school courses in chemistry and physics did not appeal to many boys willing and capable of taking up these occupations; and owing to the lack of adequate facilities, thousands of children in secondary modern schools were being lost to British industry. At the grammar school level, too, the lack of suitable equipment for training in applied science was almost universal. In suggesting that considerable scope remained for increasing the supply of young scientists, he was strongly supported by some other speakers, who considered that existing standards of requirements for entrance to industry should be critically examined and courses of training carefully reviewed.

As a whole, however, the discussion served to reveal once more the short range and empirical nature of the terms in which educational matters, and those relating specifically to training in science, are being considered not only by teachers but also by representatives of industry, members of public bodies and by many people at the universities, including a high proportion of scientists. These terms are not adequate for the effective assessment of the problems with which we are faced; still less can they be relied on to produce any satisfactory solution. A wider appreciation of the importance of fundamental research is essential, and with it must be associated a deeper understanding of the part that social forces play in the development and expression of all kinds of human ability. This is the only way in which, at this stage, the supply of scientists can be substantially increased. Only then will science take its true place in the cultural life of the nation.

OBITUARIES

Prof. W. H. Keesom

Prof. W. H. Keesom, whose death occurred in Leyden on March 3, was born on June 21, 1876, the son of a farming family at Texel, which is one of the small islands in the north of Holland. On this island the majority of the habitants make their living by lamb breeding. During many years the father of Prof. Keesom was a well-known figure on the lamb market of Leyden, which he regularly visited to deliver his lambs. His origin from the north established a strong impress on the personality of Keesom. So he was tenacious, but 'silent' and difficult in conversation. Also from his origin the young Keesom was not prepared to become a specialist in physics. Because of his unusual intelligence, his parents sent him to Alkmaar to study there at the secondary school.

At the age of eighteen, Keesom started to study at the University of Amsterdam. There he followed the courses of van der Waals and van 't Hoff. It was under the influence of those great masters that Keesom's interest for physics appeared.

In 1900 Keesom left the University of Amsterdam and became assistant under Kamerlingh Onnes at the Physical Laboratory of the University of Leyden. There he worked for seventeen years (1900–17), first as assistant and later as conservator, under the direction of Kamerlingh Onnes on the thermodynamic properties of gases and specially of helium. In 1904 he obtained his doctorate under van der Waals at the University of Amsterdam with a thesis entitled "Isotherms of Mixtures of Oxygen and Carbon Dioxide". In 1912 there appeared his famous paper "Die Zustandsgleichung", in the "Encyclopädie der Mathematischen Wissenschaften".

Keesom left Leyden in 1917 to become lecturer and later professor in the University for Veterinary Science in Utrecht. There he developed a laboratory for X-ray analysis of the structure of solidified gases. In 1923 he returned to Leyden as successor to Kamerlingh Onnes, and since 1924 he had, with Prof. W. J. de Haas, directed the Kamerlingh Onnes Laboratory there. From that date the laboratory was divided into two sections (I and II): Keesom undertook the directorship of section I, which was specially devoted to the study of molecular physics; de Haas took for his part the field of magnetism.

After the success obtained by Kamerlingh Onnes in liquefying helium, the remaining programme consisted in making a systematic study of the physical properties of liquid helium. So Keesom started to study, with Wolfke, the dielectric constant of liquid helium. With Clusius, and later with his daughter Annie, he measured the specific heat of liquid helium. It is well known that those measurements led Keesom to the detection of the two phases of liquid helium, helium I and helium II. Just before 1926, Keesom had succeeded in solidifying helium. Also, in his attempts to obtain still lower temperatures, Keesom, together with Gaede, succeeded in 1932 in reaching a temperature of 0·7° K. by pumping off liquid helium. During his systematic study of the specific heat of metals and in particular of superconducting metals, Keesom detected with Dr. Kok the jump in the specific heat of tin.

Apart from his two famous discoveries, namely, the λ-point of liquid helium and the jump in the specific heat of superconducting metals, Keesom and his collaborators carried out a lot of important work in the field of molecular physics. Thus I may mention his systematic work on van der Waals forces by means of measurements on the equation of state, the vapour pressure curve of helium, adsorption of gases, viscosity of gases and liquid helium, the structure of condensed and solidified gases, etc.

To close his scientific career Keesom wrote his book "Helium", which contains essentially a complete report of his life-work on helium in the three states. It is also necessary to mention the important part played by Keesom in the organization of the Institut International du Froid and in the preparation for its international meetings. His various collaborators during those exciting times will remember the way in which he stimulated everybody to write their reports for those meetings. He liked to feel that the outside scientific world should be impressed by the work done at Leyden.

The Second World War stopped Keesom abruptly in his scientific work. As a consequence of the tragic events of those times, Keesom began to suffer from neurasthenia, an illness which had attacked him earlier, after the death of his first wife. He retired from the University of Leyden in 1945.

During recent years, Keesom had recovered intellectually and again found some interest in scientific problems, which he discussed with his son Piet, professor of physics in the University of Purdue,

who is continuing the systematic work of his father on the specific heat of metals.

Keesom was known by his collaborators and friends as a severe but kindly director; he was always extremely helpful to young scientists and students. A. Van Itterbeek

Brigadier J. A. Sinton, V.C., O.B.E., F.R.S.

John Alexander Sinton, who died on March 25, was born in British Columbia, of Ulster parents, on December 2, 1884. He was educated at the Royal Belfast Academical Institution and at The Queen's College, Belfast, where he was an exhibitioner. He graduated M.B., Ch.B., with first-class honours at the Royal University of Ireland in 1908, and after holding house appointments at the Royal Victoria Hospital, Belfast, became Riddell demonstrator in pathology at The Queen's University and clinical pathologist to the Ulster Eye, Throat and Ear Hospital and to the Mater Infirmorum Hospital. In 1911 he took the diploma of tropical medicine at Liverpool, and in the same year entered the Indian Medical Service.

During the First World War, Sinton served as a regimental medical officer in Mesopotamia and was awarded the Victoria Cross for most conspicuous bravery and devotion to duty during an action at Sheikh Sa'ed in 1916. He also received the Russian Order of St. George, and was mentioned in dispatches on four occasions. He was promoted brevet major in 1919 and saw further active service in Afghanistan and Waziristan, being again mentioned twice in dispatches and being appointed O.B.E. in 1921.

On reversion to civil employment in 1921, Sinton entered the Medical Research Department of the Indian Medical Service. He was in charge of the Quinine and Malaria Inquiry at Kasauli during 1921–30 and was director of the Malaria Survey of India from its foundation until 1936. He returned to England in that year, and in 1937 became Manson Fellow of the London School of Hygiene and Tropical Medicine and adviser on malaria to the Ministry of Health. He also carried out researches in the Malaria Laboratory, Horton. On the outbreak of the Second World War he was recalled to duty and, after a brief period in India, became consultant malariologist successively to the East African Forces, the Middle East Forces and the War Office. He finally retired in 1945 with the honorary rank of brigadier and settled down on a country estate at Cookstown in Northern Ireland. He took an active part in public affairs, being a justice of the peace and high sheriff for Tyrone.

Sinton's activities covered a wide field, but were principally concerned with the study of malariology in its various aspects. His researches on the chemotherapy of the disease were of outstanding importance and he also published a number of papers on its immunology, parasitology, laboratory and survey techniques and sociological effects. Among his other interests was the study of cutaneous leishmaniasis, on which he published several articles. He was also the author of a series of thirty-six papers on Indian species of *Phlebotomus*, on which he was a leading authority.

Sinton was elected a Fellow of the Royal Society in 1946 and received a number of other honours. He was awarded the Arnott Memorial Medal of the Irish Medical Schools and Graduates Association in 1917; the Chalmers Memorial Medal of the Royal Society of Tropical Medicine and Hygiene in 1928; the Bisset–Hawkins Medal of the Royal College of Physicians of London in 1944; the Robert Campbell Memorial Medal of the Ulster Medical Society in 1946; the Mary Kingsley Medal of the Liverpool School of Tropical Medicine in 1949; and the Manson Medal of the Royal Society of Tropical Medicine and Hygiene in 1956, an award which was announced only a few days before his death.

Sinton was a man of boundless energy, high moral rectitude and outstanding personal charm. He never spared himself in any of his endeavours and was a source of inspiration to all who came in contact with him. He was buried with full military honours near his home in County Tyrone. G. Covell

Dr. A. G. Lowndes

Ashley Gordon Lowndes, who died on March 15 at Falmouth after an attack of pneumonia, has left his mark on science in several ways. His passion for investigation produced some valuable researches and, perhaps even more important, it generated in others a love of the subject and a rigour of method that have been the basis of many successful investigations. He went to sea in the Merchant Navy at the age of thirteen, until he was twenty-six, when the curate of a church in Portsmouth, where Lowndes was taking a Sunday School, recognized his brilliance as a teacher. The curate's father was the headmaster of Ardingley and he took Lowndes on to his staff. From there he went to Cambridge, where he was one of J. T. Saunders's first pupils and obtained a 'double first' and a 'swimming blue'. He joined the analytical staff of Nobel Industries as a chemist, and there his ideas led to several successful new processes.

The next phase of Lowndes's career was that Norwood took him to Marlborough as biology master, and it was here that he did his best work, both as teacher and investigator. He drove his pupils hard but gave them a real opportunity to see the fascination of living things and the possibility of exact investigation of them. It must be more than an accident that so many of them have proved to be successful investigators and teachers. His simple belief in scientific and moral principles, single-minded love of the subject and directness of statement, provided a compelling appeal to boys and an excellent basis for life.

Lowndes became interested at this time in Crustacea, and his series of papers on them are probably his best scientific work. He quickly mastered the systematics of the Entomostraca and contributed substantially to knowledge of freshwater copepods and ostracods. He would probably have been wise to concentrate on systematics, but it was characteristic of him to want to do more. By breeding experiments he showed that the superficially similar *Leptocyclops speratus* and *agilis* are unable to cross, although the various races of the latter do so freely. He then embarked on a study of locomotion and feeding, first in *Chirocephalus*, then in calanoids. He used elegant photographic techniques and obtained results that seemed to him unambiguous. But as he entered these experimental fields his aggressiveness led him into controversies of a type that often seemed unhappy; but were perhaps necessary for him. They became still more marked as he attacked more complicated problems, such as the mechanism