

logical system, and he desired that his much larger work, *An Investigation of the Laws of Thought, on which are founded the Mathematical Theories of Logic and Probabilities*, published in 1854, should alone be considered as containing a mature statement of his views. Nevertheless, there is a charm of originality about his earlier logical work which no competent reader can fail to appreciate, and the introduction gives striking evidence of his profound views and wide reading.

It is not easy to give in a few words a correct notion of Boole's logical system, and only those who are conversant with the principles of symbolical reasoning can exactly apprehend his position. He did not regard logic as a branch of mathematics, as the title of his earlier pamphlet might be taken to imply, but he pointed out such a deep analogy between the symbols of algebra and those which can be made, in his opinion, to represent logical forms and syllogisms, that we can hardly help saying that logic is mathematics restricted to the two quantities, 0 and 1. By unity Boole denoted the universe of thinkable objects; literal symbols, such as  $x, y, z, v, u$ , &c., were used with the elective meaning attaching to common adjectives and substantives. Thus, if  $x$  = horned, and  $y$  = sheep, then the successive acts of election represented by  $x$  and  $y$ , if performed on unity, give the whole of the class *horned sheep*. Boole showed that elective symbols of this kind obey the same primary laws of combination as algebraical symbols, whence it followed that they could be added, subtracted, multiplied, and even divided, almost exactly in the same manner as numbers. Thus,  $1 - x$  would represent the operation of selecting all things in the world except *horned things*, that is, *all not horned things*, and  $(1 - x)(1 - y)$  would give us *all things neither horned nor sheep*. By the use of such symbols propositions could be reduced to the form of equations, and the syllogistic conclusion from two premises was obtained by eliminating the middle term according to ordinary algebraic rules.

Still more original and remarkable, however, was that part of his system, fully stated in his *Laws of Thought*, which formed a general symbolic method of logical inference. Given any propositions involving any number of terms, Boole showed how, by the purely symbolic treatment of the premises, to draw any conclusion logically contained in those premises. The second part of the *Laws of Thought* contained a corresponding attempt to discover a general method in probabilities, which should enable us from the given probabilities of any system of events to determine the consequent probability of any other event logically connected with the given events. Soon after its publication this method was the subject of a controversy in the *Philosophical Magazine*; but it cannot be said that the exact value of this part of his works has ever been clearly ascertained.

It is often supposed that mathematicians are deficient in judgment and knowledge of other matters. In Boole this was not the case; for though he published little except the mathematical and logical works already mentioned, his acquaintance with general literature was wide and deep. Dante was his favourite poet, and he preferred the *Paradiso* to the *Inferno*. The metaphysics of Aristotle, the ethics of Spinoza, the philosophical works of Cicero, and many less celebrated works of a kindred character, were also frequent subjects of study. His reflections upon scientific, philosophical, and religious questions are to be mainly gathered from four addresses upon *The Genius of Sir Isaac Newton, The Right Use of Leisure, The Claims of Science, and The Social Aspect of Intellectual Culture*, which he delivered and printed at different times.

The personal character of Boole inspired all his friends with the deepest esteem. He was marked by the modesty

of true genius, and his life was given to the single-minded pursuit of truth. Though he received a royal medal for his memoir of 1844, and the honorary degree of LL.D. from the University of Dublin, it may be said that he neither sought nor received the ordinary rewards to which his discoveries would entitle him.

On the 8th of December 1864, in the full vigour of his intellectual powers, Boole died of an attack of fever, ending in suffusion on the lungs. An excellent sketch of his life and works, by the Rev. R. Harley, F.R.S., to which the present writer is indebted for many particulars, is to be found in the *British Quarterly Review* for July 1866, No. 87. (w. s. j.)

BOOM, a town of Belgium, in the province of Antwerp, and 12 miles S. of that city, at the junction of the Brussels Canal with the River Rupel. It is an active industrial town, possessing tanneries, salt-works, starch-factories, breweries, and brick and tile works, and carries on a considerable trade. Population of the commune, 10,064.

BOOMERANG, a missile instrument of the Australian aborigines, in the use of which they are very dexterous. It consists of a piece of hard wood, with the curve of a parabola, and is about 2 feet long,  $2\frac{1}{2}$  inches broad,  $\frac{1}{3}$  inch thick, and rounded at the extremities. One side is flat, the other is rounded, and it is brought to a bluntish edge. It is discharged with the hand by one end, the convex edge being forward and the flat side upwards. After advancing some distance, and ascending slowly in the air with a quick rotatory motion, it begins to retrograde, and finally falls to the ground behind the thrower. A weapon of similar form, but wanting the return flight, has been found in use among savage tribes both in India and Africa. A very full comparative account of the boomerang is contained in Colonel A. H. Lane Fox's lecture on "Primitive Warfare" (*Jour. of the Royal United Service Institution*, vol. xii. No. 51).

BOOTH, BARTON, an English tragedian, descended from an ancient family in Lancashire, was born in 1681. He was educated at Westminster school under the celebrated Dr Busby, and his success in the Latin plays, customarily performed there by the scholars, gave him an inclination for the stage. He was intended for the church; but at seventeen years of age he ran away from school, and after some vicissitudes obtained employment in a theatrical company in Dublin. His first appearance was hailed with applause; and he continued to improve daily. After two successful campaigns in Ireland he returned to his native country, having first reconciled himself to his friends. Betterton, to whom he had an introduction, received him with great cordiality, and gave him all the assistance in his power. His success at London was complete, and he established his reputation as only second to his great instructor. He was indebted to a happy coincidence of merit and chance for the celebrity which he at length attained in the character of Cato. The Whigs, in favour of whose principles Addison's tragedy had been written, thought it their duty to support it strongly; while the Tories, at every passage susceptible of a popular turn, were no less vehement in their approbation, and at the close the actor was presented by Lord Bolingbroke with a purse of fifty guineas, "as a slight acknowledgment of his honest opposition to a perpetual dictator, and his dying so bravely in the cause of duty." Booth was twice married,—first to a daughter of Sir William Barkham, Bart., and afterwards to Miss Hester Santlow, an actress of great merit. During the twenty years of his management the theatre was in the greatest credit; and his death, which happened on the 10th of May 1733, contributed not a little to its decline. Booth was a man of excellent character, and greatly esteemed for his amiability and goodness of heart.

(See *Memoirs of the Life of Barton Booth*, 1733; Gibber, *Lives and Characters of the most Eminent Actors*, &c., pt. i., 1753.)

BOOTHIA FELIX, a peninsula of British North America, between lat. 69° and 72° N., and long. 92° and 97° W. It was discovered by Captain (afterwards Sir James) Ross, in 1830, and was named after Sir Felix Booth, who had fitted out the expedition. It forms the western side of the gulf of the same name into which Prince Regent's Inlet leads from Baffin's Bay. From the American shore it is almost separated by lakes and inlets; and a narrow channel known as Bellot Strait intervenes between it and North Somerset Island, which was discovered by Sir E. Parry in 1819. The peninsula is not only interesting for its connection with the Franklin expedition and the Franklin search, but is of scientific importance from the north magnetic pole having been first distinctly localized there by Ross.

BOPP, FRANCIS, glottologist, was born at Mainz on the Rhine, September 14, 1791. In consequence of the political troubles of that time, his parents removed to Aschaffenburg, in Bavaria, where Francis received a liberal education at the Lyceum. It was here that his attention was drawn to the languages and literature of the East by the eloquent lectures of Carl J. Windischmann, who, with Creuzer, Görres, and the brothers Schlegel, was full of enthusiasm for Indian wisdom and philosophy. And further, Fr. Schlegel's book, *Ueber die Sprache und Weisheit der Inder* (Heidelberg, 1808), which was just then exerting a powerful influence on the minds of German philosophers and historians, could not fail to stimulate also Bopp's interest in the sacred language of the Hindus. He was, however, too strictly trained in grammatical and philological studies, and too eager for the scientific analysis of language, to allow the clearness of his judgment to be warped by the romantic and speculative predilections of Windischmann and Fr. Schlegel. In 1812 he went to Paris at the expense of the Bavarian Government, with a view to devote himself vigorously to the study of Sanskrit. There he enjoyed the society of such eminent men as Chézy, S. de Sacy, Langlès, and, above all, Al. Hamilton, who had acquired, when in India, a respectable acquaintance with Sanskrit, and had brought out, conjointly with Langlès, a descriptive catalogue of the Sanskrit manuscripts of the Imperial library. At that library Bopp had access not only to the rich collection of Sanskrit manuscripts, most of which had been brought from India by Father Pons early in the 18th century, but also to the Sanskrit books which had up to that time issued from the Calcutta and Serampore presses.

The first fruit of his four years' study in Paris appeared at Frankfurt-on-the-Main in 1816, under the title *Ueber das Conjugationssystem der Sanskritsprache in Vergleichung mit jenem der Griechischen, Lateinischen, Persischen, und Germanischen Sprache*, and it was accompanied with a preface from the pen of Windischmann, bearing date 16th May of that year. In this first book, Bopp entered at once on the path on which the philological researches of his whole subsequent life were concentrated. It was not that he wished to prove the common parentage of Sanskrit with Persian, Greek, Latin, and German, for that had long been established; but his object was to trace the common origin of their grammatical forms, of their inflexions from composition,—a task which had never been attempted. By a historical analysis of those forms, as applied to the verb, he furnished the first trustworthy materials for a history of the languages compared.

After a brief sojourn in Germany, Bopp came to London, where he made the acquaintance of Wilkins and Colebrooke, and became the friend of Wilhelm von Humboldt, then Prussian ambassador at the court of St James's, to whom he gave instruction in Sanskrit. He brought out, in the

*Annals of Oriental Literature* (London, 1820, pp. 1-65), an essay entitled "Analytical Comparison of the Sanskrit, Greek, Latin, and Teutonic Languages," in which he extended to all parts of the grammar what he had done in his first book for the verb alone. He had previously published a critical edition, with a Latin translation and notes, of the story of *Nala and Damayanti* (London, 1819), the most beautiful episode of the Mahābhārata, which he had with genial tact culled from the tangled labyrinth of that gigantic epic. Other episodes of the Mahābhārata—*Indralokāgamanam*, and three others, Berlin, 1824; *Diluvium*, and three others, Berlin, 1829; and a new edition of *Nala*, Berlin, 1832—followed in due course, all of which, with A. W. Schlegel's edition of the *Bhagavadgītā*, 1823, proved excellent aids in initiating the early student into the reading of Sanskrit texts. On the publication, in Calcutta, of the whole Mahābhārata, Bopp discontinued editing Sanskrit texts, and confined himself thenceforth exclusively to grammatical investigations.

After a short residence at Göttingen, Bopp was, on the recommendation of W. von Humboldt, appointed to the chair of Sanskrit and comparative grammar at Berlin in 1821, and was elected member of the Royal Prussian Academy in the following year, both which posts he held up to his death, Oct. 23, 1867. In his quality as Sanskrit professor he brought out, in 1827, his *Ausführliches Lehrgebäude der Sanskrita-Sprache*, on which he had been engaged since 1821. A new edition, in Latin, was commenced in the following year, and completed in 1832. A shorter grammar (*Kritische Grammatik der Sanskrita-Sprache in kürzerer Fassung*) has run through three editions (Berlin, 1834, 1845, 1863). At the same time he compiled a Sanskrit and Latin glossary (1830) in which, more especially in the second and third editions (1847 and 1867), account has also been taken of the cognate languages. His chief activity, however, centred on the elaboration of his *Comparative Grammar*, which appeared in six parts at considerable intervals (Berlin, 1833, 1835, 1842, 1847, 1849, 1852; 1511 pages in small 4to), under the title *Vergleichende Grammatik des Sanskrit, Zend, Griechischen, Lateinischen, Lithauischen, Altslavischen, Gothischen, und Deutschen*. How carefully this work was matured may be gathered from the series of monographs printed in the *Transactions of the Berlin Academy* (1824 to 1831), by which it was preceded. They bear the general title, *Vergleichende Zergliederung des Sanskrits und der mit ihm verwandten Sprachen*. Two other essays (on the "Numerals," 1835) followed the publication of the first part of the *Comparative Grammar*. The Old-Slavonian began to take its stand among the languages compared from the second part onwards. At the instance of the earl of Ellesmere (then Lord Francis Egerton) the work was translated into English by Mr E. B. Eastwick (3 vols., 1845; second edition, 1854). A second German edition, thoroughly revised (3 vols., 1856-1861), comprised also the Old-Armenian. From this edition an excellent French translation was made by Professor Michel Bréal, which came out in 5 vols. in 1866, *f*. A third German edition has been published since the author's death, in 1871, *f*.

The task which Bopp endeavoured to carry out in his *Comparative Grammar* was threefold,—to give a description of the original grammatical structure of the languages as deduced from their intercomparison, to trace their phonetic laws, and to investigate the origin of their grammatical forms. The first and second points were subservient to the third. As Bopp's researches were based on the best available sources, and incorporated every new item of information that came to light, so they continued to widen and deepen in their progress. Witness his monographs on the vowel system in the Teutonic languages (1836), on the Celtic



languages (1839), on the Old-Prussian (1853) and Albanian languages (1854), on the accent in Sanskrit and Greek (1854), on the relationship of the Malayo-Polynesian with the Indo-European languages (1840), and on the Caucasian languages (1846). In the two last-mentioned the impetus of his genius had led him on a wrong track. They show the rocks against which the student of comparative philology has to guard.

As for the charge that has been made against Bopp of neglecting the study of the native Sanskrit grammars, every excuse ought to be made in his favour. In those early days of Sanskrit studies the requisite materials were not accessible in the great libraries of Europe; and if they had been, they would have absorbed his exclusive attention for years, while the grammars of Forster, Wilkins, and Colebrooke, from which his grammatical knowledge was derived, were all based on native grammars. The further charge that Bopp, in his *Comparative Grammar*, gave undue prominence to Sanskrit may be disproved by his own words; for, as early as the year 1820, he gave it as his opinion that frequently the cognate languages serve to elucidate grammatical forms lost in Sanskrit (*Annals of Or. Lit.*, i. 3),—an opinion which he has further developed in all his subsequent writings. In his translations from the Sanskrit Bopp was not successful. He seems to have felt this himself; for, after the publication, in 1838, of his metrical translation of the *Story of Nala*, he resigned that task to more skilful hands.

The method of tracing the life and growth of language, so successfully applied by Bopp in the case of the Indo-European languages, has become the corner stone on which all modern linguistic science rests. His researches, carried with wonderful penetration into the most minute and almost microscopical details of linguistic phenomena, have led to the opening up of a wide and distant view into the original seats, the closer or more distant affinity, and the tenets, practices, and domestic usages of the ancient Indo-European nations, and form the only safe basis on which further investigations in each direction are possible. The outlines of his great work had been distinctly traced by him in his very first publication, from which the science of comparative grammar may truly be said to date. In grateful recognition of that fact, on the fiftieth anniversary of the date of Windischmann's preface to that work, a fund called *Die Bopp-Stiftung*, for the promotion of the study of Sanskrit and comparative grammar, was established at Berlin, to which liberal contributions were made by his numerous pupils and admirers in all parts of the globe.

Bopp was specially favoured by fortune in living to see the results of his labours everywhere accepted, and his name justly celebrated. But the sun that gilds the writer's pen did not shine upon him, and he died a poor man,—by his genuine kindness and unselfishness, his devotion to his family and friends, and his rare modesty, endeared to all who knew him. (*Bréal's Translation of Bopp's Comp. Gr.*, vol. i., introduction; Th. Benfey, *Geschichte der Sprachwissenschaft*, 1869; A. Kuhn in *Unsere Zeit*, Neue Folge, iv. 1, 1868.)

BORAX, the borate of sodium ( $\text{Na}_2\text{B}_4\text{O}_7$ ), a substance found in commerce under the two different forms of ordinary or prismatic borax, which contains ten equivalents of water of crystallization, and octahedral or jeweller's borax, which has only five molecules of water in its composition. The former, which is the variety commonly met with, occurs as a natural product in various parts of the world. In former times crude borax was procured chiefly from Thibet, whence it came by way of India under the name of tincal. It also is found in other parts of Central Asia, at Halberstadt in Transylvania, in Canada, and in Peru: and in recent years an important source of

the mineral has been discovered near the Clear Lake in California, in a body of water now called the Borax Lake. In very dry seasons the water almost entirely disappears from the basin of the Borax Lake, which is situated in a region containing hot springs and the remains of volcanic action. In 1863, when the lake measured 4000 feet long, 1800 feet across at its widest part, and about 3 feet deep, the water was found to contain 2401.56 grains of solid matter per gallon, of which 535.08 grains represented crystallized borax. The bed of the lake is occupied with a deposit of borax crystals, which are obtained by sinking caissons, pumping out the water, and digging up the deposit. Californian crude borax is fit for use by assayers and others without undergoing any purification; but that obtained from Thibet contains a greenish encrusting matter of a soapy consistence which has to be separated before the material is fit for use under the name of refined borax.

The supply of borax is, however, more largely derived by artificial means from boracic or boric acid, or from salts in which that acid occurs, than from these natural sources. Boracic acid is found among the ejecta around the craters of some volcanoes, and it is found in jets of vapour which stream forth from fissures in the earth in regions of volcanic disturbance. The chief source of boracic acid at the present day is found in the Maremma of Tuscany, an extensive and desolate track of country embracing an area of about forty miles, over which jets of vapour and heated gases (*soffioni*) and springs of boiling water spurt out from numerous chasms and fissures. The Maremma is disturbed by frequent volcanic shocks; at some points the mouths of the fissures open direct into the air, at others they are covered by small muddy lakes (*lagoni*). In addition to a small impregnation of boracic acid the soffioni contain ammoniacal vapour, to fix and obtain which the gases at some works are led through sulphuric acid. For obtaining the boracic acid a series of basins or artificial lagoni are formed over the soffioni, so arranged that water to be charged with the acid is conveyed by gravitation from the first to the last of the series. Water is led into the highest and by the action of the heated gases it is soon in a state of ebullition. After being so left for about a day it is drawn off into the second, where it remains under like circumstances for the same period, and so to the end of the series, when the water should contain nearly 2 per cent. of boracic acid. The mechanical impurities being allowed to subside, the liquor is then run into evaporating pans, shallow lead-lined vessels, heated by the gases from the soffioni themselves. The evaporating pans are worked on a continuous system, similar to the lagoons; the liquor placed in the upper being concentrated down to half its original bulk is run into the second, and so on till it reaches a degree of concentration fit for crystallizing out the acid. In recent years artificial soffioni have been formed by boring through the rock till some of the numerous chasms or chambers, with which the interior is honey-combed, are reached, when immediately all the phenomena of a boracic soffione are established. From some of these artificial soffioni issues water of sufficient richness in acid to be led there direct to the evaporating pans. Similar emanations of volcanic vapours and boracic acid have been discovered in Nevada, United States. Boracic acid is also obtained from boronatrocalcite (Ulexite or Hayesine), a double salt of sodium and calcium, of which extensive deposits exist in the neighbourhood of the nitrate of soda beds of Chili and Peru. It is very variable in constitution and condition of purity. Similar deposits are found in California, Nevada, and Nova Scotia, and from the West Coast of Africa is received a borate of lime bearing the name of rhodizite. The boronatrocalcite, or borate of lime, as it is called in commerce, is applied in its unrefined condition

to many uses for which borax is employed. In 1855 Dr T. Richardson patented a process for using the picked and washed boronatrocalcite as a substitute for borax in the glass manufacture and preparation of pottery glazes. It is, however, chiefly employed as a source of boracic acid, and there are also several methods of obtaining borax direct from the compound salt.

Commercial boracic acid usually contains a considerable percentage of sulphates of ammonium, magnesium, and calcium besides other impurities. To prepare borax from this acid, from 110 to 120 parts of crystallized sodium carbonate are required for 100 parts of boracic acid. The soda is dissolved in a lead-lined vessel heated with steam, to which the boracic acid is added in repeated charges. The vessel is covered and the carbonate of ammonia given off is led into a solution of sulphuric acid and fixed. For the production of ordinary or prismatic borax the solution is brought to a strength of 20° to 22° Baumé (1.161 to 1.180 sp. gr.) and allowed to cool down as slowly as possible, so that the crystals may assume the large size demanded in commerce. Octahedral borax is deposited when a solution indicating 30° Baume (sp. gr. 1.264) is slowly cooling down from 79° to 56° C. Below this point the formation of ordinary borax takes place.

Under the blowpipe borax parts with its water, and melts into a clear glass which has the peculiar property of dissolving many metallic oxides, and thereby exhibiting characteristic colours, on which account it is of great value in blowpipe analysis. The same property also renders it a valuable material for pottery glazes and enamels, and as it adheres closely to clean surfaces of metal and prevents their oxidation under high heat, it is indispensable for use in hard soldering, and is largely employed in brass manufactures. It is also one of the ingredients employed in glass-making. Borax forms with oils and fats a soap which has been proposed as a detergent; but experiments conducted by the late Professor Thomas Anderson of Glasgow show that it has a more corrosive influence on fibres than common soap. In Belgium powdered borax is used in domestic washing, with the object of economizing soap. Borax is used in medicine as an external application in skin diseases, and the preparation known as *mel boracis* is a useful gargle in ulceration of the mouth and throat. In Sweden boracic acid is extensively employed for the preservation of meat and milk; and while it forms an efficient antiseptic, food prepared with it is said to be perfectly fit for use. A very beautiful pigment, now much used in calico-printing, under the name of Guignet's green, is a borate of chromium.

BORDA, JEAN CHARLES, mathematician and nautical astronomer, was born at Dax on the 4th May 1733. He studied at La Flèche, and at an early age obtained a commission in the cavalry. In 1756 he presented a valuable paper to the Academy of Sciences, who elected him a member. He was present at the battle of Hastenbeck, and soon afterwards joined the naval service. He visited the Azores and the Canary Islands, of which he constructed an admirable map. In 1782 his frigate was taken by a British squadron; he himself was carried to England, but was almost immediately released on parole, and returned to France. He died on the 20th February 1799. Borda was an admirable mathematician, and contributed a long series of valuable memoirs to the Academy of Sciences. His researches in hydrodynamics were highly useful for marine engineering, while the reflecting and repeating circles, as improved by him, were of great service in nautical astronomy. He was associated with Delambre and Méchain in the attempt to determine an arc of the meridian, and the greater number of the instruments employed in

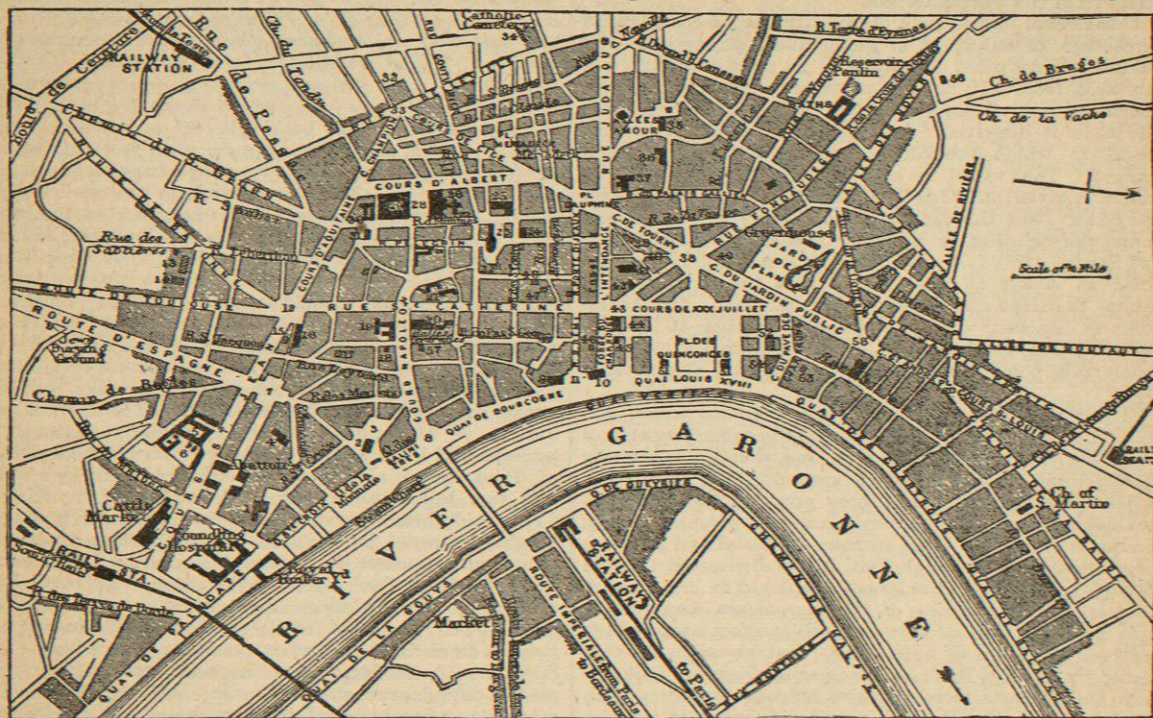
the task were invented by him. (See Biot, "Notice sur Borda" in the *Mém. de l'Acad. des Sciences*, iv.)

BORDEAUX, one of the finest and wealthiest commercial cities of France, formerly the capital of Guienne and Bordelais, and now the chief town of the department of Gironde. It is situated 370 miles S.E. of Paris, in 44° 50' N. lat. and 0° 25' W. long., on the left bank of the Garonne, about 60 or 70 miles from its mouth, and in the midst of an extensive plain which comprises the district of Médoc, well-known for its red wines. Opposite the town the river makes a semicircular curve, and widens out into an extensive basin, which serves as a harbour, and is lined with quays on both sides for a distance of three miles. Vessels of 800 tons can come up to the town, and ships of the greatest ordinary tonnage have depth enough as far as Pauillac, about 35 miles from the mouth of the river. The basin is crossed by a magnificent stone bridge of 17 arches, 1534 feet long, which was built in 1821, and remained in the hands of a company till 1861 when it was declared free. A short distance further up the river is spanned by a railway bridge. Few cities in Europe can show such a striking water-front as Bordeaux; and though the streets of the older part are narrow and mean, those of the newer portions are wide and well paved, and contain handsome houses and public buildings. The principal square is the Place des Quinconces, which is adorned with statues of Montaigne and Montesquieu. Among the ecclesiastical buildings the most important are the cathedral of Saint André, a fine Gothic structure with two spires 160 feet high; the church of Saint Michel, founded in 1160, and formerly remarkable for a spire 319 feet in height, destroyed by a storm in 1768; Saint Croix, probably in existence before the 7th century, restored in 1864-5; Saint Paul, built by the Jesuits in 1676; and the church of the Collège Royal, in which is the tomb of Montaigne. The great intellectual activity of the city may be seen from the fact that it possesses an academy (with faculties of theology, law, science, and literature), a medico-pharmaceutical school, a lyceum, a school for deaf-mutes, a normal school, and a school of navigation; numbers among its societies an academy of sciences, arts, and belles lettres, a medical society (founded in 1798), an agricultural society, a philomatic, a Linnean, a horticultural, and an archæological society; and maintains nine daily papers, about as many weeklies, and two or three monthly periodicals, besides the official publications of several of the above-mentioned societies. Its communal library, which dates from 1566, contains about 200,000 volumes; and it has also an antiquarian museum, a museum of natural history, and a picture gallery. Among its benevolent institutions are the hospital of Saint André, founded in 1825 to replace an older building of the same name, which dated from 1390, a children's hospital, originated in 1619, a hospital for incurables, a maternity, and a military hospital, the lock hospital of Saint Jean, and a magnificent deaf and dumb asylum. Of theatres there are five,—the Grand Théâtre, finished in 1780 and seated for 1300; the Théâtre Louit, opened in 1868, for 2500; the Théâtre Français, dating from 1857, for 1300; the Théâtre National, opened in 1866, for 1000; and the Théâtre des Folies Bordelaises built in 1872. A few buildings are of merely antiquarian interest, the most important being the Palais Gallien, which is really an old Roman amphitheatre of the 3d century, and the tower of Pey Berland. Bordeaux is the seat of an archbishop, and has a court of appeal, a court of assize, and tribunals of primary instance and commerce. It has also a mint the coinage of which is marked by the letter K. Its commercial institutions are necessarily numerous and varied, comprising an exchange, banks, insurance-offices, custom



houses, public warehouses, and consulships of some forty different countries. The trade is very extensive, particularly in wines, and has undergone a remarkable development since the introduction of railways and steamships. For a long time Bordeaux was greatly indebted to the Languedoc canal, but this means of communication is now

of minor importance. The total value of the export and import trade is annually about £16,500,000, about a third belonging to Britain. In 1872 the value of Bordeaux wines exported from France was upwards of £5,600,000, and the brandy and liqueurs from Bordeaux itself annually produce about £1,000,000. The other articles exported



Ground-Plan of Bordeaux.

- |                           |   |                                |  |   |
|---------------------------|---|--------------------------------|--|---|
| 1. Hospital for Old Men.  | 14. Church of St Nicholas.                      | 25. Hôtel de Ville.            | 37. Mint.                                  | 49. Hôtel de la Marine.                             |
| 2. Church of St Michel.   | 15. St John's Hospital.                         | 26. Prison Départemental.      | 38. Place de Tourny.                       | 50. Church of the Carmelites.                       |
| 3. Place du Marché Neuf.  | 16. Hospital for Incumbles.                     | 27. Palais de Justice.         | 39. Théâtre des Variétés.                  | 51. Baths.  |
| 4. Grand Séminaire.       | 17. Synagogue.                                  | 28. Place d'Armes.             | 40. Place des Grands Hommes.               | 52. English Protestant Church.                      |
| 5. Petit Séminaire.       | 18. St James's Chapel.                          | 29. St Andrew's Hospital.      | 41. Church of Notre Dame.                  | 53. Protestant Church.                              |
| 6. Asylum for the Insane. | 19. Barracks.                                   | 30. St Raphael's Barracks.     | 42. Hôtel de l'Académie.                   | 54. Entrepôt réel.                                  |
| 7. Place des Capucins.    | 20. Old Palais de Justice and St Paul's Church. | 31. Church of St Eulalie.      | 43. Place de la Comédie.                   | 55. Church of St Louis and Archives du Département. |
| 8. Place Bourgogne.       | 21. Lycée Impérial.                             | 32. Tobacco Manufactory.       | 44. Grand Theatre.                         | 56. Collège de Tyrroll.                             |
| 9. Custom House.          | 22. Old Chapelle des Irlandais.                 | 33. Place Rodesse.             | 45. Hôtel de la Préfecture.                | 57. Church of St Eloi.                              |
| 10. Exchange.             | 23. St Andrew's (Cathedral).                    | 34. Church of St Bruno.        | 46. Old Church of St Rémi.                 | 58. Place Fégère.                                   |
| 11. Place de la Bourse.   | 24. Municipal Barracks.                         | 35. Church of St Saurin.       | 47. Chapelle de Notre Dame de Bon Secours. |   |
| 12. Place d'Aquitaine.    |   | 36. Deaf and Dumb Institution. | 48. Archbishop's Palace.                   |   |
| 13. Military Hospital.    |   |                                |  |   |

comprise corn, fruits, sugar, wood, resin, rags, madder, tartar, gums, indigo, and native manufactures. Shipbuilding is a leading industry, the number of firms in that department being about twenty in 1875. In the same year 220 vessels belonged to the port, with a total tonnage of upwards of 92,000 English tons.

Bordeaux, or *Burdigala*, was originally the chief town of the Bituriges Vivisci. Under the Roman empire it became a flourishing commercial city, and in the 3d century it was made the capital of Aquitania Secunda. Ausonius, a writer of the 4th century, who was a native of the place, describes it as four-square and surrounded with walls and lofty towers, and celebrates its importance as one of the greatest educational centres of Gaul. In the evils that resulted from the disintegration of the empire Bordeaux had its full share, and did not recover its prosperity till the beginning of the 10th century. Along with Guienne it belonged to the English kings for nearly three hundred years (1154-1452), and was for a time the seat of the brilliant court of the Black Prince, whose son Richard was

born in the city. An extensive commerce was gradually developed between the Bordeaux merchants and their fellow subjects in England,—London, Hull, Exeter, Dartmouth, Bristol, and Chester being the principal ports with which they traded. For full details regarding the character of the traffic and its influence on the destinies of the city the reader may consult Francisque Michel's *Histoire du Commerce et de la Navigation de Bordeaux*, 1867. In 1548 the inhabitants resisted the imposition of the salt-tax by force of arms, a pardonable rebellion for which they were punished by Montmorency with merciless severity. At a later period they held out for the Frondeurs against the royal army under Louis XIV. and Richelieu, with an obstinacy that brought the monarch and his minister to a humbler mood. During the Reign of Terror the city suffered almost as severely as Lyons and Marseilles, and its commerce was greatly reduced under Napoleon I. In 1814 it declared for the House of Bourbon; and Louis XVIII. afterwards gave the title of duke of Bordeaux to his grandnephew, better known as the Count de

Chambord. In 1870 the French Government was transferred to Bordeaux from Tours on the approach of the Germans to the latter city. Population, in 1872, 190,682.

Dupré de Saint Maur, *Hist. Curieuse de Bordeaux*, 1760; Devienne, *Hist. de la ville de Bordeaux*, 1771 and 1862; Bernadan, *Hist. de Bordeaux*, 1838-40; O'Reilly, *Hist. complète de Bordeaux*, 1853-60.

BOREAS, in Greek Mythology, was a personification of the north wind, and to be like it he was represented as rough, powerful, and accustomed to gain his ends by irresistible force. A favourite instance of this was the story of his carrying off the beautiful Oreithyia, a daughter of Erechtheus, king of Athens, when he found her gathering flowers by the banks of the Ilissus, or at the sources of the Cephissus,—others said the Areopagus, and others, again, the Citadel. He had sought before to woo her in vain, and now carried her to Mount Hæmus in Thrace, where they lived as king and queen of the winds, and had two sons, Zetes and Calais, and two daughters, Cleopatra and Chione. For the loss of Oreithyia the Athenians in after times counted on Boreas's friendliness, and were assured of it when he sent storms which wrecked the Persian fleet at Athos and at Sepias. For this they erected to him a sanctuary, or, as others said, an altar near the Ilissus, and held a festival in his honour. Thuri also, which was a colony of Athens, offered a sacrifice to him every year, because he had destroyed the hostile fleet of Dionysius the elder. Boreas was described as a son of Astræus and Aurora. In works of art he was represented as bearded, powerful, draped against cold, and winged. On the Tower of the Winds at Athens he is figured holding a shell, such as is blown by Tritons. Boreas carrying off Oreithyia is the subject of a beautiful bronze relief in the British Museum, found in the island of Calymna. The same subject occurs frequently on the painted Greek vases.

BORELLI, GIOVANNI ALFONSO, the head of what has been called the iatro-mathematical sect, or that which, misled by the great progress which the application of mathematics had produced in the physical sciences, attempted to secure the same advantage for medicine, by subjecting to calculation the phenomena of the living economy. He was born at Naples, January 28, 1608, taught mathematics for some time at Pisa, and seems afterwards to have held the professorship of medicine at Florence. He was greatly favoured by the princes of the house of Medici; but having been engaged in the revolt of Messina, he was obliged to retire to Rome, where he spent the remainder of his life under the protection of Christina, queen of Sweden, who honoured him with her friendship, and by her liberality softened the rigour of his fortune. He died of pleurisy on the 31st December 1679. Borelli, more judicious than Bellini, restricted the application of his system chiefly to muscular motions, or to those phenomena of the animal economy which are in certain points subject to the laws of mechanics, and was led to the discovery of some principles new in themselves, and directly opposed to the received beliefs of his time. His followers, less cautious, wishing to generalize the application he had made, by hypotheses, to which the return to a sound medical philosophy has done justice, greatly retarded the restoration of the science.

The works of Borelli are,—1. *Della Causa delle Febri maligne*, Pisa, 1658, 4to; 2. *De Renum usu Judicium*, Strasburg, 1664, 8vo; 3. *Euchides Restitutus*, 1628, 4to; 4. *Apollonii Pergæi Conicorum libri v. vi. et vii.* Florence, 1661; 5. *Theoriae Medicorum Planetarum ex Causis Physicis deductæ*, Florence, 1666, 4to; 6. *Tractatus de Vi Percussionis*, Bologna, 1667, 4to; 7. *Historia et Meteorologia incendiæ Ethnæ*, Reggio, 1669, 4to; 8. *De Motibus naturalibus a gravitate pendentibus*, Bologna, 1670, 4to; and 9. *De Motu Animalium, opus posthumum*, Rome, 1680, 1681, 4to.

BORGA, or BORGIO, a seaport town of the Russian Grand Duchy of Finland, situated in the province of Nyland, at

the entrance of the River Borgia into the Gulf of Finland, about 25 miles N.W. of Helsingfors, in 60° 22' N. lat. and 25° 45' E. long. It was at one time a wealthy and handsome city, but has greatly decayed. It is still the seat of a Lutheran bishopric which extends over a large part of Finland; and it possesses a beautiful cathedral, a gymnasium (where the well-known Swedish poet Runeberg lectured for many years), and a theatre. The weaving of sail-cloth and the manufacture of tobacco are the principal industries, and the chief articles of trade are wood, butter, and meal. In 1873 the value of the imports, mainly from Germany, England, and Russia, was upwards of £141,000, while that of the exports was rather under £50,000. Borgia was the seat of the Finnish diet in 1809. Population, which is mostly Swedish, in 1867, 3420.

BORGERHOUT, a flourishing township of Belgium, in the arrondissement of Antwerp, and on the road from that city to Turnhout. It has bleachfields, dye-works, woollen factories, and corn-mills. Population, 10,787.

BORGHESE, a noble Sienese family, one of whom, on being elected pope in 1605, assumed the name of Paul V., after which the family became among the most powerful of the Roman nobility by their union with the Aldobrandini. Camillo Filippo Ludovico, Prince Borghese (born 1775), married in 1803 Pauline, sister of the Emperor Napoleon, and widow of General Leclerc. In 1806 he was made duke of Guastalla, and for some years acted as governor of the Piedmontese and Genoese provinces. After the fall of Napoleon he fixed his residence at Florence, where he died in 1832. The Borghese palace at Rome is one of the most magnificent buildings in the city, and contains a splendid gallery of pictures.

BORGIA, CÆSAR and LUCRETIA. The history of Cæsar and Lucretia Borgia up to the death of their father has been related under ALEXANDER VI. (vol. i. p. 487). Alexander's sudden decease at an unfavourable conjuncture proved the ruin of Cæsar, who, as he subsequently told Machiavelli, had provided for every contingency except that of his father and himself being disabled at the same time. Though suffering from a dangerous illness, popularly believed to be the effect of poison, he possessed himself of his father's treasures, and exerted sufficient influence in the conclave to procure the election of a friendly pope. The pontificate of Pius III., however, only endured for a few weeks, and his successor, Julius II., the hereditary enemy of the Borgias, threw Cæsar into the prison of St Angelo, where he was detained until he had consented to deliver up all his fortresses. He was then sent to Naples, where the Spanish viceroy, Gonsalvo de Cordova, in violation of his pledge, caused him to be arrested and sent to Spain. After two years' confinement in the castle of Medina del Campo, he escaped and took refuge with his brother-in-law, the king of Navarre, in whose service he was slain before Viana, March 12, 1507. Cæsar possessed considerable abilities, but these are in general much overrated by historians, especially by Lord Macaulay in his essay on Machiavelli. His extraordinary success was not so much owing to the superiority of his qualities as to his utter emancipation from every restraint of conscience and honour. As a ruler he was intelligent and sagacious; his subjects regretted him, and his mercenaries served him with remarkable fidelity. Lucretia Borgia's life, after her marriage to the duke of Ferrara's son, was prosperous and uneventful, or at most only troubled by the not very well attested homage of Cardinal Bembo. She obtained universal respect by her piety and prudence, and her patronage of men of letters, and died in 1520. In fact, although intelligent and highly educated she was essentially a common-place woman, incapable from every point of view of the atrocities imputed to her by libellers in her own