Anniversary Meeting of the Royal Society.

THE anniversary meeting of the Royal Society was held on Nov. 30, and in his presidential address Sir Ernest Rutherford referred to the Society's loss by death during the past year of two foreign members, thirteen fellows, and two fellows who were elected under Statute 12, which provides for the election of persons who have rendered conspicuous service to science, or whose election would be of signal benefit to the Society. He also reviewed the work of the three Yarrow and two Foulerton professors who have been appointed since 1923, and announced that the Council has decided to fill the Foulerton chair vacant through the death of Prof. E. H. Starling. Dr. E. D. Adrian, lecturer in physiology in the University of Cambridge, has accordingly been appointed. With the aid of apparatus using electrical amplification, Dr. Adrian has been engaged in recording and analysing the minute changes transmitted, from an excited peripheral sense-organ, along the conducting system of the nerves—changes which, on arrival at a nerve-centre in the brain of a conscious being, would result in one or another form of sensation.

Sir Ernest Rutherford then gave an account of recent work on high frequency radiation, which appears elsewhere in this issue. The presentation of medals followed, and we print below extracts from the descriptions of the work of the medallists.

Presentation of Medals.

THE COPLEY MEDAL, AWARDED TO SIR CHARLES PARSONS.

In the world of mechanical engineering the genius of Charles Parsons has opened up a new era. He has originated and developed a new type of thermal engine entirely flexible and adaptable, and capable of high efficiency combined with concentration of power never even imagined before. By continuous practical effort for the past forty-five years, aided by remarkable mathematical insight acquired in his university days, he has perfected the parallel-flow compound steam turbine, and has applied it successfully to electric generation and to marine propulsion, both attaining to an unprecedented scale. While the utilisation of heat in the best triple-expansion reciprocating steam engine amounts to 17 per cent of the whole, the Parsons' large central station turbines now convert 25 per cent into mechanical power, and in still larger turbines 28 per cent is anticipated. The first steam turbine of 4 kilowatts was used in 1885 for electric lighting; at present, turbines of 20,000 and 30,000 kilowatts are in operation. The application to marine propulsion was signalised in 1897 by the appearance of the *Turbinia*, a small experimental craft developing the extraordinary speed of 33 knots. Large turbine-driven destroyers for the Navy rapidly followed, and now all large high-speed liners are turbine driven. During this remarkable development numerous problems arose involving a precise study of jet velocities, leakage, turbulent flow, and vacuum augmenters. The phenomena involving cavitation of screw propellers opened up new fields of abstract as well as practical interest. Sir Charles Parsons has been greater in the scientific development of thermal power produced by steam than any engineer since James Watt. A recent side product of his activities has been the revival of the British scientific industry of optical glass and telescopic construction, while some of his hours of relaxation have been spent in the strenuous endeavour to crystallise carbon into diamonds by catastrophic processes.

THE RUMFORD MEDAL, AWARDED TO PROF. FRIEDRICH PASCHEN.

Prof. Paschen is especially distinguished for his practical and theoretical contributions to spectroscopy. He early acquired remarkable skill in the investigation of infra-red radiation and made valuable determinations of the distribution of energy in the spectrum of a black body, giving the first experimental proof of the law that the frequency of maximum energy is proportional to the absolute temperature. He afterwards made numerous observations of the infra-red emission spectra of various elements, which were of fundamental importance for the development of our knowledge of series in spectra, and afterwards for the theory of spectra in relation to atomic structure. He has also contributed in a notable degree to the precise measurement and series classification of spectrum lines in general; he has long been one of the foremost workers on the Zeeman effect, and the results which he has obtained, including the discovery of the well-known Paschen-Back effect, have been invaluable for theoretical discussions. He has shown extraordinary skill in the design and manipulation of apparatus, and his work is characterised by an obvious striving for the greatest attainable precision.

A ROYAL MEDAL, AWARDED TO PROF. ARTHUR STANLEY EDDINGTON.

Prof. Eddington's contributions to knowledge within the past ten years have been mainly in connexion with the internal constitution of stars and with the generalised theory of relativity. He has formulated a complete theory of the internal structure of a star, assumed to be a non-rotating whirl of atoms and electrons, with radiation gradually forcing its way to the surface; further, he pointed out that the masses of stars, which are found by observation not to vary greatly, ranged about the point where radiation pressure balances gravitation. Later, he obtained a theoretical relation between the mass and absolute luminosity of giant stars. Prof. Eddington has also worked out a mathematical theory of Cepheid variables on the assumption that they are oscillating radially. In connexion with the theory of relativity, he conducted in 1919 one of the two eclipse expeditions which verified the deflection of light rays from stars near the sun. He also developed the theory, to a certain extent on the philosophical side, but considerably on the analytical side, especially with regard to the electromagnetic and gravitational fields.

A ROYAL MEDAL, AWARDED TO DR. ROBERT BROOM.

During the course of thirty-three years' search in Australia and South Africa, Dr. Broom has made a very large number of important discoveries in vertebrate palæontology, embryology, and morphology that shed new light upon the problems of the origin of mammals, lizards, crocodiles, and birds. His researches represent the most significant contribution made by any one investigator to the determination of the relationships of the main groups of vertebrate animals and to the definition and solution of the problems involved in the evolution of the higher groups.

THE DAVY MEDAL, AWARDED TO PROF. FREDERICK GEORGE DONNAN.

Prof. Donnan is, like his master van 't Hoff, a man of ideas. Early in his scientific career he wrote on

the nature of soap emulsions and on the theory of capillarity and colloidal solutions. His theory of membrane equilibrium and membrane potential is an achievement of the first rank, and has been the starting-point of numerous studies not only in the domain of pure chemistry, but more especially in biochemistry, where the conditions for displaying the phenomena he predicted are often encountered. His researches on surface tension and absorption at liquid-liquid interfaces have led to results of the greatest interest, and his verification by means of nonylic acid of the Gibbs' absorption formula is a most brilliant experimental conception. A by-product of his activities during the War is a theory of the action of gas-scrubbers, based on the velocity of absorption of gases by liquids.

THE DARWIN MEDAL, AWARDED TO DR. LEONARD COCKAYNE.

A true naturalist, Dr. Cockayne has waited patiently upon facts before drawing conclusions. For more than thirty years he has made it his task to deepen and widen our knowledge of New Zealand botany in the broadest sense. He is one of the foremost living students of plant-association; the taxonomic studies rendered necessary by his ecological results have led to those remarkable discoveries of natural hybrids in New Zealand that have won for him a world-wide reputation and have made on modern thought an impression akin to that produced by the results of Darwin's studies of plants under domestication. Dr. Cockayne's researches have had, on sylvicultural and agricultural procedure, a practical bearing which has been appreciated by, and has influenced the policy of, New Zealand statesmen.

THE SYLVESTER MEDAL, AWARDED TO PROF. WILLIAM HENRY YOUNG.

Dr. W. H. Young has taken a very prominent part in the development of the modern theory of functions of real variables, and in its application to the theory of Fourier's and other series. His earlier work dealt chiefly with the theory of sets of points, and contains important developments on the lines laid down by G. Cantor and Harnack. He soon preceeded to apply this theory in the integral calculus, and he obtained a general definition of the integral which is essentially equivalent to, although somewhat less simple in form, that given about the same time by H. Lebesgue, which latter has become a corner stone of modern analysis. Much of Dr. Young's work has proved to be a starting point for further investigations by other mathematicians. By means of his conception of restricted Fourier's series he was enabled to devise a method by which conditions of convergence, summability, etc., known to hold good for Fourier's series, could be carried over to series of Legendre's and Bessel's functions.

THE HUGHES MEDAL, AWARDED TO M. LE DUC DE BROGLIE.

Maurice François César, Duc de Broglie, is distinguished especially for his pioneer researches on X-ray spectra and secondary β-rays. He was one of the first to obtain the complete emission spectrum of X-rays and to study X-ray absorption spectra, while his work on the magnetic spectrum of the β-rays, arising from the passage of X-rays through matter, has proved of great importance. He founded in Paris a private laboratory directed by himself, which is devoted to researches on X-rays and allied subjects.

Applied Chemistry.

PHYSICAL CHEMISTRY AND BIOLOGY.

THE first Liversidge lecture was delivered before the Chemical Society on Nov. 29 by Prof. F. G. Donnan, who discussed the applications of physical chemistry in the service of biology. In connexion with similar lectures to be provided by the University of Sydney, the Royal Society of New South Wales, and the Australasian Association for the Advancement of Science, this series of annual lectures has been established by the Chemical Society in accordance with the terms of a bequest by the late Prof. Liversidge, of the University of Sydney, a bequest which was made with the object of stimulating thought and encouraging the acquisition of new knowledge. Liversidge lectures delivered before the Chemical Society will be concerned with physical and inorganic chemistry, whilst another series of lectures, perpetuating the memory of the late Sir Alexander Pedler, will deal similarly with organic chemistry.

Prof. Donnan first referred briefly to the part played by organic and inorganic chemistry in the advancement of biology. Physical chemistry, as created by Raoult, van 't Hoff, Ostwald, Arrhenius, and Nernst, first began to exert a powerful influence on biology, although no period in the development of physical chemistry clearly marked the beginning of the application of that science to biological problems. The osmotic theory of semi-permeable membranes, based on the work of Pfeffer and van 't Hoff, was of exceptional importance in its explanation of the then mysterious vital action of the living cell. The triumph and development of the ionic theory has revolutionised a large part of the theory of solutions, and has been of correspondingly fundamental importance in the study of essential constituents of the living organism; the hydrogen ion activity determines the molecular state and colloidal condition of the amphoteric proteins in aqueous solution, and the optimum activity of enzymes. It is not surprising, therefore, that the delicate dynamic equilibrium of living protoplasm requires a close regulation of the hydrogen ion concentration, determinable by known or theoretically calculable ionic equilibria.

Prof. Donnan also referred during his discourse to the great biological importance of the thermodynamical studies of Willard Gibbs, to whom we owe very important considerations relating to surfaces of separation between different media. There exist at such surfaces powerful uncompensated fields of atomic and molecular forces, as a result of which molecules and ions are held or adsorbed in spite of general thermal agitation tending to disperse them. Some of the forces may be of considerable extent, and perhaps considerable symmetry, whilst others are highly localised; the latter are of great importance since they cause the orientation and regular arraying of molecules and ions at surfaces and surface films. "A living cell," said Prof. Donnan, "is not merely a little bag containing salts, proteins, sugars, fats, and enzymes in which chemical reactions occur as in a beaker or flask. There is organisation, and organisation in space means arrangement. In this orientation and arraying of molecules and ions at surfaces we may perceive, perhaps, the first faint glimmering of the organised arrangement of life's mechanism."

Finally, Prof. Donnan referred to three considerations of major significance which must be taken into account. First, that the laws of thermodynamics, being statistical in their nature, do not necessarily