prising that so versatile a man should ever have admitted the existence of limitations. Nevertheless he came to distrust his powers as a poet. At the age of fifteen he had produced an epic poem of four thousand verses in the Virgilian idiom. This composition so pleased him that he rescued it at the peril of his life when the house in which he was living was destroyed by fire. Yet, to quote Vicq d'Azyr, one year sufficed to dissipate his satisfaction, and he committed the poem to the same destructive element from which he had saved it. Haller's incomparable bibliographical works involved the consultation of 52,000 books and memoirs, and his own library, probably the most complete of its kind ever assembled by a private individual, numbered more than 20,000 volumes. He is said to have written 13,000 papers. Leyden, Oxford and other universities were anxious to secure his services; but in spite of tempting proposals he declined all such invitations.

Apart from these six outstanding figures there are still a number of biologists, only less distinguished, whose debt to the University of Leyden was direct and considerable. Dodoens (1517–1585), the medical botanist and author of a famous Herbal, collaborated with Christopher Plantin, the renowned printer of Antwerp, in the production of scientific works. Clusius (1526–1609), also a herbalist, added 600 species to the flora, and was one of the first to introduce the potato into Europe. Bontius (1598–1631), a member of a Leyden family, was a pioneer of the study of tropical medicine, and the first to describe beriberi and tropical dysentery. Jonston (1603–1675), of Scots descent and a Leyden M.D., was a voluminous writer on natural history, whose works passed through many editions and translations and enjoyed a considerable vogue up to the time of Linnæus. Piso (1611–1678), born in Leyden and an M.D. of the University, wrote on the natural history of Brazil and was a student of tropical medicine, being the first to describe yaws.

Blasius (? –1692) produced one of the earliest comprehensive treatises on comparative anatomy (1681), and founded an important medico-anatomical society in Amsterdam in 1664. Drelincourt (1633–1697) was the teacher of Boerhaave and wrote on anatomy and generation. Ruysch (1638–1731), the most celebrated anatomical preparateur of his time, obtained a mastery over injection methods which astonished his contemporaries and successors. Kerckring (1640–1693) was a notable anatomist whose views on generation aroused considerable interest and controversy. Bidloo (1649–1713) produced a magnificent work on human anatomy. Breynius (1680–1764) investigated the flora of Holland, Italy, France and Spain. 's Gravesande (1688–1742), professor of mathematics, physics, astronomy and philosophy, developed the physical aspects of physiology. B. S. Albinus (1697–1770), who occupied the chair of anatomy at Leyden for nearly fifty years, raised anatomy to the level of a scholarly study distinguished by the accuracy, artistic beauty and literary style of its published results. His contemporaries regarded him as the leading anatomist of his age. Baster (1711–1775), one of the earliest pupils of Albinus, was a pioneer of marine biology, and explored the structure and life-history of marine animals and plants. Lieberkuhn (1711–1756), a pupil of Boerhaave and Albinus, became famous for his micro-injections of the wall of the gut. Camper (1722–1789), a native of Leyden and a great comparative anatomist, applied metric methods to the study of anthropology, being responsible for the introduction of the 'facial angle' as a criterion of race. An artist himself, he demonstrated the connexion between the science of anatomy and the arts of painting and sculpture. Gronovius (1730–1777), a senator and justice of Leyden, was a well-known systematic naturalist and bibliographer.

It is a remarkable tribute to the international character of the Royal Society of London and to its efforts to advance natural knowledge in lands other than its own, that thirteen of these distinguished members of the University of Leyden were elected fellows of the Society.

Our brief sketch barely touches the fringe of the labours and influence of this venerable academy, and it leaves out of account the activities in biology and medicine of the University in modern times. True to a tradition which goes right back to its foundation, the policy of Leyden has always been a progressive one. It moves not only abreast of the times, but also plays a great part in initiating and directing new developments. The closing of such an institution is an offence against the light, and a crude and blundering negation of the ancient rights of universities.

[1] For an account of his life and work see NATURE, **139**, 218 and 287 (1937).
[2] NATURE, **142**, 1013 (1938).

CONTRIBUTIONS TO PHYSICS AND CHEMISTRY

BY DR. L. C. JACKSON

Now once more Holland is in the grip of an enemy even more opposed to those ideals of freedom of conscience and of scientific inquiry than the one against whom the citizens of Leyden fought so bravely. The present professors and students of the University of Leyden, being men of independent spirit and worthy successors of their

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forebears of 1575, it is not surprising that they have come into conflict with the Nazi authorities temporarily in power in their country. The suppression of the University has been the consequence, and once more "all instruction of youth in the sciences and liberal arts is likely to come into entire oblivion". This brief appreciation of one side of the University's work since its foundation may serve to express the regret which will be felt in all free and cultured countries at this further evidence of German barbarity.

Throughout its existence the University of Leyden has contributed notably towards the development of physical science. One may recall the names of Willebrord Snel (1591–1626), who discovered the law of the refraction of light and carried out the first geodetic measurements in Holland over an arc from Alkmaar to Bergen op Zoom; of Christiaan Huygens (1629–95), who was a student at Leyden and whose discoveries in optics and mechanics are too well known to need more than a passing reference; of P. van Musschenbroek (1692–1761), whose researches on static electricity gave us the Leyden jar; and of H. Boerhaave (1668–1738), who, though primarily concerned with medicine, included studies in the physical sciences among his many activities.

Coming to more modern times, the Leyden dissertation of J. D. van der Waals (1873), "On the Continuity of the Gaseous and Liquid States", was a milestone in the history of physics. His equation of state, his law of corresponding states, and his later work on the phase relationships of binary mixtures, initiated a stream of research which has contributed enormously to our knowledge and is still being actively pursued.

When H. Kamerlingh Onnes was appointed to the chair of physics at Leyden in 1882, he set himself the task of collecting accurate data on the properties of liquefied gases to test the theoretical conclusion of van der Waals. This demanded extensive facilities for work at low temperatures and led step by step to the foundation of the famous Cryogenic Laboratory, where physical problems of all kinds can be investigated down to the lowest temperatures obtainable. Here was realized Onnes' dream of an international research laboratory, where workers of all nationalities were welcomed and provided with facilities for carrying out investigations in low temperature physics. It would be difficult to over-estimate the contribution of Kamerlingh Onnes to international goodwill and understanding among men of science by his infectious enthusiasm and generous hospitality, coupled as it was with his part in the foundation of the "Institut international du Froid". Ironically enough, the last meeting of the Institut took place at Karlsruhe and Baden-Baden in July 1939. The scientific work of Onnes and his collaborators ranged over all branches of low-temperature physics, and the hundreds of papers reprinted in the *Communications from the Physical Laboratory of the University of Leiden* are a permanent testimony to his skill and industry. Of Onnes' own achievements his liquefaction of helium, whereby temperatures in the neighbourhood of 1° K. became accessible, and his discovery of superconductivity, are perhaps the most notable.

W. H. Keesom and W. J. de Haas, co-directors of the Cryogenic Laboratory in succession to Onnes, have maintained the tradition of the high quality of scientific output and international hospitality. Keesom's work has mainly concerned the production of solid helium, the determination of specific heats at the lowest temperatures and the investigation of the thermal properties of superconductors, while that of de Haas has dealt with paramagnetism, the electrical and magnetic properties of superconductors and the production of temperatures below 1° K. by the method of adiabatic demagnetization.

It was at Leyden, too, that P. Zeeman discovered the effect of a magnetic field on the emission and absorption of light in 1896, and so provided an invaluable tool for the formal analysis of spectra and the investigation of atomic structure. An interpretation of this discovery was immediately furnished by H. A. Lorentz (1853–1928), then professor of theoretical physics at Leyden, in terms of the electron theory of matter with which his name will always be associated. Lorentz was one of the outstanding figures in theoretical physics in that transition period when the difficulties of classical theory were becoming more and more apparent, and were being overcome by the introduction of the ideas of the quantum theory. His brilliance as a physicist was only equalled by his excellence as a linguist, which, coupled with the charm of his personality, made him the ideal chairman of international gatherings. He contributed notably to work of this nature, being president of the Institut international de Physique Solvay and chairman of the Committee for Intellectual Cooperation of the League of Nations.

Lorentz's successor in the chair of theoretical physics was P. Ehrenfest. The latter's own publications were not very numerous, but were all of fundamental importance and characterized by the clarity with which the essential features of the problem were presented. It was, however, as a teacher and inspirer of younger men that Ehrenfest, with his restless enthusiasm and vivacious personality, will best be remembered. All who knew him regret his sad end and the clouding of his later years by the dismal fate of his native Austria, which he foresaw so clearly.

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