the history of quantum mechanics in which nearly every advance has been shown later to have contained some erroneous components.

Wilson's later work was mainly concerned with basic problems such as a search for a relation between general relativity, electromagnetism and quantum mechanics. In the final volume of his text-book *Theoretical Physics*, which appeared in 1940, he expressed the view that a unified theory may follow the ideas of Kaluza who, in 1925, suggested that the paths of particles were geodesics in a 5-dimensional continuum. The fifth dimension would be related to the conservation of charge.

In all his researches he chose difficult subjects which were insoluble with the state of knowledge at the time. In his last years he was engaged in speculations concerning the shapes of the spiral nebulae.

Wilson was a fluent and remarkable lecturer and teacher. He had an unusual gift for personal contact and discussion with each student, often during the course of a laboratory class. His *Theoretical Physics*, in three volumes, contains many short, clear and original derivations of formulae. After his retirement he published the *Microphysical World* and *A Hundred Years of Physics*.

The latter contains valuable details of the history of recent ideas of the structure of the material world. It is at the same time an excellent, concise text-book of modern physics in which the human interest of the story helps the reader to follow the subtle arguments and experiments by which the facts have been established. The book is one of the "Hundred Years" series, but the title has perhaps deterred undergraduate students from appreciating its virtues as a source of information.

Wilson's wife died in 1957. He is survived by his son and his grandchildren. H. O. W. RICHARDSON

## Dr. Basil Roland Record

DR. B. R. RECORD, senior principal scientific officer in the Ministry of Defence, head of the Biophysics Section of the Microbiological Research Establishment, Porton, died at his home in the New Forest on November 17, 1965. He was fifty-four years of age.

He was educated at King Edward School, Birmingham, and as a schoolboy, passionately interested in chemistry, carried out quite advanced chemical preparations in his garden-shed laboratory. With this interest he went on, naturally, to study chemistry at the University of Birmingham under the late Sir Norman Haworth and graduated with first-class honours in 1933. His first research study, also carried out at Birmingham, under the direction of Dr. S. R. Carter, was in the field of physical chemistry—an investigation of the molecular weights of polysaccharide derivatives using osmotic pressure methods. The osmometer designed by Carter and Record for use with organic solvents formed, then, a notable advance in technique and is still quoted approvingly in modern texts.

In 1937, with the aid of an extended scholarship from the Department of Scientific and Industrial Research and with Sir Norman's encouragement, he was one of the earliest of those who went to work in Prof. Svedberg's laboratory in Uppsala to use the ultra-centrifugal and diffusion techniques then recently developed there. He found the 18 months he spent in Sweden in the quiet university town of Uppsala among the happiest of his working days, and it was there that he produced his very successful results on the physico-chemical characteristics of a series of methylated glycogens and of the specific polysaccharides from Types I, II and III pneumococcus. Although the publication of this work was much delayed, the observations must have been the earliest demonstration of the strong dependence of sedimentation and diffusion coefficients on concentration found with some materials.

Although he thought seriously of remaining longer in Sweden, where he found the way of life much to his liking, the prospect of approaching war sent him back to England in 1938 to join Drs. A. S. McFarlane and R. A. Kekwick, who had by then brought both a Svedberg ultra-centrifuge and Tiselius electrophoresis apparatus into operation at the Lister Institute. It is in striking contrast with present-day science that in his first year at the Lister Institute no financial support could be found for him from either the Lister or public funds. In 1939, however, he was awarded a coveted Beit Memorial Fellowship, which he held until he resigned it in 1940 to undertake more active war work. It was during this period at the Lister that he worked with R. A. Kekwick on a physico-chemical investigation of the development of diphtheria anti-toxin in the immunized horse and the characteristics of anti-toxin proteins, the work which he, in retrospect, thought of as his most successful.

From 1941 until 1944 he worked in the Army Operational Research Group under Brig. Schonland, and principally on radar predictors, field fire-control procedures (anti-aircraft) and trials of new equipment. It was typical of him that, conceiving that he could not work freely and scientifically under senior army officers, he refused throughout to accept a commission though at much cost to himself in terms of income and the advantages of commissioned rank in war-time.

In 1944 he was released from the A.O.R.G. at the request of Sir Alan Drury to join the 'Medical Research Council–Lister Blood Products Unit' which had been set up at the Lister Institute to undertake human plasma fractionation and, initially, the preparation of fibrinogen and thrombin which, together with fibrin foam, were urgently required for war-time clinical application: at a later stage the work was extended to cover the production of γ-globulin and albumin. He had a marked aptitude, and took much pleasure in his engineering skills and contributed to the design of pilot plant equipment for plasma fractionation under aseptic conditions.

The final move in his career was made in 1947 when, at the urgent request of the director, Dr. D. W. Henderson, he took up an appointment at the Microbiological Research Establishment. Here he was made responsible for the formation of a biophysics unit together with an extensive freeze-drying laboratory, for which he designed a range of freeze-drying machinery. Under his guidance, physico-chemical investigations of several biologically important macromolecular systems were made, including, particularly, botulinus toxin and polyglutamic acid, the latter of interest both biologically and as a member of the then emerging field of polyelectrolyte systems. He was, however, most particularly concerned with the fundamental aspects of the survival of micro-organisms during the freeze-drying process.

His work was characterized by the most scrupulous attention to the conception, design, performance and analysis of experiment, by his insistence that deductions and conclusions were adequately based on experiment and by the preparation of careful, clearly written and unambiguous reports: nothing aroused his anger more than the inclusion of unwarranted speculation in a scientific paper. Although somewhat retiring, he had a strong personality, and he was devoted to the idea, perhaps no longer really possible, that a scientist should be personally engaged in experimental observation and, in consequence, showed no desire to form a large group of workers, but gathered and retained only a few bound to him by his integrity and friendship.

Conflicting with his laboratory-bound science was his wish to be actively engaged outdoors, and he was fortunate in having spent his last years in a house with a large woodland garden in the New Forest, which gave him the greatest pleasure. R. G. WALLIS