

manganese on the mechanical properties of gun steels, and (c) the effects of heat treatment on gun steels. Merrett carried out all the experimental work on which these reports were based. He conducted an investigation, also under Roberts-Austen, for the Board of Trade on the St. Neots railway disaster. This examination was published *in extenso* as a Blue Book in 1900, and the accident traced to a broken rail. He found evidence of a 'martensitic' structure, which is associated with great brittleness, on its surface. A temperature of at least 800° C. is required to produce this. Merrett was at least partly, if not wholly, responsible for a new lyddite shell exploder, for which a secret patent was taken out by the late Lord Haldane. He was also largely concerned with the development of ammonium nitrate for use as an ingredient of explosives, which led to the introduction of amatol.

In 1901, Merrett was appointed instructor in the Metallurgy Department of the Royal School of Mines, and spent the remainder of his professional life there until his retirement. He rose to the position of assistant professor. He was an admirable teacher, clear and inspiring. This side of his work appealed to him very much. He was always anxious that his students should conduct themselves with credit in their examinations, and this led him sometimes to take a kindlier view of their performances than the results warranted. As early as the age of sixteen years he showed his taste for military work and joined the 3rd Middlesex Artillery in 1888. He was transferred as a sapper ten years later to the newly-formed Corps of London Electrical Engineers. He rose to the rank of major and was mobilized for

active service on July 29, 1914. During the Great War he was in charge of various coast defences and anti-aircraft units. Afterwards his scientific knowledge was made available to the Ordnance College as instructor in metallurgy, chemistry and explosives. In 1926 he retired from military service on reaching the age limit and was awarded the Territorial Decoration and Long-Service Medal.

Merrett was a member of many scientific societies, a governor of the School of Metalliferous Mining at Camborne and a member of council of the Institution of Mining and Metallurgy. The writer was a colleague of his at the Royal School of Mines for twenty-three years. He possessed qualities which made him one of the most delightful of fellow workers. Some of these, such as punctuality and reliability, could probably be traced to some extent to his military training. Others, such as his perfect courtesy, generosity and good temper, were natural to him. It is impossible to think that he had an enemy. His many friends mourn the loss of one of the kindest and most unselfish of men.

H. C. H. C.

WE regret to announce the following deaths :

Mr. J. F. Bailey, director of the Botanic Gardens, Brisbane, from 1905 until 1917, and director of the Botanic Garden, Adelaide, from 1917 until 1932.

Prof. E. M. East, professor of genetics in Harvard University, aged fifty-nine years.

Admiral Sir Herbert Purey-Cust, K.B.E., C.B., formerly hydrographer to the Navy, on November 11, aged eighty-one years.

News and Views

The Royal Society

HIS MAJESTY THE KING has been graciously pleased to approve the recommendations made by the Council of the Royal Society for the award of the two Royal Medals for the current year to Dr. F. W. Aston, F.R.S., in recognition of his discovery of the isotopes of non-radioactive elements; and to Prof. R. A. Fisher, F.R.S., in recognition of his important contributions to the theory and practice of statistical methods. The Council of the Royal Society at its recent meeting recommended the following for election as officers and council at the anniversary meeting on November 30: *President*, Sir William Bragg; *Treasurer*, Sir Henry Lyons; *Secretaries*, Prof. A. V. Hill and Prof. A. C. G. Egerton; *Foreign Secretary*, Sir Albert Seward; *Other members of the Council*, Prof. F. C. Bartlett, Prof. F. E. Fritsch, Prof. M. Greenwood, Mr. H. L. Guy, Sir Thomas Holland, Dr. A. D. Imms, Prof. C. K. Ingold, Prof. G. B. Jeffery, Prof. J. Mellanby, Prof. J. Proudman, Dr. F. L. Pyman, Prof. O. W. Richardson, Prof. W. W. C. Topley, Prof. D. M. S. Watson, Prof. R. Whiddington, Prof. R. Whytlaw-Gray.

Prof. Enrico Fermi

THE Nobel Prize for Physics for 1938 has been awarded to Prof. E. Fermi, professor of theoretical physics in the University of Rome, and his work in connexion with artificial radioactivity induced by neutrons is specially mentioned in the award. Bombardment of the nucleus with neutrons is peculiarly effective in producing nuclear reactions because the neutron does not experience the strong electrostatic forces which oppose the approach of a proton or α -particle. Fermi in 1934 showed that most nuclei, even the heaviest which are most resistant to charged particles, are disrupted by neutrons with the formation of new radioactive nuclei. In the same year, he discovered that the effectiveness of neutron bombardment is greatly increased in the presence of masses of water or paraffin, and concluded that the neutrons are slowed down by collisions with hydrogen nuclei in these substances, and that the slow neutrons have a high probability of entering and disrupting nuclei. Prof. Fermi has, however, made other outstanding contributions to atomic physics. In 1926 he applied Pauli's exclusion principle to deduce a

new kind of statistics for electrons (Fermi-Dirac statistics). He applied this to the assemblage of electrons in an atom (Thomson-Fermi atom model), and it has become the basis of the modern theory of electrons in metals. In 1934 he devised a theory of β -decay, starting from the view that a β -particle is emitted when a neutron in the nucleus turns into a proton. The distribution of energies in a continuous spectrum requires that a neutral particle (neutrino) be emitted with the β -ray. This theory has formed the starting point for many more recent discussions. Fermi has also published work on spectroscopy, on quantum electrodynamics, and, with Rossi, on the deflection of cosmic rays in the earth's magnetic field.

Dr. W. D. Lang, F.R.S.

DR. WILLIAM DICKSON LANG, who retires from the keepership of geology in the British Museum (Natural History) at the end of the year, has made notable contributions both to palaeontology and to geology. While occupied with curatorial duties he has studied especially polyzoans and corals, and in classifying them he has always sought for underlying principles. Like palaeontologists studying other groups, he soon recognized parallel lineages in the evolution of these fossils as he traced them through geological time, and he found corresponding grades in the same order in each parallel lineage, showing that there was a definite common trend, as he termed it. Natural selection, therefore, did not work on indefinite individual variations but on trends which were 'orthogenetic' or in a certain fixed direction. Dr. Lang contributed several valuable papers on this subject to the *Proceedings of the Geologists' Association*, and he summarized his results in discussions at the centenary meeting of the British Association in 1931.

DEALING with animals which retained the complete skeleton of a lifetime in each individual, Dr. Lang could also study the growth stages, and he was convinced of the truth of the doctrine of recapitulation (the immature stages of an organism repeating more or less exactly the adult stages of its ancestors). He described it as "a guiding principle" for palaeontologists. Dr. Lang also recognized that the calcareous skeleton of the polyzoans, when once started in a lineage, often proceeds to superfluity and eventually leads to extinction. He treated this subject in a memoir in the *Philosophical Transactions* in 1919, and in two valuable volumes of the British Museum Catalogue of Cretaceous Polyzoa, 1921-22. Dr. Lang spent many vacations in studying the succession of zones in the Lias of the Dorset coast. In 1924 he contributed to the *Proceedings of the Geologists' Association* a remarkably detailed map of these formations, and during more recent years he and other specialists have made a detailed examination of the fossils he collected. His interests have always been varied, and during the Great War he investigated insects which spread disease, eventually preparing an exhaustive "Handbook of British Mosquitoes", which was published by the Trustees of the British Museum in 1920.

Prof. A. V. Hill, O.B.E., F.R.S.

THE Guthrie Lecturer of the Physical Society this year was Prof. A. V. Hill, Foulerton research professor and secretary of the Royal Society, who chose as the title of his lecture delivered on November 11 "The Transformations of Energy and the Mechanical Work of Muscles". Prof. Hill is a Cambridge man, where, under Langley, he devoted two years to research on the heat produced by living tissues. Here Hill found a congenial and stimulating environment, for those working in the laboratory at the time included such well-known figures as Anderson, Barcroft, Fletcher, Hardy, Hopkins and Keith Lucas. Prof. Hill's success may be said to be due to his appreciation of the basic essentials of a problem, to his knowledge of the methods by which such problems may be solved, to his ability to design the apparatus required by such methods, and lastly to his skill in constructing the necessary apparatus himself. A first-rate athlete, he was specially interested in the physiology of athletics. It was he who showed that energy is developed in muscle at two different times during a single contraction. Two pieces of apparatus have entered largely into these studies, namely, extremely delicate thermopiles and galvanometers which have a short period and great sensitivity. While the study of energy of contraction of muscle has been Hill's main line of research, a number of branch lines have interested him from time to time, mostly on biophysical subjects; for example, the measurement of small differences of osmotic pressure and the heat produced in nerves during the passage of impulses. During the Great War, Hill was director of research on anti-aircraft defence. In 1920 he became professor of physiology in Manchester, and in 1923 professor of physiology at University College, London. Prof. Hill has been honoured by several foreign universities and learned societies, and in 1922 he received the Nobel Prize for Medicine.

Energy Transformations in Muscles

IN his Guthrie Lecture on the subject, Prof. A. V. Hill pointed out that the study of the heat given out by muscles in relation to the work done by them is one of the classics of physiology. Until recently, however, the matter appeared much more complicated than it really is, owing to technical difficulties. These have been overcome by the use of a very rapid recording system and an insulated thermopile only 0.002 inch thick. Some very simple relationships have now emerged. An active muscle liberates energy in three forms: in maintaining a contraction, as heat; in shortening, as heat; in shortening against load, as work; its behaviour in any circumstances is deduced from the resultant of these three. Rate of total energy liberation of a muscle is determined by the load upon it, increasing as the load decreases. This allows a simple equation to be deduced for the relation between speed and load. The constants of the equation are the same whether they are obtained by thermal or by mechanical measurements. The fact that a muscle does less external work when shortening at a higher speed has led to the hypothesis that muscle is endowed with 'viscosity', attributed