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 palæontology 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 palæontologists 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 palæontologists. 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