

rops can be studied at sea by evaluation of their numbers in measured volumes of water and also experimentally in the laboratory. Certain species of plankton organisms are restricted to certain types of water, and form most valuable biological indicators of their respective water masses, which are often not easily distinguishable by the usual hydrological features, such as salinity and temperature.

Bottom-living invertebrates form the food of many fish and are specialized for life in different grades of bottom material, from fine mud to coarse gravel, and normal metamorphosis from the larval stage may only occur on the appropriate substratum. Study of the available food in the different deposits reveals considerable variations. The topography of the sea bottom is also important in connexion with water movements. There are indications that the embayments resulting from submerged valleys may cause submarine waves, with consequent upwelling of nutrient-laden water into the photic layers.

With the exception of insects, all the major groups of animals are represented, many of them exclusively, in the sea. The problems they present for inquiry to the systematist, morphologist, ecologist, parasitologist, embryologist and geneticist are without limit, and so, from this point of view, are the facilities of the Plymouth Laboratory. From a study of structure there is a natural transition to that of life-histories, food and feeding, breeding and growth, and the general relationships between the animal and the environment. Apart from the bearing of such studies on food fishes and shellfish, they provide essential knowledge for combating the activities of marine boring animals and of fouling organisms. During the War the demand for raw material, such as alginic acid, agar and mannitol, from seaweeds, gave a sudden stimulus to research on the life-history and growth-rate of intertidal weeds, of which very little was known. Extension of work into estuarine waters has provided physiological problems of the first importance and data of value in assessing pollution. Finally, by the working out of new methods of collection and analysis, the Laboratory has played an important part in the success of deep-sea expeditions carried out by vessels of many countries.

While the work of the staff at Plymouth is most varied, as revealed in the foregoing brief survey, it is greatly increased by that of the continuous stream of visiting workers from all countries which has always been encouraged in every way possible. To them in particular has been due the increasing volume of physiological work for which the rich supply of animal life provides material often unobtainable elsewhere, such as the spider crab, *Maia*, used for nerve physiology and studies on the respiratory pigment, haemocyanin, the squids and cuttlefish with their giant nerve fibres, sea anemones with their simple nerve net, and the dogfish which has provided material for elucidation of the function of the lateral line and of the labyrinth.

From the simple beginnings of accommodation, staff and programme in 1888, the Plymouth Laboratory has been gradually raised to its present commanding position among research institutions, above all by the careful guidance of Dr. E. J. Allen, its director for forty-two years, and of his successor for an all too brief period, Dr. Stanley Kemp. With their names will always be associated that of Dr. G. P. Bidder, who has given so generously in wisdom and money. The present buildings can accommodate some forty workers, including the present twelve

members of the permanent staff. It possesses an admirable library and an aquarium. There are two research vessels, a 25-ft. motor boat and a 90-ft. motor fishing vessel used for investigations at sea and also for collection of specimens and for stocking the aquarium. During the Easter vacation, they also assist in the courses for students which are so important a feature in the work of the Laboratory, and which have guided many young zoologists into a life-work of fruitful research either in the universities or in marine laboratories.

The Plymouth Laboratory, in the words of its present director, F. S. Russell, "aims to give facilities for any research, not necessarily only biological, on problems for which the sea can provide the materials or the environment required. Its position is unique, lying as it does between the extremes of a fishery research laboratory and of an oceanographical institution, yet serving both, and at the same time offering facilities for visitors like the laboratory at Naples on whose pattern it was first founded. Let us hope it may continue to hold this focal position and attract all those interested in the science of the sea and indeed of life itself."

THE VIENNA ACADEMY OF SCIENCES (1847-1947)

THE "Kaiserliche Akademie der Wissenschaften" of Vienna was founded by Kaiser Ferdinand I on May 14, 1847. Although not a State institution, the Academy is conducted under the aegis of, and is endowed by, the State. It consists of two Sections (Klassen), the Mathematical and Natural Science Section for mathematics, natural science, medicine and technical science, and the Philosophical and Historical Section for philosophy, history and archaeology, art and music, language and literature, geography and ethnology, law, political science and economics. The Sections meet separately every fortnight for the consideration and discussion of scientific subjects, and they have a joint session once a month.

The work of the Academy is carried out under the continuous supervision of a commission for each scientific subject or for a particular research undertaking, this commission advising on the equipment, methods and problems of the undertaking, and on the choice of suitable personnel. From the scientific point of view, the main work of the Academy is under the care of its members, and it maintains a scientific liaison with various State institutes, in particular with those of the University of Vienna. Moreover, the Academy has several institutes under its direction, especially on the scientific side.

Each Section of the Academy has 33 members and 80 corresponding members, of whom 35 are Austrians and 45 foreign nationals, and there are also 8 honorary members in each Section. Provision is also made for the election of eight honorary members of the whole Academy, and these would be mostly highly placed dignitaries of the State who have rendered service to research or to the advancement of the interests of the Academy, or distinguished men of learning of national or international repute. Corresponding members are entitled to take part in open meetings of the Sections, but they are not automatically promoted to full membership of the Academy. Places rendered vacant by the death of members or corresponding members

are filled at the annual elections, and membership is only possible by election.

During the past hundred years, the activities of the Academy have been many and varied. In the Mathematical and Natural Science Section, a beginning was made in 1849 with meteorological observations in Austria, and these laid the foundation for the establishment of the Zentralanstalt für Meteorologie und Geodynamik, now a State institution, but with which the Academy still maintains close scientific connexion. Measurements of gravity in Austria in relation to geotectonic structure have been carried out, a magnetic survey of the country has been made, and investigations on atmospheric electricity have been undertaken. Furthermore, the Academy has taken part in Polar expeditions and fitted out the station on Jan Mayen Island (off Greenland) in the years 1882-83 and 1932-33. In the years 1867-79 investigations of a hydrographic and physical nature were carried out in the Adriatic, and during 1890-98 expeditions were sent to the Eastern Mediterranean (north of Crete), to the Sea of Marmora and to the Red Sea for hydrographic and geophysical observations, for the chemical and physical investigations of the water, and for the collection of zoological specimens. In 1901 a botanical expedition was sent to Brazil, and one for zoology in 1903.

On the scientific side, the Academy administers wholly or in part a number of research institutions. The Institut für Radiumforschung (Vienna Radium Institute) was founded in 1910 and possesses 4 gm. of radium chloride for research purposes. From among its past activities may be mentioned the provision and certification (jointly with Paris) of radium standards, the development of methods of measurement, investigation of the various radioactive radiations and the effects of radioactive substances, the isolation and properties of the radio-elements, and work on isotopy. The years between the two World Wars were characterized primarily by K. Przibram's work on crystal physics, and a large amount of work was done in the Institute on problems connected with artificial transmutation (by Pettersson, Kirsch, Ortner, Stetter, Blau and others). At the Biologische Versuchsanstalt in Wien (Prater), experimental zoological and botanical work was carried out between 1913 and 1941, more especially on *Entwicklungsmechanik* and research on regeneration. The Station was damaged during the War, and its director and co-founder, Hans Przibram, was a war victim and died in a concentration camp. The Biologische Station in Lunz investigates the plant and animal world from the point of view of biology and ecology in the three Alpine lakes and in the neighbourhood accessible from the Station. The Academy also has Höhenobservatorien (mountain observatories) on the Sonnblick (Hohe Tauern, 3,100 m.), and on the Obir (2,000 m.) in the Karawanken, south-east of Klagenfurt.

The Philosophical and Historical Section of the Academy has conducted research in the field of Austrian history back to prehistoric times. It has carried out prehistoric excavations and investigations on monuments from Roman times, and has published "Quellen zur österreichischen Geschichte" (Sources of Austrian History) dating back to the early Middle Ages. Between 1900 and 1910 research expeditions were sent to Southern Arabia for linguistic purposes, and likewise to Palestine and Transjordan for archaeological studies. It has also published a *corpus* of

ecclesiastical writers in Latin, as well as records of Greek and Roman inscriptions of Asia Minor resulting from journeys of exploration in that region. Furthermore, excavation of an extensive cemetery near Giza, in the neighbourhood of the Great Pyramids, yielded important results on the history of architecture and sculpture of the Old Kingdom in Egypt. Linguistic and archaeological investigations in the Balkans have also been undertaken.

Among the institutes under the control of the Academy there is also a Phonogrammarchiv (Gramophone Library), equipped with the most modern methods of recording, and here are housed a large number of speech records of most of the world's living languages, vocal 'portraits' of important historical Austrian personages and representatives of the stage, together with interesting medical records on rare defects in speech.

In the realm of natural science, the Academy has the names of many distinguished men of science on its roll, including the mathematician Wilhelm Wirtinger, the physicists Loschmidt, Boltzmann, Franz Exner, Ernst Mach and Stefan, the chemist Auer von Welsbach, the geologist Eduard Suess, the botanists Richard Wettstein and Hans Molisch, and the medical scientists Karl Rokitsky (pathological anatomist), Sigmund Exner (physiologist) and Theodor Billroth (surgeon).

The Academy issues the following publications: *Denkschriften der Gesamtkademie* (Vol. I: History of the Academy, 1847-1947, by the present vice-president, Prof. R. Meister), *Almanach* (annual reports of the Academy), *Anzeiger* (preliminary notices) of the two Sections (annual reports of activities). Scientific papers in each Section are published in *Denkschriften* and in the *Sitzungsberichte*.

It is not generally known that the Vienna Academy rendered incalculable service in two directions in the early days of radioactivity. When it was realized that there were other radioactive substances than uranium and thorium present in pitchblende, it seemed probable that these would be found in the uranium residues resulting from the extraction of uranium, of which large quantities lay derelict at St. Joachimstal in Bohemia. The French approached Suess, who was president of the Academy at the time, and through his intervention with the Ministry of Agriculture, two wagon loads of the residues were dispatched free of charge to Paris. It was from this material that the Curies isolated the element radium and prepared the Primary International Radium Standard, and it has been estimated that 60,000 kgm. of these residues contained a total of about 24 grams of radium. The second instance concerns the loan by the Academy of about 400 milligrams of radium to the late Lord Rutherford; it was primarily with this material that most of the work of the Rutherford Schools at Manchester and Cambridge was carried out. After the First World War, Lord Rutherford purchased this radium from the Academy in annual instalments, and as a direct result the Vienna Radium Institute was enabled to carry on through the first lean years of peace.

On the recommendation of Prof. H. Mache, of the Technical High School, it was my happy privilege to work in the Vienna Radium Institute during 1913-19. That grand old man of science, the spectroscopist Franz Exner, lovingly known as 'Väterchen', was the representative of the Academy in the Institute, and Stefan Meyer made an ideal director. It is good to know that, after a break of several years, he is again

directed also the School of his wealth in the in 1911 success prison family through the pi (radio) Instit weigh radioa Höngig Instit Patko was a the cl rays a mem Prize a for recent to fel for ti receiv of the of wh able, publi which tion I I given Prof. tion Akad frien tion.

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directing the Institute, and that Karl Przibram is also there. Imbued with the spirit of the Exner School, Meyer was ever ready to place at the disposal of his fellow-workers his stimulating ideas and great wealth of experience as a pioneer and fruitful worker in the field of radioactivity. At the outbreak of war in 1914, and with the backing of the Academy, he successfully appealed for my release as a civilian prisoner of war, and as a result my work in the happy family atmosphere of the Institute continued throughout hostilities. During these years much of the pioneer work on isotopy and on tracer elements (radioactive indicators) was carried out in the Institute (Hevesy and Paneth), and the atomic weights of lead of radioactive origin and of other radioactive elements were accurately determined by Hönigsmid. Several Polish refugees worked in the Institute at that time, including Godlewski, Loria and Patkowski. Work on the counting of radioactive rays was actively pursued, mainly in collaboration with the chief assistant, V. F. Hess, discoverer of cosmic rays (1912). It is of interest to note that two of the members of the Institute later received the Nobel Prize (Hess and Hevesy), the latter also being elected a foreign member of the Royal Society, and quite recently Paneth (now at Durham) has been elected to fellowship of the Society. I shall be ever grateful for the friendly and cordial way in which I was received into the fellowship of the Radium Institute of the Academy, the stimulating and fertile influence of whose members was alone responsible for my being able, as an enemy alien in those eventful years, to publish twenty-three scientific papers, sixteen of which were presented to, and accepted without hesitation by, the Academy for publication in the *Berichte*.

I have much pleasure in acknowledging the help given me by the vice-president of the Academy, Prof. R. Meister, who supplied much of the information contained in this article. I am also indebted to Akademierat Dr. W. Oberhummer and to my old friend Hofrat Prof. H. Mache for additional information.

ROBERT W. LAWSON

CENTENARY CELEBRATIONS

The centenary of the Academy was celebrated in Vienna during the week beginning May 11. After the reception of guests in the Academy on the previous evening, the proceedings began on Monday, May 12, with a meeting of the Historical and Philosophical Section. The meeting was opened by the vice-president, Prof. Richard Meister, and after submitting the report of the Section, the general secretary, Prof. Josef Keil, described the work of the Austrian Archaeological and Philological Expedition to the Balkans, Asia Minor, Arabia and Egypt. In the evening, there was a performance of Hoffmannsthal's "Jedermann" given in the Ronacher Theatre, since the Burgtheater had been damaged by bombing. The meeting of the Mathematical and Science Section was opened on the following day by the president, Prof. Heinrich Ficker, and after the report had been presented by the secretary, Prof. Adalbert Frey, a historical account of the meteorological and geophysical work of the Academy was given by Prof. Ficker.

On May 14 the main ceremonial meeting was held in the great hall of the Academy. The ceiling, which had been damaged by water, has been restored, and this hall, with its magnificent baroque interior, made a fine setting for the distinguished gathering. The

president of the Academy, in opening the ceremony and in welcoming the guests, pointed out that the Academy, which once belonged to a great country, now belongs to a small one, but that he hoped it would maintain, on the intellectual level, the characteristics of a great country. The President of Austria, Dr. Karl Renner, who had recently been elected an honorary member, then addressed the meeting, and stressed the importance of the freedom of science and research, and its independence from political influence or ideas. The Austrian Chancellor, Dr. Leopold Figl, then spoke. He referred to the role of Austria in the past as a mediating influence between East and West, and hoped that, in the present times, this could be taken up again. After a speech by the Minister of Education, Dr. Felix Hurdes, the congratulatory addresses from foreign societies were presented. In spite of the difficulties of travel, a number of learned societies sent delegates to attend in person: these included the British Academy (Sir Charles Webster); Royal Academy of Brussels (Prof. Henry Gregoire); Cambridge Philosophical Society (Dr. F. P. Bowden); Czech Academy of Sciences (Dr. Viktor Trkal); Papal Academy of Sciences, Rome (Prof. Ernst F. Petritsch); Paris Academy of Sciences (Prof. Charles Jacob); Polish Academy of Sciences (Prof. Tadeusz Kowalski); Swedish Royal Academy of Sciences (Dr. Orvar Nybelin); Swedish Royal Scientific Society (Prof. Einar Löfstedt); Swiss Academy (Prof. A. von Muralt); and Hungarian Academy of Sciences (Prof. S. Domanovsky). Congratulatory addresses and telegrams were also received from learned societies throughout the world.

The president then announced the election of new members and the award of prizes. Dr. Karl Renner was elected the sole honorary member of the whole Academy. Of the Mathematical and Science Section, J. Radon and W. Schwarzacher were elected full members; E. Hubble and P. Niggli, foreign honorary members; Sir Henry Dale, A. Ernst, O. Hahn, E. Hertzprung, H. Pettersson and F. Vening-Meinesz, foreign corresponding members. Of the Philosophical and Historical Section, R. Köstler and K. Mras were elected full members; A. Dempf, I. P. Dengel and C. Rauch, Austrian corresponding members; P. F. Jouguet and Gilbert Murray, foreign honorary members; and C. Borren, B. Croce, S. Eitrem, H. Kelsen, G. Mercati and C. Samaran, foreign corresponding members. The Grillparzer Prize was awarded to Rudolf Holzer; the Fritz Pregl Prize to Heinz Holter; the Haitinger Prize to Prof. Berta Karlik, who worked for a time at the Royal Institution, London; and the Rudolf Wegscheider Prize to Prof. Alfons Klemenc. The meeting closed with an account, given by the vice-president, Prof. Meister, of the history of the Academy during the hundred years of its existence; the first award of the Jubilee Prize was made to him for his "Geschichte der Akademie der Wissenschaften in Wien, 1847-1947".

In the evening, there was a special performance by the State Opera Company of "Figaro", given in the Redoutensaal of the Hofburg. It was a remarkable performance, sparkling with life and gaiety, and it seemed typical of the gay courage of the Viennese and Austrian people that such an art could flourish in spite of the present hardships and the distress and misery of the past few years. On May 15 there was an excursion to the Benedictine Monastery at Melk, and to the Biological Station at Lunz. The Station is beautifully situated near the lake in the hills, and

the surrounding fields were thick with wild narcissi and spring flowers. On the last day there was a visit to the National Library, followed by a lunch on the Kahlenberg, given by the Mayor of Vienna, and a farewell gathering in the evening in the Rathauskeller.

The visiting delegates naturally found great pleasure in establishing once more normal human relationship with their colleagues, and took the opportunity of visiting their laboratories. Even in the buildings which have not been damaged, the difficulties of carrying on with work are considerable. The problem of fuel for heating the buildings and laboratories throughout the severe Viennese winter is a serious one. Last winter, for example, in the physical and chemical laboratories, no fuel was available; and unless some can be obtained for the coming winter, much of the practical teaching and of the research work must again come to a standstill. No apparatus can be obtained to replace that which has been destroyed or stolen, and the lack of chemicals and the impossibility of getting any is a severe handicap both to teaching and to research. In all departments, the inability to get current publications or books from other countries is considered to be one of the most urgent problems. Action on this is being taken by the British Council and other bodies, but this necessarily takes time, and at the moment there is very little scientific literature available. It was impressive to see how the pursuit of knowledge and the arts, and interest in things of the spirit, took precedence over the material discomfort and struggle of living.

The celebrations were an unqualified success, and, considering the grave material difficulties, it was a remarkable achievement on the part of the secretaries of the Academy and the organisers. There is no doubt that the success owed much to the genial and commanding personality of the president, Prof. Ficker.

F. P. BOWDEN

OBITUARIES

Prof. H. S. Jennings

THE death of Prof. H. S. Jennings, just after his seventy-ninth birthday, at Santa Monica, California, on April 14, has removed the most venerable figure from the ranks of students of the physiology and genetics of the Protozoa. His passing marks the end of an epoch.

Herbert Spencer Jennings, son of George Nelson Jennings, was born at Tonic (Illinois) on April 8, 1868. He graduated B.S. at Michigan in 1893, and afterwards held several different posts in other American universities. He took the degrees of A.M. (1895) and Ph.D. (1896) at Harvard, and after further wanderings settled at Johns Hopkins. Here he was appointed professor of experimental zoology in 1907, and became director of the zoological laboratory three years later (1910). He occupied this position with distinction until his retirement as professor emeritus in 1938, when he went to prolong his life's work—as a 'research associate'—at the University of California at Los Angeles. His name is therefore especially linked with Johns Hopkins, though he worked in many other places and received degrees and honours from many other American universities. His first wife—he married twice—was Louise Burridge, who assisted in the illustration of his publications.

During 1896–97 Jennings studied at Jena under Max Verworn, whose "Allgemeine Physiologie" (first published in 1894) was then arousing much interest among zoologists. Verworn was a pupil of Haeckel, and his book was not inaptly labelled by Rádl "the first—and probably also the last—Darwinistic physiology". Yet there can be little doubt that Jennings's brief residence in the stronghold of Haeckelism favourably influenced all his subsequent researches. After numerous preliminary papers he finally produced—while at Philadelphia—his famous "Behavior of the Lower Organisms" in 1906; and this is now generally accepted as a classic of protozoological physiology.

His studies on the physiology of *Paramecium* gradually led Jennings to investigate variation and heredity in this and other ciliates. A long series of papers—from 1907 until the end of his life—records the results of his accurate and admirable experiments. It is impossible to review these here, but most of his general conclusions will be found in his book "Life and Death, Heredity and Evolution in Unicellular Organisms" (Boston, 1920), his review "Genetics of the Protozoa" (*Bibl. Genet.*, vol. 5, 1929), and the article on "Inheritance in Protozoa" which he contributed to "Protozoa in Biological Research" (edited by Calkins and Summers, 1941; reviewed in *Nature*, vol. 149, p. 149; 1942).

Jennings's own labour, and that of his many pupils in similar fields, covered a restricted area but dug very deeply. It is still doubtful, however, how far their findings, in the intensive study of such highly specialized and peculiar organisms as the Ciliata, can be utilized for generalization in the larger domain of genetics. But taken as a whole, the extensive published work of H. S. Jennings does not belie the promise in his forenames: it is all distinguished by a sound philosophical outlook and profound appreciation of the value and scope of scientific method. Consequently, much that he did and wrote will withstand the test of time; and though all his conclusions may not ultimately prove correct, his experiments and his reasonings will undoubtedly endure as a solid basis for the researches of a newer generation.

CLIFFORD DOBELL

Mr. G. H. Tipper

GEORGE HOWLETT TIPPER was born in Kendal in 1881, and educated at Kendal Grammar School and Clare College, Cambridge. He entered the Geological Survey of India in 1902. Apart from service in many parts of India, he went to Burma, the Andaman and Nicobar Islands; he travelled through Baluchistan and across Persia and spent three years in Chitral. During the First World War he served with the Bikanir Camel Corps in Egypt and the Libyan Desert and was in France for a short time. He was eventually recalled to help with the production of mica, a mineral in which he had already specialized. From this time he became keenly interested in its mining and preparation for industry, working at the mines themselves and even learning the technique of trimming and splitting.

Tipper had several severe attacks of malaria while abroad and retired after twenty-five years service in 1927. After visiting mica mines in Rumania and a period of travel in Canada and the United States, he married Dr. C. F. Elam, the well-known metallurgist, and retired to Cambridge with the view of working