ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held as usual on St. Andrew's Day, November 30, when the report of the council was presented, and the president, Sir Archibald Geikie, K.C.B., delivered an address. Most of the matters mentioned in the council's report have been referred to already in the columns of NATURE, and others are of domestic, rather than of general scientific, interest. The council has decided "that the surplus annual income of the Darwin Fund, after providing for the silver medal and money gift prescribed by existing regulations, be devoted, not to the provision of scholarships or medals, but to the furtherance of biological research in the Darwinian field."

Upon the recommendation of the president and council of the society, the Government has agreed to continue its subscription to the International Association of Seismology for six years more, up to the end of March, 1916. In alluding to this decision in his address, the president took the opportunity to refer to Dr. John Milne's extensive work in modern observational seismology. "The valuable service whic ho has thus rendered to the study of earthquakes has been universally recognised, and there is a widespread conviction that the system of observing stations which he has created is worthy of being made a national undertaking."

It is proposed to publish a collected edition of the works of Sir William Herschel, under the editorial supervision of Dr. J. L. E. Dreyer. The cost will be shared with the Royal Astronomical Society.

A number of facts of importance relating to sleeping sickness in Uganda have been described by Sir David Bruce and his colleagues in papers presented to the society. The council reports as follows:—

Research on Tropical Diseases.

The work of the commission in Uganda has confirmed the conclusions, mentioned in the council's report of last year, that the *Glossina palpalis* is capable of conveying the infection of sleeping sickness for a much longer period than was thought to be the case at first, and that this fly may act as a carrier of other trypanosome diseases, such as those animal diseases that are produced by *Trypanosoma dimorphon*, *T. vivax*, and *T. nanum*.

One of the most important results of the last year's work of the commission is the discovery that the flies of the lake shore are still capable of transmitting the infection of sleeping sickness, although two years have now elapsed since the population was removed. The cause of this has not yet been ascertained with certainty, but further work is being done to determine, if possible, whether there is an animal reservoir for the *T. gambiense*, and especially whether cattle and antelope harbour the parasite of the disease, as laboratory experiments made at Mpumu suggest. This is a question of great importance with regard to the means to be adopted to control the malady.

The commission has not only done a great deal of work on sleeping sickness, but a number of researches on other maladies, human and animal, have also been carried out. Thus a disease affecting the natives in the province of Ankole, and known as "muhinyo," was investigated by Sir David Bruce and his colleagues, and the very interesting discovery was made that this malady was really Malta fever, and affected both men and goats in Central Africa.

In his presidential address, Sir Archibald Geikie referred to the losses by death sustained by the society during the year. These include the patron, King Edward VII.; foreign members: Alexander Agassiz, Stanislao Cannizzaro, Giovanni Schiaparelli, Robert Koch, Friedrich Wilhelm Kohlrausch, and Melchior Treub; and fellows, Sir William Huggins, Dr. Ludwig Mond, Dr. Shelford Bidwell, Sir Robert Giffen, Rev. Robert Harley, Mr. J. B. N. Hennessey, Mr. Edward Saunders, Sir Charles Todd, and Mr. C. Greville Williams.

The work of the medallists for this year was described by the president in the following words:—

COPLEY MEDAL.

The award of the Copley medal has this year been made to one of our own countrymen, who has been more than fifty years a Fellow of the Royal Society. Sir Francis Galton's life has been one of ceaseless activity in many varied departments of intellectual effort. Few of us can remember how he began as an enthusiastic explorer and geographer, "urged," as he confessed, "by an excessive fondness for a wild life," and with "the love of adventure" as his chief motive. He chose south-western Africa as the theatre of his exploration, penetrated into regions where no European foot had preceded him, and brought back with him a vivid impression of the scenery, physical geography, natural history, and ethnology of Damaraland and South Ovampoland. He embodied his observations in an interesting volume of travel published in 1853. That work showed that he was no mere hunter after game or seeker of adventure, but a shrewd and observant traveller, with his eyes open to every distinctive natural feature in the countries and their inhabitants. His experience in these African journeys led him to plan and to publish in 1854 his well-known and admirable handbook, "The Art of Travel," which, as a pioneering treatise in the practical methods of scientific exploration, has proved of inestimable service to the travellers of the last half-century.

Sir Francis at an early period of his career was led to interest himself in meteorology, which, as a science of observation, was then in its earliest infancy. With much labour and skill he constructed weather charts, and discussed meteorological statistics. His zeal and success in these studies led to his being chosen a member of the Meteorological Council at its origin, and he remained in that position until the council was superseded in 1901 by the Meteorological Office. He likewise acted as chairman of the Royal Society's Committee of Management of Kew Observatory from 1888 until 1900, when the work of this committee became merged in that of the National Physical Laboratory.

But it was not only in geography and meteorology that Sir Francis Galton manifested his versatile energies. He was much interested likewise in biological studies, especially in regard to questions of relationship and heredity. So far back as 1871 he began what has proved to be a voluminous and important series of contributions to these subjects. From his first paper, "Experiments in Pangenesis," down to his last volume on "Eugenics," his successive papers have shown a continuous development of ideas and conclusions. He was led from his early ethnological inquiries into the mental peculiarities of different races to discuss the problems of heredity genius from the fundamental postulate that "a man's natural abilities are derived by inheritance under exactly the same limitations as are the form and physical features of the whole organic world." To obtain further data for the discussion of this subject he carried out the elaborate statistical inquiries embodied in his "English Men of Science." Confident in the results of these researches, he proceeded after the manner of "the surveyor of a new country who endeavours to fix, in the first instance, as truly as he can, the position of several cardinal points." His results in this quest were given in his "Inquiries into Human Faculty and its Development," published in 1883. A further contribution was made by him in 1889, when his work on "Natural Inheritance" appeared. His subsequent papers and essays on "Eugenics" have still further stimulated inquiry into a subject of such deep interest and transcendant importance in all efforts to improve the physical and mental condition of the human race. It has seemed to the council fitting that a man who has devoted his life with unwearied enthusiasm to

the study and improvement of many departments of natural knowledge, whose career has been distinguished by the singleness and breadth of its aims and by the generosity with which he has sought to further them, should receive from the Royal Society its highest award in the Copley medal.

RUMFORD MEDAL.

The Rumford medal has been awarded to Prof. Heinrich Rubens, in recognition of the value of his researches in radiation. For many years he has been engaged in the experimental investigation of optical radiations of very long wave-length. In the course of this work he elaborated, in conjunction with Prof. E. F. Nichols, a method of isolating pencils of nearly homogeneous rays, using the fact that a non-metallic substance reflects very copiously waves of the same length as those to which it is opaque. If, then, a pencil of rays of mixed wave-lengths is reflected several times to and fro between mirrors of the same kind of substance, the rays finally emerging (the "Reststrahlen") have the wave-lengths of the kinds of light which the substance refuses to transmit. The light of other wave-lengths has been transmitted freely at each incidence, and by a sufficient number of reflections is ultimately removed from the pencil. By using different substances as reflectors, Prof. Rubens has isolated infra-red light of various wave-lengths up to as much as 96 μ, or about 0·1 of a millimetre; while, on the other hand, purely electric waves have been produced of wave-lengths as small as 2 millimetres. He has thus enormously extended our knowledge of the infra-red spectrum. Moreover, in conjunction with colleagues, he has investigated the absorbing and reflecting powers of substances for these long wave-length rays. He has shown that, for radiation of wave-length even fewer than ten times the wave-lengths in the visible spectrum, the reflecting and absorbing powers of metals and alloys are determined by their electric conductivities alone, in accordance with Maxwell's theory. It followed from Maxwell's own observations on the absorption of gold-leaf for visible light that agencies more complex than conductivity must be involved for these shorter wave-lengths.

Prof. Rubens has recently applied to the measurement of the long infra-red wave-lengths a quartz interferometer, and among other results he has found that the refractive index of water, for waves of length about 82 μ, is of the same order as for waves in the visible spectrum, while for the shortest Hertzian waves yet examined, about 2000 μ, it is as high as 9.

These examples will serve to illustrate how much Prof. Rubens has already done to bridge the gap between optical radiations and electric waves produced by direct electric agency, and how much more is to be expected from him in the investigation of the interval still remaining in which such fundamental changes of properties take place.

ROYAL MEDALS.

The awards of the two Royal medals given annually by our Patron the King have received his Majesty's approval.

One of these medals has been assigned to Prof. Frederick Orpen Bower, in recognition of the great merit of his contributions to morphological botany, of which department of science he is the acknowledged leader in Great Britain. Prof. Bower's early studies in this field (1880–2), on the genera Welwitschia and Gnetum, were marked by the discovery of the true nature of the two persistent leaves in Welwitschia. The next period of his work was given to a study of the morphology of the leaf. He developed in 1884 the idea of the phyllopodium or leaf-axis, and discussed in 1885 the apex of the leaf in Osmunda and Todea. This latter study was cognate to subsequent researches, the results of which were given in 1886 in a review of "Apospory and Allied Phenomena." This work, of much intrinsic interest, is important as having led its author to formulate the views advanced in 1890 in a memoir on "Antithetic as distinguished from Homologous Alternation [of Generation] in Plants." Another memoir, published in 1889, on "The Comparative Examination of the Meristems of Ferns as a Phylogenetic Study," prepared in the light of the then received belief that the leptosporangiate ferns are the more primitive, was followed in 1891 by a discussion of this question, in which Prof. Bower advanced morphological reasons for reversing the hitherto accepted phylogenetic order. The new conclusion has proved to be in accord with palæobotanical results, and marked another distinct step in the advancement of botanical science. During the third period of his work, 1892–1903, Prof. Bower's papers, including an important series on the spore-producing members, have resourcefully maintained the antithetic doctrine, and have afforded a striking instance of the advantage of a well-considered working hypothesis as a guide to investigation. The career of morphological research here outlined has been recently crowned by the publication (1908) of a book on "The Origin of a Land Flora," which is one of the "most important contributions to the advancement of natural knowledge, published originally in his Majesty's dominions," within the period prescribed in respect of the award of Royal medals.

The other Royal medal has been adjudged to Prof. John Joly, who is eminent in two branches of science, geology and physics. This combination of studies has proved to be reciprocally fruitful to both departments. It was from his mineralogical interests that he was led to devise the steam calorimeter, which has enriched physics with an apparatus of high refinement. The use of this method was extended by him to the direct determination of the specific heats of gases at constant volume, a measurement dealing with minute quantities of heat in circumstances quite beyond the capabilities of the usual forms of calorimeter. Among many contributions to standard physical data, which are accepted and in use, may be instanced his determination of the density of saturation of steam. His meldometer primarily intended for determining the melting points of mineralogical and geological specimens, has been the means of providing data for use in thermometry. He has devised and applied a method of determining the change of volume of rocks and other substances on fusion, which is a datum of primary importance for cosmical theories. He has carried out a refined research, with negative results, on the possibility of minute change of mass (as distinguished from weight) accompanying chemical combination. His recent extended investigations of the occurrence of radio-active substances in materials from various strata have been utilised for fundamental geological discussions. Of other useful inventions which he has introduced, one of the best known is the translucent block photometer.

Prof. Joly has made important contributions to the subject of colour photography, and devised some years ago a three-colour system in which all three colours are present on the same plate in the form of fine parallel lines or small dots.

He has also contributed substantially to the theory of biological processes, such as the ascent of sap in vegetation. Reference may likewise be made to his suggestive memoir on the age of the earth, based upon a discussion of the chemical constitution of the ocean.

DAVY MEDAL.

The Davy medal has been assigned this year to Prof. Theodore W. Richards, as a mark of appreciation of the value of his work in the determination of the atomic weights of the elements. His researches on this subject have not been surpassed in comprehensiveness by those of any other chemist. He has himself determined the atomic weights of no fewer than fourteen elements, and many other atomic weight determinations have been made under his direction and superintendence. The accuracy of the numbers obtained is certainly much higher than that which has been attained by any previous series of researches, and it is impossible to speak in too high terms of the ingenuity, the unremitting labour, and the masterly manipulation which Prof. Richards has brought to bear on his investigations.

In addition to this work on atomic weights, Prof. Richards has made many important contributions to physical chemistry, and it is probably no exaggeration to say that he has done more to raise the standard of accuracy in physico-chemical work than any other living

chemist. Theoretical contributions to this branch of science are comprised in a series of papers on "The Possible Significance of Changing Atomic Volume," in which he suggests a relation between the energy of the atoms and their compressibilities. In order to test his hypothesis, he has made a long series of investigations on the compressibility of elements and compounds. He has determined this constant for nearly all the solid and liquid elements, and he has shown that the compressibility is a periodic function of the atomic weights. In electrochemistry Prof. Richards has made important determinations of the electro-chemical equivalent of silver, and he has supplied some of the most rigorous proofs of the universality of Faraday's law.

DARWIN MEDAL.

To Mr. Roland Trimen, who was for many years curator of the South African Museum in Cape Town, the Darwin medal has been awarded. His official position, and the duties it involved, enabled him to do admirable work in African zoology. His name will always stand with those of Bates and Wallace in the establishment and illustration of the theory of mimicry. In addition to his researches on that subject, he has done admirable systematic work, his descriptions of insects, especially the *Lepidoptera rhopalocera*, being models of accuracy and literary style. He, furthermore, rendered the greatest assistance to Charles Darwin, especially in his work on orchids—assistance the high value of which is acknowledged in a long series of that great naturalist's published letters.

SYLVESTER MEDAL.

The medal which perpetuates the name and mathematical prowess of James Joseph Sylvester has this year been assigned to Dr. Henry Frederick Baker, in recognition of his work in the theory of functions, wherein he has shown himself to be a profound analyst. His book on the Abelian functions, published in 1897, is a classic, and probably no better guide to the analytical development of pure mathematics has appeared during the last three-quarters of a century. While basing the argument of the work on the methods of Riemann, he never loses sight of the arithmetical ideas which we owe to Kronecker, Dedekind, and Weber, or of the geometrical notions brought to light by the labours of Clebsch, Gordan, Noether, and Klein. The critical insight which was thus in evidence marked him out a few years ago as the editor of "Sylvester's Collected Papers." This work, which, with the approaching issue of the fourth and last volume, may be said to be complete, has been necessarily a difficult task, which, besides making demands upon the resources of an accomplished mathematician, has entailed no little editorial labour. Dr. Baker, by explanatory and critical observations, and by frequent ameliorations of the text, has done much to assist mathematical students. His scholarly work has resulted in a faithful record of the course of Sylvester's thought. It seems eminently fitting that the Sylvester medal should be given to one who has erected so lasting a memorial to the great mathematician.

HUGHES MEDAL.

To Prof. John Ambrose Fleming the Hughes medal has been awarded. For thirty years he has been actively engaged in researches in experimental physics, chiefly in the technical applications of electricity. He was an early investigator of the properties of the glow lamp, and elucidated the unilateral conductivity presented in its partial vacuum between glowing carbon and adjacent metal, a phenomenon which has been linked up recently with the important subject of the specific discharges of electrons by different materials. He has published in the scientific and technical Press, and in technical text-books, many admirable experimental investigations and valuable expositions in the applications of electricity, as, for example, to electric transformers and wireless telegraphy. Of special interest and value for theory were the important results concerning the alterations in the physical properties of matter, such as the remarkable increase in the electric conductivity of metals when subjected to very low temperatures, which flowed from his early collaboration with Sir James Dewar in investigating this domain. In recent years he has taken a prominent part in the scientific development of telegraphy by free electric waves.

In the evening the fellows and their guests dined together at the Whitehall Rooms, Hotel Metropole.

ENTERIC FEVER CARRIERS.[1]

THE frequent difficulty in accounting for the source of infection of enteric fever once led to the theory that this disease could arise *de novo*, that is to say, that certain organisms in human dejecta were capable of developing, in favourable circumstances, into enteric fever organisms. It has also been maintained more recently that the specific organism of this disease was capable of living and multiplying in water and soil, for considerable periods. But the bacteriological work of the past few years has discredited both these hypotheses; and the "carrier" case of enteric fever or the mild, unrecognised case of infection generally, explain the transmission of the disease in those cases in which the disease crops up in the absence of any recognised sufferer from the disease.

A "carrier" of enteric fever is a person who, although he may be in good health, carries the infectious material in his body, from which it may pass out. He is not merely a passive transmitter of infection; he is also a breeding-ground and storehouse of these specific organisms; and it appears that not only those sick with the fever, but also healthy persons who happen to be "carriers" of the infection, offer the best explanation for the maintenance of the infection in communities.

The subject has naturally attracted much attention and led to many investigations, the results of which are to be found in numerous recent publications, and Dr. Ledingham has done a great service in preparing for publication a summary of the more important investigations that have hitherto been made of this subject. He gives the history of a large number of occurrences of enteric fever in domestic life, in institutions, and in military populations, in which the source of infection has been traced more or less convincingly to a "carrier." In many of these cases the evidence is conclusive that the infection was conveyed by food or milk. The recorded instances go to prove that the female sex is more liable to carry the infection than the male, and that of both sexes some 2 to 4 per cent. of previous sufferers may continue to harbour the germ, and become "carriers," who intermittently discharge the germ, for periods extending maybe for many years.

As Dr. Theodore Thomson, who writes an introduction to this report, states, the difficulty of dealing with "carriers" is very great indeed, having regard more particularly to the long periods during which people may harbour the infection and to the fact that it has hitherto proved very difficult to free them from the infection. The chief available measures include: all possible efforts to detect "carriers" in the community, and to endeavour to secure on the part of a "carrier" those precautions of strict personal cleanliness and of disposal of dejecta that will minimise the risk of infecting others; an endeavour must also be made to prevent such "carriers" from taking any part in the milk trade or in the preparation or handling of food.

In this interesting report, Dr. Ledingham also discusses the diagnostic methods employed in the search for "carriers" and the immunity question in "carriers." A useful bibliography is appended.

[1] Dr. J. C. G. Ledingham's Report to the Local Government Board on the Enteric Fever "Carrier"; being a Review of current knowledge on this subject. Pp. 138. (London: Wyman and Sons, 1910.) Price 1s.