OBITUARIES

Sir Ralph Fowler, O.B.E., F.R.S.

THE death, the tragically early death, of Sir Ralph Fowler in Cambridge on July 28, 1944, at the age of fifty-five, leaves a gap in British and indeed in international mathematical physics which will be hard to bridge in the years that are to come. Whatever Fowler touched, he did well, superlatively well; he was a hard hitter, both at work and games; and he had a quickness of apprehension, and power of plunging into a new subject, of getting abreast of all its details and more than holding his own with it in the presence of its acknowledged experts, at the shortest possible notice, that are exhibited in equal fashion perhaps only in the higher flights of advocacy. He was that rare combination, an accomplished pure mathematician with a sound physical insight. In fact, the only criticism I ever heard of his use of his powers was that he mistook physics as a field for the exercise of mathematical rigour. It was scarcely a fair criticism; only the gruelling training he received in pure mathematics at Cambridge, and the use that he put it to in his early pamphlet on the differential geometry of plane curves, could have given him the experience which was afterwards to mean that no non-rigorous deduction in mathematical physics proper ever escaped his trenchant and sometimes pungently expressed comments. He could make up his mind with lightning rapidity (he was a first-class bridge-player) and his conclusions were always strongly based on common sense, but his mathematical powers ensured that his strokes were savoured with something subtler than mere common sense.

Ralph Howard Fowler was born on January 17, 1889, the eldest son of Howard Fowler, of Burnham, Somerset. He was educated at Winchester (of which he was afterwards a fellow) and at Trinity College, Cambridge, where he was elected to a prize fellowship in 1914 for work in pure mathematics. He already had a commission when he was admitted fellow—I was in chapel at the time, being admitted a scholar, and remember the unaccustomed sight of a gown over an officer's uniform—and while serving as a lieutenant in the Royal Marine Artillery he was seriously wounded in Gallipoli. During convalescence, he encountered A. V. Hill (then a captain in the Cambridgeshires) who was engaged in developing with Horace Darwin what eventually became known as the Darwin-Hill mirror position-finder. The two officers, with the author as assistant, went down to Northolt Aerodrome in March 1916 for the first experiments with this instrument, and there were joined by the late W. Hartree. Thus began A. V. Hill's 'band of brigands' who were to become the A.A. Experimental Section of the Munitions Inventions Department; and thus began R. H. Fowler's interest in mathematical physics. Fowler's main work in the rest of the War of 1914–18 was carried out at Whale Island, under H.M.S. *Excellent*'s hospitality, and besides covering all aspects of the then nascent science of anti-aircraft gunnery, dealt experimentally and mathematically with the fundamental problem of the motion of a yawed shell under aerodynamic forces. These papers, written in conjunction with other well-known mathematicians, and published in the *Philosophical Transactions of the Royal Society*, became classical.

Fowler became a member of the mathematical staff of Trinity in 1919, and turned his attention to the problems of mathematical physics that came to the fore with the return of the late Lord Rutherford to Cambridge as Cavendish professor—problems of kinetic theory, of Aston's mass spectrograph, of collisions 'of the second kind' and the principle of detailed balancing. He also made important contributions to astrophysics. This series of papers developed into a fundamental treatment of problems of statistical mechanics, begun in collaboration with Sir Charles Darwin: evaluations of the enumeration of 'complexions' of a given assembly of similar systems under given external macroscopic conditions, in the forms of coefficients of 'partition functions', were expressed as contour integrals, which in turn were evaluated by the method of 'steepest descents', and led to the identification of a certain mathematical parameter with the absolute temperature, to evaluations of mean energies, mean fluctuations of energy and degrees of dissociation in reversibly reacting constituents. The method was one of extreme generality and power. In essay form it was awarded the Adams Prize of the University of Cambridge in 1925, and in book form it appeared as "Statistical Mechanics", which is now in its second edition and was translated into German. It is a mine of information, of the most detailed kind, on the thermodynamic and quantal properties of dynamical systems in large assemblies—gases (perfect and imperfect), mixed phases, crystals. The first edition contained, too, many astrophysical applications. The work is nowhere easy reading, but its professional competence is amazing. It brought Fowler an international reputation, and led eventually to his joint editorship (with Kapitza) of the Oxford series of Monographs on Physics, and his membership of the editorial board of the newly founded American *Journal of Chemical Physics*.

In the middle nineteen twenties, astronomers had concluded that certain stars, of which the companion of Sirius is the best known, from the evidence of their high-surface temperatures, normal masses and faint absolute luminosities, must have small surface areas and so excessively large densities. It was for some time a mystery as to how matter could exist in this state. In a fundamental paper under the title "Dense Matter", Fowler pointed out that these stars, in their deep interiors, must be examples of ionized gases in the 'degenerate state' to which theoretical physicists had recently been directing attention. This state, differing completely in its physical properties from the classical ideal gas, supervenes under conditions of *relatively* high density and low temperature. The theory was afterwards applied by Sommerfeld to assemblies of electrons in conductors, but to Fowler belongs the credit of first realizing a physical application of the statistical mechanics of degenerate gases.

Fowler was always ready to turn aside to abstract problems of pure mathematics. A notable example was his definitive treatment of the general solutions of the second-order differential equation known as Emden's differential equation, which is of importance in the theory of stellar structure. In 1929 and 1930 there was considerable controversy as to the configurations of a gaseous mass—controversy which is still not settled—and certain empirical results obtained numerically concerning solutions of Emden's equation with non-central boundary conditions attracted Fowler's attention, reminding him of some of his pre-fellowship work. He now found

the clue; and in a set of papers developed a partly geometrical, partly analytical, method of surpassing beauty, which finally classified all solutions of Emden's equation and its generalizations. As G. H. Hardy remarked in a debate on the subject at the Royal Astronomical Society, theories of stellar structure may come and go, but Fowler's contributions to the pure mathematics of the subject have a permanent value.

Fowler had become the mainstay of theoretical physics at the Cavendish, and in 1932 he was appointed to the new Plummer chair at Cambridge. Here he found the fullest opportunity for the exercise of his remarkable versatility and power of assimilating new ideas. Anyone in doubt over an unusual argument, anyone in need of encouraging but salty criticism, always turned to Fowler and came away comforted.

In 1938 Fowler was appointed director of the National Physical Laboratory. But an unexpected illness made it undesirable for him to take up the appointment, and he had the unusual experience of being re-elected to his resigned chair. But he could not be persuaded to reduce his activities. During the present War he undertook important liaison work between British and Canadian science, in Canada, and later he did similar work in the United States. He was created a knight in 1942. Unfortunately, his illness returned, and though he threw himself into further work at the Admiralty, it gradually mastered him. He was attending important conferences up to within a few weeks of his death.

Fowler was elected a fellow of the Royal Society in 1925, and awarded its Royal Medal in 1936. He married Eileen, only daughter of the late Lord Rutherford; she died in 1931. He leaves two sons and two daughters.

Fowler had a forceful, even a masterful personality. As I once put it in a sketch of Fowler for the *Granta*, when Fowler was proctor at Cambridge, he had a short way with any committee he was chairman of, and a short way with the chairman of any committee he was a member of. He could be outspoken to the point of inducing tears, but his subsequent contrition was so endearing that he never left bitterness. He was a man who, starting his scientific career in a promising but by no means excessively distinguished way, went on maturing throughout his life, and attained a fame which surprised even his earliest admirers, but which was wholly deserved, and wholly earned. Had he lived, Fowler would have become one of the greatest scientific powers in the land. He had a tremendous capacity for personal friendships; to collaborate with him on a scientific paper was to embark on high adventure, and the thrill and 'agogness' of working alongside him, when results were being turned out quickly and one was on tip-toes as to what was round the next corner, were things never to be forgotten.

Fowler was big and powerful of frame, and he applied his strength with success to a variety of ball-games. He had claims to distinction as a cricketer, both in batting and bowling; he played an excellent game of both lawn tennis and real tennis; he represented Cambridge at golf and declared (and, we hope, made) many a 'Barnwell no-trumper' on his way home from golf at Mildenhall; he was also a rock-climber.

Fowler was the whole man, of many parts. His life was one of unsparing devotion to high scientific ideals. We cannot over-estimate the loss his untimely death means to Great Britain and to science generally.

E. A. MILNE.

WE regret to announce the following deaths:

Mr. Selskar M. Gunn, vice-president of the Rockefeller Foundation, and formerly director of the Paris office of the International Health Board of the Foundation, aged sixty-one.

Sir Henry Lyons, F.R.S., formerly director of the Science Museum, London, on August 10, aged seventy-nine.

NEWS and VIEWS

Prof. T. R. Elliott, C.B.E., F.R.S., and the Beit Trust

MANY generations of Beit Memorial research fellows will hear with regret of the retirement of Prof. Elliott from the honorary secretaryship of the Advisory Board to the Beit Memorial Trustees, an appointment he has held since 1930 when he succeeded the late Sir James Kingston Fowler. The Beit Trust, one of the first great benefactions for medical research in Great Britain, has played a very notable part in the training of a number of skilled investigators who have made important contributions in most branches of scientific medicine. From its inception in 1910, the Trust has been particularly fortunate in its first two honorary secretaries to the Advisory Board, both of whom have been distinguished by their enthusiasm for its work, pride in its achievements and vision in its possibilities. The continuity of the generous policy of the Trust, the ease of its adjustment to changing conditions without any lowering of standards or narrowing of aims, have owed much to their work.

Prof. Elliott, a former Beit fellow (1911–12), became a member of the Advisory Board in 1922, and thus has been able to draw upon his own earlier memories in acting as friend and adviser to many of those he has helped to elect to fellowships. During the last fourteen years his intimate knowledge of the working of the Trust has been of the greatest value to the work of his colleagues on the Advisory Board, and of the Trustees to whom he carried their recommendations. Prof. Elliott will take with him the grateful memories of all who have worked with him on the Advisory Board and of many in all parts of the world who, as Beit Memorial fellows, have had his friendly guidance. He hands on a fine tradition to his successor, Dr. A. N. Drury, director of the Lister Institute.

Metallurgy at the National Physical Laboratory: Dr. N. P. Allen

DR. NORMAN P. ALLEN, who has been appointed superintendent of the Department of Metallurgy at the National Physical Laboratory in succession to