common to Madagascar, Mauritius and Bourbon, but not elsewhere known, such as *Pittosporum Senacia, Aphloia mauritiana, Gouania mauritiana, Nesœa triflora, Lobelia serpens*, and *Buddleia madagascariensis*; thirdly, of species that spread across Tropical Africa, such as *Haronga paniculata, Desmodium mauritianum* and *oxybracteum, Gynura cernua, Brehmia spinosa*, and *Mussoenda arcuata*; fourthly, of species spread universally through the tropics of the Old World, but not reaching America, such as *Crotalaria stricta, Oxalis sensitiva, Nymphœa stellata, Trichodesma zeylanica, Indigofera enneaphylla, Avicennia officinalis*, and *Rhizophora mucronata*; and fifthly, of species spread universally through the tropical zone of both hemispheres, such as *Eleusine indica Tephrosia purpurea, Drymaria cordata, Elephantopus scaber, Teramnus labialis, Zornia dephylla, Waltheria americana, Sida rhombifolia*, and *Nephrodium molle*. In Mauritius and the Seychelles there are 145 species which occur also both in Asia and Africa, in addition to 225 which are spread all round the world in the tropical zone, and nearly all these 370 species are now known in Madagascar also. A small proportion of the Madagascar genera and species are Asiatic but not African, and these present collections add to the island flora *Lagerstromia, Buchanania*, and *Strongylodon*, three well-marked Indian types.

But perhaps still more interesting, in the light that it throws on the past history of the island, is the relationship of the comparatively limited flora of the mountains of the interior to that of other parts of the world. A certain number of the plants, especially the ferns and fern-allies, are widely-spread temperate species, which now have their head-quarters in the temperate regions of the northern hemisphere; we have instances of this in *Nephrodium Filix-mas, Aspidium aculeatum, Osmunda regalis, Lycopodium claratum, L. complanatum, Sanicula europœa, Potamogeton oblongus, Sonchus asper, S. oleraceus, Polygonum minus*. Most of the characteristic types of the Cape flora are represented on the Madagascar mountains, but nearly always by species which are distinct from those which are now found in the extra-tropical regions of the main continent: for instance, the Aloes by a couple of species of *Eualoe*; the Heaths by several species of *Philippia* and *Ericinella*; the bulbous Iridaceæ by species of *Gladiolus, Geissorhiza* and *Aristea*; the saprophytic *Scrophulariaceœ* by *Harveya obtusifolia*; the special Cape ferns by *Mohria caffrorum, Cheilanthes hirta, Pellœa hastata*, and *P. calomelanos*; the Proteaceæ by the curious genus *Dilobeia* (which Du Petit Thouars found at the beginning of the century, and of which Dr. Parker has now sent home the first specimens which have been seen in England); and the *Selagineœ* by *Selago muralis* of Bentham, which grows in the grounds of the Queen's palace at Antananarivo. But perhaps the most interesting feature of all is the occurrence of several striking cases of specific identity between plants of the Madagascar mountains and those of the tropical zone of the African continent. The only Madagascar violet (*Viola emirnensis*, Bojer, = *V. abyssinica*, Steud.) only occurs elsewhere high up amongst the mountains of Abyssinia, at 7000 feet above sea-level in the Camaroons, and at 10,000 feet above sea-level at Fernando Po. The only Madagascar Geranium (*G. emirnense*, H. B. = *G. compar*, R. Br. = *G. simense, latistipulatum* and *frigidum*, Hochst.) has a precisely similar area of distribution. *Caucalis melanantha* of Bentham is only known in Madagascar and amongst the mountains of Abyssinia. The Madagascar *Drosera* (*D. madagascariensis*, D.C. = *D. ramentacea*, Burch.) reappears at the Cape and the mountains of Angola and the west tropical coast; *Agauria salicifolia*, Hook. fil., which we noted lately as having been gathered by Mr. Thomson on the high plateaux of Lake Nyassa, is found in the Cameroons and on the mountains of Madagascar, Mauritius, and Bourbon; *Crotalaria spinosa* reappears in Nubia, Abyssinia, Angola, and Zambesi-land; *Asplenium Mannii*, Hook., on the mountains of Zambesi-land, the Cameroons, and Fernando Po. As a whole, it would seem that the flora of the Madagascar mountains corresponds closely with that of the great ranges of the tropical zone of the main African continent.

J. G. BAKER

BENJAMIN COLLINS BRODIE, BART., F.R.S., D.C.L.

ON Wednesday, November 24 last, died Benjamin Collins Brodie the younger, a worthy son of a distinguished sire. Born to affluence, but early imbued with the liberal and high-minded views of the great surgeon, he determined to devote his life and energies to the prosecution of science for its own sake, and well has he done his work. Brodie was born in London in 1817, and educated first at Harrow under Longley, and afterwards at Balliol, taking his Master's degree in 1842. In those days it was absolutely impossible to carry out original chemical work at Oxford, and Brodie naturally betook himself to Giessen, where Liebig's name drew students from all parts of the world. There in the summer of 1845 Brodie, at Liebig's suggestion, carried out analyses of certain waxes obtained by Gundlach by feeding bees on different kinds of sugar. The results thus obtained led him to continue his examination of bees'-wax on his return to England, and from his private laboratory in the Albert Road now came forth his well-known researches on the Chemical Nature of Wax (*Phil. Trans.* 1848, 147-170; 1849, 91-108), for which in 1850 he received the well-merited reward of the Royal Medal. These researches will always remain not only remarkable as having given a successful solution of a difficult problem, but as having proved, by careful preparation and exact analysis, the existence in wax of solid bodies which play the part of alcohols, and of which common spirit of wine is a direct lineal descendant. This unexpected discovery of solid alcohols containing respectively twenty-seven and thirty atoms of carbon in the molecule completely confirmed the truth of the views concerning the existence of an homologous series of alcohols first enunciated by Schiel and Gerhardt, and thus placed in firm position one of the chief pillars of the organic portion of our science.

Brodie's next work was not inferior either in importance or in workmanship to his first. In 1850 he published his memoir "On the Condition of certain Elements at the Moment of Chemical Change" (*Phil. Trans.*, 1850, 750-804), in which he carefully investigates the remarkable reducing action exerted by peroxide of hydrogen. Not only does this body lose half its oxygen when brought in contact with oxide of silver, but reduces this oxide to metal. This anomalous action was satisfactorily explained by Brodie, who pointed out that the second atom of oxygen in these peroxides is not only retained in an unstable state of combination, but that when brought into contact with silver oxide a true synthesis of oxygen occurs, two atoms of this element uniting to form one molecule of free oxygen. That this reaction really takes place was shown by Brodie to be the case by careful experiment. These results led him to consider the constitution of the alcohol radicals (*Chem. Soc. Journ.* iii. 405), and to assert in 1851 the important fact, now universally admitted, that the molecule of the radical ethyl contains four atoms of carbon. To him too we owe the prediction of the possibility of the existence of the mixed radicals, a prediction so soon afterwards experimentally verified by Wurtz. Next we find him active as secretary of the Society of which he afterwards became president, viz. the Chemical Society of London; also in lecturing at the Royal Institution on the allotropic changes of certain elements, on the formation of hydrogen and its homologues, in which he clearly brings forward his views concerning the union of atoms to form the molecule.

In 1853 he published his interesting observations on the conversion of yellow phosphorus into the red modification by heating it to 200° in presence of mere traces of iodine (*Chem. Soc. Journ.* v. 289). Another very important and difficult investigation which occupied much of his attention about this time was the question of the purification (*Ann. de Chimie*, 45, 351) of graphite, and the determination of its "atomic weight" (*Phil. Trans.* 1859, 249). By heating graphite with strong nitric acid and chlorate of potash, Brodie showed that, unlike all the other modifications of carbon, graphite yields a remarkable crystalline acid, to which he gave the name of graphitic acid, having the formula $C_{11}H_4O_5$. The existence of this interesting body led Brodie to the conclusion that graphite may be considered as a peculiar radical, to which he gave the name of graphon. In the year 1855 Brodie was appointed Waynflete Professor of Chemistry in the University of Oxford, a position which enabled him to throw all his influence into forcing the recognition of chemical science as a proper object of academic training. Under his fostering care the science which had hitherto been so long neglected put out distinct signs of life: new laboratories and lecture-rooms were built, to which students flocked in numbers, and Oxford saw the unwonted sight of her professor of chemistry busily engaged in original investigation, as well as in the tutorial duties of his chair. The discovery of those singular and dangerous bodies, the peroxides of the organic radicals (*Proc.* Roy. Soc. ix. 361, *Phil. Trans.* 1863, 407), was made in the laboratory of the New Museum. The same laboratory soon afterwards saw the minute and careful investigation on ozone (*Phil. Trans.* 1872, 432), which proved beyond doubt or cavil that the supposition that the molecule of ozone is represented by the formula O_3 is both necessary and sufficient to explain all the observed phenomena.

Next we find him experimenting on the synthetic production of the hydrocarbon methane, as well as of formic acid, by the direct union of hydrogen and carbon monoxide under the influence of the electric spark. Then he examines the effect of an induced electric current upon pure and dry carbonic acid, and proves that this gas is partially decomposed with formation of carbon monoxide and oxygen, the latter gas being converted into ozone. And he then proceeds to ask whether the ozone thus produced is identical with that obtained from ordinary oxygen, and by a series of careful quantitative experiments demonstrates the identity of the ozone from these two sources.

This was Brodie's last experimental investigation. Ere long he resigned the Chair of Chemistry at Oxford, regretted by the whole University. He retired to his charming seat on the summit of Box Hill. Neither his own scientific activity nor his deep interest in the scientific work of others ceased on his withdrawal from professional life. Before his retirement he had put forward (*Phil. Trans.* 1866, 781-860) in his "Calculus of Chemical Operations," views altogether novel respecting the nature of chemical change. In place of the usual mode of considering this as due to a change in the relative positions of the atoms of which matter is composed, Brodie founds his theory of the constitution of chemical elements and compounds on the simple volume-relations discovered by Gay-Lussac to exist between these substances in the gaseous state. To hydrogen Brodie gives a simple symbol, because the unit of hydrogen can, as he expresses it, be conceived as made at once by one operation, whilst to oxygen he gives a double symbol, because it cannot, according to him, be made by less than two operations. The element chlorine is supposed to be made up of three operations, and a treble symbol is given to this body. Concerning the probable or possible decomposition of the elements Brodie naturally speculates. His analysis had led him to suspect that "chemical substances are really composed of a primitive system of elemental bodies analogous in their general nature to our present elements, some of which we possess, but of which we possess only a few" ("Ideal Chemistry," p. 54). But no experimental evidence of this fact was offered by him, and none of a satisfactory character was otherwise forthcoming, until Victor Meyer announced his belief that chlorine was capable of undergoing decomposition at high temperatures.

Here was a proof of the truth of Brodie's complex symbol! Sad to say, further experiment has not corroborated this conclusion. No substance differing essentially from chlorine has yet been got from this body. Even the change of density at a white-heat appears in the case of chlorine to be, to say the least, doubtful. So we are left for the present, and the author of the "Calculus of Operations" is left for ever, without the experimental confirmation of his conclusions which he so much desired. Whatever may be the verdict of the future as to the value of Brodie's Calculus, there is no doubt that science is indebted to him for an altogether new view of chemical combination obtained by a systematic analytical process.

This occasion is not a fitting one to enlarge upon the high personal character of the late Sir Benjamin Brodie. Suffice it to say that in all relations in life, in the domestic circle as in society, in the chair at Burlington House as in that at Oxford, he displayed all those qualities of heart and head which alone give dignity and sweetness to life, the possession of which ensures for his memory a lasting place in the minds of all those who were fortunate enough to count him amongst their friends. H. E. R.

THE PHYLLOXERA IN FRANCE

THE new vine-disease, due to the *Phylloxera vastatrix* Planchon, has already caused much damage to the French vineyards and wine-production. From the taxes arising from that national industry France derives a considerable part of her revenue; and this subject has consequently occasioned innumerable publications and investigations. Of the latter some have been empirical and without result; others, which were conducted scientifically, have alone been of any use. It was moreover absolutely necessary to have an unswerving confidence in exact observations, in order to persevere in making experiments which are often disturbed and rendered apparently self-contradictory by the secondary and ever-varying conditions of cultivation. These experiments have at last been crowned with success, and now there are decidedly good grounds for hope. For the last two years the public have shown a steadily increasing confidence in scientific methods.

One of the most distinguished chemists, a man of whom France is proud, and with whom readers of NATURE are well acquainted, especially as they were lately presented with his portrait and biography, M. Dumas, applied himself to the study of the Phylloxera, and pursued his task from day to day with keen determination, notwithstanding the attacks of some and the discouraging advice of others. It is his well-intentioned and unceasing diligence that we must thank for never having lost heart; it is to him that those results are due which are presently to be indicated. When the pébrine-disease was raging on silkworms in the South of France, it was by his personal suggestion and repeated encouragement that M. Pasteur agreed to devote himself to that difficult study; and it is the same gentle influence and guidance that have directed the present writer, together with several others, especially MM. Balbiani, Duclaux, and Mouillefert.

Henceforward the principal problems raised by the study of vine diseases are solved. They were solved one after another in regular order, as fresh light appeared and the ends to be aimed at became more definite. It cannot