t_0 onwards, the waves leave the interior of G in all directions, in such a way that the amplitude of the outgoing wave is small compared to the initial amplitude of the wave system inside G . The farther these outside waves spread, the more the amplitude of the waves inside G diminishes, and correspondingly the intensity of the later waves issuing from G . Only after infinite time has passed is the wave supply inside G exhausted, while the outside wave has spread over an ever-increasing space.

But what has this wave process to do with the first object of our interest, the particle originally enclosed in G ? To answer this question, we must imagine some arrangement which will permit us to carry out measurements on the particle. For example, let us imagine somewhere in the surrounding space a screen so made that the particle sticks to it on coming into contact with it. Then from the intensity of the waves hitting the screen at some point, we draw conclusions as to the probability of the particle hitting the screen there at that time. As soon as the particle has hit any particular point of the screen, the whole wave field loses all its physical meaning; its only purpose was to make probability predictions as to the place and time of the particle hitting the screen (or, for example, its momentum at the time when it hits the screen).

All other cases are analogous. The aim of the theory is to determine the probability of the results of measurement upon a system at a given time. On the other hand, it makes no attempt to give a mathematical representation of what is actually present or goes on in space and time. On this point the quantum theory of to-day differs fundamentally from all previous theories of physics, mechanistic as well as field theories. Instead of a model description of actual space-time events, it gives the probability distributions for possible measurements as functions of time.

The new theoretical conception owes its origin not to any flight of fancy but to the compelling

force of the facts of experience. All attempts to represent the particle and wave features displayed in the phenomena of light and matter, by direct recourse to a space-time model, have so far ended in failure; and Heisenberg has convincingly shown, from an empirical point of view, that any decision as to a rigorously deterministic structure of Nature is definitely ruled out, because of the atomistic structure of our experimental apparatus. Thus it is probably out of the question that any future knowledge can compel physics again to relinquish our present statistical theoretical foundation in favour of a deterministic one which would deal directly with physical reality. Logically, the problem seems to offer two possibilities, between which we are in principle given a choice. In the end, the choice will be made according to which kind of description yields the formulation of the simplest foundation, logically speaking. At the present, we are quite without any deterministic theory directly describing the events themselves and in consonance with the facts.

For the time being, we have to admit that we do not possess any general theoretical basis for physics which can be regarded as its logical foundation. The field theory, so far, has failed in the molecular sphere. It is agreed on all sides that the only principle which could serve as the basis of quantum theory would be one that constituted a translation of the field theory into the scheme of quantum statistics. Whether this will actually come about in a satisfactory manner, nobody can venture to say.

Some physicists, among them myself, cannot believe that we must abandon, actually and for ever, the idea of direct representation of physical reality in space and time; or that we must accept the view that events in Nature are analogous to a game of chance. It is open to every man to choose the direction of his striving; and also every man may draw comfort from Lessing's fine saying, that the search for truth is more precious than its possession.

OBITUARIES

Prof. Hugo Merton

THE Nazi régime has claimed as victim another scientific worker in the person of Prof. Hugo Merton, zoologist and traveller. In 1935 he was compelled to withdraw from his posts of deputy director of the Senckenberg Naturalist Society's Museum, assistant in the Zoological Institute of the University of Heidelberg and professor without chair of zoology, and in 1937, at the invitation of Prof. F. A. E. Crew,

he went to the University of Edinburgh to work at the Institute of Animal Genetics. In the autumn of 1938 he set out for Heidelberg, but on reaching Germany was arrested and sent to the concentration camp at Dachau, and when he was released and returned to Edinburgh in the following year his health was broken. He died on March 23, 1940, sixty years of age.

Merton was educated at the Universities of Bonn,

Berlin and Heidelberg, and specialized in the biological sciences. His many researches fall into groups, to each of which he made contributions of value: the histology of the sense-organs, nervous system and musculature of various molluscs; the anatomy and histology of the aberrant *Temnocephala* linking Turbellaria and Trematoda; studies on spermatozoa and experiments on ciliary movement and Protozoa, including his work on the geotaxis of *Paramecium*. In Edinburgh he concentrated upon physiological problems relating to sex.

But the most striking of all Merton's achievements was his expedition to the south-east Moluccas, undertaken on behalf of the Senckenbergischen Naturforschenden Gesellschaft. From October 1907 until August 1908 he explored the Aru and Kei Islands, bringing home vast zoological collections, the description of which by experts occupies two large volumes published at Frankfurt-am-Main in 1911 and 1913. The catholicity of his own interests is shown by his 200-page introductory account of the geography and ethnology of the islands.

Dr. Merton is survived by his widow, to whom the late Prof. Max Weber paid the compliment of dedicating one of his new species of fish from the Moluccas, on the ground that throughout she took an active part in the labours of her husband.

JAMES RITCHIE.

Prof. Pierre Marie

PROF. PIERRE MARIE, the celebrated French neurologist, whose death took place recently, was born on September 9, 1853, in Paris, where he received his medical education and qualified in 1883 with a thesis on the incomplete forms of Graves' disease, which afterwards became a classic. After serving as Charcot's chief assistant at La Salpêtrière he was elected physician in 1885 to the Bicêtre Infirmary, where he set up a rich collection of interesting records of cases, specimens and photographs of various diseases of the nervous system and attracted a large number of practitioners and students, many of whom have become distinguished neurologists. In 1907 he was elected professor of morbid anatomy in the Paris faculty of medicine in succession to Victor Cornil.

Prof. Marie made numerous valuable contributions to neurology. In addition to adding to our knowledge of well-recognized diseases such as rabies, disseminated sclerosis and epilepsy, he was the first to describe acromegaly (1886). In 1892 he brought out a book on diseases of the spinal cord which, like his articles on acromegaly, was published in English by the New Sydenham Society. In 1906 he caused a considerable sensation in the medical world by the publication of three articles on aphasia in the *Semaine Médicale*, in which he declared that the third left frontal convolution of the brain played no special part in the function of language, as had been maintained by Broca. During the War of 1914-18 he did valuable work in conjunction with his *interne*, Mme. Athanasio Benisty, on the symptoms and treatment of injuries of the nerves, which were published by her in the French "Horizon" series and in English

form in the "Medical Military Manuals". In 1926 and 1928 he did good service to neurologists and others by publishing in two volumes, entitled "Travaux et Mémoires", the most important of his articles which had appeared in various periodicals and society reports.

J. D. ROLLESTON.

Prof. W. Blackadder

PROF. W. BLACKADDER, who died on May 14, graduated B.Sc. in engineering in the University of Edinburgh in 1897 and was awarded the Vans Dunlop Scholarship. After graduating he gained a wide experience in general engineering practice with the Caledonian Railway, Aberdeen Harbour Commissioners and the Clyde Navigation Trust. In 1907 he was appointed lecturer in civil engineering and applied mechanics in the Royal Technical College, Glasgow, under the late Prof. Longbottom, who at one time acted as assistant to the late Karl Pearson.

Prof. Blackadder was specially interested in structural theory and hydraulics and succeeded in developing this interest in students and staff alike. His teaching bore the hallmark of the master and was always abreast of modern developments. In 1924 he was appointed as first occupant of the Jackson chair of engineering in the University of Aberdeen and succeeded in building up a most efficient department. He was deeply interested in the welfare of his students and aimed at giving a sound theoretical training in engineering science in which the teaching of practical engineering formed little part except to illustrate to some small extent the application of that science in practice.

As a result of researches into the losses in turbine pumps and flow of water in looped pipes he was awarded the D.Sc. by his Alma Mater in 1923, while in 1932 he was awarded the Telford Premium by the Institution of Civil Engineers for his paper on "Direct Methods for Construction of Influence Lines for Continuous Girders".

WE regret to announce the following deaths:

Sir James Baillie, O.B.E., formerly vice-chancellor of the University of Leeds, on June 9, aged sixty-seven.

Sir Thomas Hudson Beare, regius professor of engineering in the University of Edinburgh, on June 10, aged eighty.

Mr. Oliver Gatty, research chemist, aged thirty-two, and Mr. A. S. Chessum, research engineer, aged twenty-seven, during an experiment in connexion with air raid precautions, on June 5.

Prof. A. E. H. Love, F.R.S., Sedleian professor of natural philosophy in the University of Oxford, on June 5.

Sir Jocelyn Thorpe, C.B.E., F.R.S., emeritus professor of organic chemistry in the University of London and in the Imperial College of Science and Technology, on June 10, aged sixty-seven.