. Among his numerous works is a history of Pomerania, which remained unpublished till 1728, *Pomerania in IV. Libros Divisa.*

BUGULMA, a town of European Russia, in the government of Samara, 243 miles from the city of that name, on the small river Bugulminka, a sub-tributary of the Volga, in 54° 32′ N. lat. and 52° 47′ E. long. The town rose into existence about 1741–5, and was peopled by soldiers, exiles, and peasants. During the Pugacheff insurrection it was vainly besieged by the rebels. In 1781 it was made a town of the Ufa government; in 1806 it was transferred to Orenburg, and in 1851 to Samara. Its principal importance is derived from its situation at the junction of two great roads from Ufa and Orenburg, by which it maintains an extensive transit trade. A great annual fair is held from 14th to 21st of September (o. s.). Population in 1867, 5455.

BUGURUSLAN, a town of European Russia in the government of Samara, situated at the junction of the rivers Kinell and Tarkhanka, 177 miles E.N.E. of Samara, in 53° 39′ N. lat. and 52° 25′ E. long. It dates from about 1748, and in the time of the Pugacheff revolt was the scene of the outrages of Karpoff's band. Its changes from government to government coincide with those of Bugulma. The principal buildings are two or three churches, a monastery, a hospital, and a caravanserai. It manufactures leather, wax, potash, and beer, and carries on a pretty extensive trade. There are two annual fairs. Population in 1867, 7450.

BUHLE, Johann Gottlieb (1763–1821), distinguished as a scholar and an historian of philosophy, was born at Brunswick, and graduated at the university of Göttingen, where he obtained a chair at a very early age. Thence he was called to the professorship of ancient languages at Moscow. After his return to Brunswick he was appointed to the chair of natural law, which he held till his death in 1821. Buhle's activity was great, and the productions of his pen are numerous. He edited *Aratus* and part of *Aristotle* (the Bipontine edition, 5 vols.), the first volume of which is a masterly survey of Aristotelian literature. His fame, however, is principally derived from his labours on the history of philosophy. The *Geschichte der philos. Vernunft*, 1793, was suspended after the first volume, but the *Handbuch der Geschichte der Philosophie*, 8 vols. 1796–1804, is a very complete and valuable work. More important than either of these is the *Geschichte der neuern Philosophie*, forming one of the great series of histories of the sciences from the Renaissance. It is a work of much learning, and is well written; its faults are general weakness in critical appreciation and want of due sense of proportion. The *History of Modern Philosophy* has been translated into French, 6 vols. 1806.

BUHL-WORK, otherwise Bool, Boule, or Boulle-work, is a kind of inlaying and ornamentation of cabinet-work, so named after the inventor André Charles Boule, a celebrated French cabinetmaker (1642–1732) By a happy selection of different woods from India and Brazil, arranged with great taste, and the use of brass, ivory, gold, tortoise-shell, &c., Boule produced upon his furniture arabesques and pictures, representing a variety of animals, flowers, and fruits; and he finally succeeded in producing historical scenes, as battles and hunts, landscapes, and other artistic effects. Louis XIV. appreciated his abilities, gave him lodgings in the Louvre, and, in 1672, appointed him engraver in ordinary of the royal seals. In the patent authorizing this he received also the designations of "architect, painter, carver in mosaic, artist in cabinet-work, chaser, inlayer, and designer of figures." His skill was great in all these branches, and he carried them to a high degree of artistic perfection in timepieces, screens, furniture, and other articles. He worked for the royal residences and for foreign princes, and attained fortune and position.

The beginnings of art in carving are found amongst the relics of prehistoric races, and when it arrived at the degree of perfection it afterwards attained in the East, inlaying was a natural result. We find this to have been practised by the ancient Egyptain and other Asiatic races. Its attendant, veneering, was also employed by them, workmen applying the veneer with glue being represented on the Egyptian monuments. As civilization advanced westward, the Greeks and Romans followed in the art, the latter race inlaying their furniture with marquetry or tarsia-work, using ivory, ebony, box, palm, bird's-eye maple, beech, and other woods. Their bronze articles they damascened with ornaments of the precious metals and metallic amalgams. The spirit of the Middle Ages was adverse to the development of this art, and but few traces of it are found. In the South Kensington Museum is a coffer of cypress, with flat surface imagery filled in with coloured wax composition, that dates from the 14th century. The Venetians derived their marquetry from Persia and India, as is indicated by the geometric patterns inlaid with ivory, metal, and woods, stained of various colours. Florence took a prominent place in this manufacture in the 15th century. Certosina-work was the result; it was so called from the great Certosa, Charterhouse, or Carthusian monastery, between Milan and Pavia, in the choir-fittings of which this kind of ornament, ivory inlaid into solid cypress and walnut wood, is employed. Work in the Persian style, with its geometric figures, still reaches us from Bombay, the present great seat of the Parsees.

The Renaissance artists chiefly employed wood in making furniture, ornamenting it with gilding and painting, and inlaying it with agate, carnelian, lapis-lazuli, marble of various tints, ivory, tortoise-shell, mother-of-pearl, and various woods. Boule improved upon this by inlaying brass devices into wood or tortoise-shell, which last he greatly used according to the design he had immediately in view, whether flowers, scenes, scrolls, &c.; to these he sometimes added enamelled metal. In this process the brass is thin, and, like the ornamental wood or tortoise-shell, forms a veneer. In the first instance the production of his work was costly, owing to the quantity of valuable material that was cut away and wasted, and, in addition, the labour lost in separately cutting for each article or copy of a pattern. By a subsequent improvement Boule effected an economy by gluing together various sheets of material and sawing through the whole, so that an equal number of figures and matrices were produced at one operation. Boule adopted from time to time various plans for the improvement of his designs. He placed gold-leaf or other suitable material under the tortoise-shell to produce such effect as he required; he chased the brass-work with a graver for a like purpose, and, when the metal required to be fastened down with brass pins or nails, these were hammered flat and disguised by ornamental chasing. He also adopted, in relief or in the round, brass feet, brackets, edgings, and other ornaments of appropriate design, partly to protect the corners and edges of his work, and partly for decoration. He subsequently used other brass mountings, such as claw-feet to altars and pedestals, or figures in high or low relief, according to the effect he desired to produce. Boule's contemporary, Reisner, a German, used a variety of woods, tulip-wood more especially, in the production of flowers and other ornamental designs, contrasting the dark with the light kinds, crossing the grain, and employing other ingenious devices. After him this particular style was called Reisner-work. The Spaniards of the 16th century used silver for inlaying.

See *Grande Dictionnaire Universel du XIXe siècle*; Pierer's *Universal-Lexikon*, Altenberg, 1868; *Encyclopédie des Gens du Monde*; Bemrose's *Buhl-work and Marquetry*, a very useful manual; Pollen's *Furniture and Wood-work*.

BUILDING

Relation of building to architecture.

THE art of building comprises the practice of civil architecture, or the mechanical operations necessary to carry the designs of the architect into effect. It is not unfrequently called *practical architecture;* but the adoption of this term would tend only to confuse, by rendering it difficult to make the distinction generally understood between architecture as a fine or liberal art and architecture as a mechanical art. The execution of works of architecture necessarily includes building, but building is frequently employed when the result is not architectaral; a man may be a competent builder without being an architect, but no one can be an accomplished architect unless he be competent to specify and direct all the operations of building. A scientific knowledge of the principles of masonry, carpentry, joinery, &c., and of the qualities, strength, and resistance of materials, though of the utmost importance to an architect, must be attended by a minute acquaintance with a great variety of less ambitious details. Such are those which relate to the arrangement of a plan for the greatest possible degree of convenience on the smallest space, and at the least expense; its transference to the ground; the preparation and formation of foundations; the arrangement and construction of drains, sewers, and vent-shafts; the varieties of walling with stone, and of laying bricks in brickwork; the merit of the various modes of bonding and tying walls, both lengthwise and across; the arrangement of gutters on roofs, to get sufficient fall, and to conduct the water to the least inconvenient places for fixing trunks to lead it down; the arrangement and formation of flues; the protection of walls from damp, of timber from moisture and stagnant air, and of metals generally from exciting causes; the cost of materials and labour, and the quantity of each required to produce certain results. Together with these, an architect ought to be practically acquainted with all the modes of operation in all the trades or arts employed in building, and to be able minutely to estimate beforehand the absolute cost involved in the execution of a proposed structure. The power to do the latter necessarily involves that of measuring work, and ascertaining the quantities done. These things may certainly be referred to the surveyor or measurer, but they are not the less incumbent on the architect, who cannot be said to be thoroughly master of building, or the practice of his profession, unless he be skilled in these operations.

Building includes what is called construction, which is the branch of the science of architecture relating to the practical execution of the works required to produce any structure; it will therefore be necessary to explain the subject in a general manner before entering upon building in detail.

It may, perhaps, be useful to premise that, should it occur to some readers that the present article has too great a tendency to supply information on the manner of building in a modern style, and that the earlier method is not elaborated, it must be remembered that, although the styles of architecture have varied at different periods, buildings, wherever similar materials are employed, must be constructed on much the same principles. Greater scientific knowledge of the natures and properties of materials has, however, given to the modern workman immense advantages over his mediæval brother craftsman, and caused many changes in the details of the trade, or art of building, although stones, bricks, mortar, &c., then as now, formed the element of the more solid parts of all edifices. The introduction of fir, too, in place of the more solid and durable timber oak, has likewise occasioned similar changes, too numerous to mention in detail, in the sister arts of carpentry and joinery, probably also causing the division of the carpenter's trade of the mediæval period. Certain exceptional features of mediæval work did exist, and most, if not all, will, it is hoped, be found referred to in this article.

General Principles of Construction.

The object of construction is to adapt and combine fit materials in such a manner that they shall retain in use the forms and dispositions assigned to them. If an upright wall be properly constructed upon a sufficient foundation, the combined mass will retain its position, and bear pressure acting in the direction of gravity, to any extent that the ground on which it stands and the component materials of the wall can sustain. But pressure acting laterally has a necessary tendency to overturn a wall, and therefore it will be the aim of the constructor to compel, as far as possible, all forces that can act upon an upright wall to act in the direction of gravity, or else to give it permanent means of resistance in the direction opposite to that in which a disturbing force may act. Thus when an Arch. arch is built to bear against an upright wall, a buttress or other counterfort is applied in a direction opposed to the pressure of the arch. In like manner the inclined roof of Roof. a building, spanning from wall to wall, tends to thrust out the walls; and hence a tie is applied to hold the opposite sides of the roof together at its base, where alone a tie can be fully efficient, and thus the roof is made to act upon the walls wholly in the direction of gravity; or where an efficient tie is inapplicable, buttresses or counterforts are added to the walls, to enable them to resist the pressure outwards. A beam laid horizontally from wall to wall, as Beam. a girder to carry a floor and its load, may sag or bend downwards, and tend thereby to force out the walls; or the beam itself may break. Both these contingencies are obviated by trussing, which renders the beam stiff enough to place its load on the walls in the direction of gravity, and strong enough to carry it safely. Or if the beam be rigid in its nature, or uncertain in its structure, or both (as cast-iron is), and will break without bending, the constructor, by the smith's art, will supply a check and ensure it against the possible contingency.

Perfect stability, however, is not to be attained with materials which are subject to influences beyond the control of man, and all matter is subject to certain influences of that nature. The influences mostly to be contended against are heat and humidity, the former of which produces movement of some kind or to some extent in all bodies; the latter, movement in many kinds of matter; whilst the two acting together contribute to the disintegration or decay of materials available for the purposes of construction. These pervading influences the constructor seeks to counteract, by the selection and disposition of his materials accordingly. From the tenacity of wrought iron, and its almost plastic character in the hands of the smith, it is employed to tie together other more bulky but less costly and more rigid materials; but on account of its exceeding susceptibility of heat, and its consequent expansion and contraction, wrought iron must be used in short lengths only, unless where protected from great alternations of heat and cold. The rapid decay, too, of wrought iron when exposed to humidity, and especially when it is alternately wet and dry will teach the constructor not to expect enduring stability