development of biological research in Canada. The Government is the major employer of biologists, with seven hundred in the Department of Agriculture and a hundred in the Fisheries Board. Industry is now developing, and the stage of the 'branch factory' with research carried out in the United States or Britain is passing. The consequent demand for biological personnel will be met in the main from graduates trained in Canada; but there will always be opportunities, especially in government service, for well-trained research biologists. In discussion it was emphasized that the acceptance of posts in Canada and the other Dominions by British men of science is on the basis of emigration; this is in contrast to service in the Colonies, where leave and final repatriation to Britain is financed by the employing government.

Biological research in industries other than those concerned with agriculture or medicine was the subject of the next paper, by Mr. D. Neville-Jones (Intelligence Division, Department of Scientific and Industrial Research). Industries in which biology plays a part can be considered as falling into two groups: those using biological materials, in general the older industries, and those, the newer, which are based on biological processes. Research on food preservation was described as an example of biological work in the first group of industries, as were various pieces of work on timber growth and disease, on the problems of water pollution, and the prevention of fouling of ships' bottoms. Of industries dependent on biological processes the two most outstanding are those concerned with antibiotics and fermentation. Biologists in industry are a small proportion of the total scientific staff (of the thousand men of science in the establishments of the Department of Scientific and Industrial Research, eighty-eight are biologists). Many problems can only be tackled by those biologists prepared to widen their outlook, more particularly by absorbing some part of the chemist's outlook.

The functions of the Technical and Scientific Register were described by Mr. B. G. Meara (Ministry of Labour) as being: (*a*) the maintenance of an employment service; (*b*) the provision of advice on careers; (*c*) the supervision of the obligations of university graduates for National Service; (*d*) the making of surveys of employment prospects. The fulfilment of the last obligation has resulted in the report previously mentioned by Dr. Galley. The expected insufficiency of posts will affect the less well qualified; the prospects for those with first- or second-class honours degrees and sound training in physics and chemistry are reasonably good. It will be difficult to meet the demand for highly qualified specialists without increasing the pool of those at pass-level. The predictions of the Ministry's report are confirmed by the picture obtained by the employment service of the Register. Of those who graduated in 1951 only a very small number of men with first- or second-class degrees are still unemployed, while a larger number of women with such qualifications and still larger numbers of those with pass or general degrees have failed to find appropriate biological employment. In discussion Mr. Meara was able to reassure those who suggested that possible fields of employment have been overlooked. It was mentioned that a re-assessment of the employment position has been made. This confirmed the general conclusions of the report on the supply and demand of biologists.

Prof. J. F. Danielli (King's College, London), in a paper on "Biology in Universities", quoted the Technical and Scientific Register's estimate that universities are likely to absorb between fifty and a hundred biologists annually. His view is that under the impact of new knowledge the number of university biologists will be doubled in the next fifty years, leading to many new departments or the enlarging of existing departments with sub-departments such as, for zoology, protozoology, entomology, parisitology, ecology, comparative anatomy, cytology and genetics. On the analogies of physics and chemistry, a rapid growth of biological technology seems likely: this will need more specialized biologists, who could be trained either by existing universities or in possible new technological universities. Experience has shown that small units in universities are very effective for the undertaking of fundamental research, and more appointments for research, as distinct from teaching, will be desirable. Administrative assistants, recruited from capable general honours or pass graduates, in biological departments would undertake administrative work, thus freeing others for research and teaching. A revision of university teaching of biology is needed to allow for two streams of students, one following courses in botany or zoology as at present and the other specializing in subjects such as microbiology, biochemistry, cytology or genetics.

As honorary secretary of the Institute of Biology, Prof. Danielli summed up the lessons to be drawn from the symposium. It is desirable that headmasters should be encouraged to keep up the flow of pupils really suited to biology; discussions between schools, universities and employers should take place on the desirability of modifying existing courses; with existing courses students should be encouraged to take a physical science as a subsidiary subject; more biologists should enter teaching; biologists and employers should consider that a biological training is particularly suitable for those in administrative positions; by directing attention to further useful applications of biological knowledge the demand for biologists might be increased. Dr. Edward Hindle, president of the Institute, proposed, from the chair, a vote of thanks to the speakers and those, chief among them being Mr. F. T. Walker, whose work had made the symposium so successful.

OBITUARIES

Dr. Th. Mortensen

In Dr. Theodor Mortensen, who died on April 3 at the age of eighty-four, the zoological world has lost an authority of outstanding stature. Fifty-five years of his life had been devoted to the study of the Echinodermata, and of the Echinoidea in particular.

Mortensen was born, the son of a schoolmaster, in Harløse, Denmark, on February 22, 1868. In 1885 he entered the University of Copenhagen as a student of theology; but study of the works of Darwin decided him to turn his mind to zoology. In 1894 he became assistant in the Zoological Institute at Giessen in Germany, and in 1895 he was appointed to the Danish Biological Station and from then until the end of his life he worked always in or as from his own country. He took the degree of M.Sc. at the University of Copenhagen in 1895 and received his Ph.D. in 1897. During 1899–1900 he was zoological

leader of the Danish Siam expedition. He was on the staff of the Department of Zoology at Copenhagen from 1902 until 1933, and during this period he travelled with expeditions to the West Indies (1905–6), the Pacific (1914–16) and the Indo-Malayan region (1922 and 1929–30), and collaborated with the Danish *Ingolf*, the German Plankton, the German and Swedish South Polar and the American *Albatross* Expeditions. From 1927 until a few months before his death he was occupied chiefly with the "Monograph of the Echinoidea" published at the expense of the Carlsberg Fund. This fund also subsidized his research, so that from 1933 onwards he was freed from all other commitments.

When Mortensen started work on the Echinoidea in 1897, the old era was closing with the life of its greatest figure, Alexander Agassiz. The classification of the fossil and Recent forms was alike based on the coronal and apical plates, and no fundamental advance seemed possible. Yet already by 1907 the work of the *Ingolf* expedition had enabled Mortensen to revolutionize the taxonomy of the Cidaridæ, developing Doederlein's pioneer attempt to use the pedicellariæ in classification. Further expeditions provided quantities of new material and made possible the application of his methods to other groups of Regularia; and though at first his ideas met with authoritative and obstinate opposition, he lived to see them established in the end.

Mortensen's new taxonomic methods broadened the basis of classification by adducing, in addition to the characters formerly used, the micro-structure of the radioles, the form of the pedicellariæ, the distribution of spicules in the soft parts and the development of the pluteus larva—all of them features easily lost in fossilization—so that the placing of fossil species within his scheme became impossible in, for example, the Cidaridæ and Camarodonta. On the other hand, in groups with few living but many fossil representatives, an understanding of the palæontological background was essential. He accordingly sought the guidance of Prof. H. L. Hawkins in studying fossil Echinoidea, and this helped to give balance to his views of phylogeny and descent.

His opportunities were unique, for in the vigour of his youth he worked with the rich new harvests of the expeditions, and in the ripeness of his experience he could devote himself entirely to completing his life's work. He was ideally fitted to make the most of these chances, for his immense capacity for work was guided by a harmonizing intelligence of extraordinary power. His work as a draughtsman and preparator was unsurpassed. His English style was lucid and forceful, marked, but not disfigured, by a quaintness of expression inevitable in the use of a language not native to the writer. There is never any blurring in his work of the limit between observation and inference, and in his "Monograph of the Echinoidea" he was as much concerned to define what is still to be done as to summarize what is already known.

Although he outlived most of his contemporaries in the field, his mind was continually refreshed by contacts with younger workers, whom he fired with his own enthusiasm. His fellow-workers are thankful that his knowledge did not pass unrecorded and grateful to those whose trust in him was so amply repaid.

I acknowledge the help of Prof. Christian Poulsen with biographical details. R. V. Melville

Prof. J. J. Nolan

John J. Nolan was born in Omagh, County Tyrone, on December 28, 1888. Entering University College, Dublin, in 1906, he graduated in 1909 with the highest distinction in experimental physics and was immediately appointed to the staff of the Physics Department.

The influence of J. A. McClelland, in collaboration with whom he published in 1911 his first research—an investigation of the electric charge on rain—established Nolan's lifelong interest in atmospheric electricity. Later followed a series of papers on the mobility of ions produced in air by spraying water and by radioactive radiations in air under various conditions of drying. His most important work concerned the equilibrium of ionization in the lower atmosphere. Extensive observations, over many years, of the nucleus content and the number of large and small ions enabled various assumptions concerning the equilibrium to be tested, and showed finally that true equilibrium rarely exists. Other researches concerned the mass and size of condensation nuclei, derived from measurements of their diffusion coefficient and rate of fall under gravity, using a method which he had himself developed. His last paper (in conjunction with P. Burke) established a connexion between the radium A content of the atmosphere and the number of nuclei. The results of his investigations, embodied in about forty papers, many the result of collaboration with his brother, P. J. Nolan, and his research students, constitute a lasting record of the work of the school of atmospheric electricity which he developed.

On McClelland's early death in 1920, Nolan succeeded him as professor of experimental physics. He was an inspiring teacher with a fine voice and a commanding presence which enabled him to capture and hold the interest of very large first-year classes. Every lecture was a model of clarity, force and accuracy, emphasizing the physical ideas and using relatively little mathematics. For many years he was a member of the governing body of the College and of the Senate of the National University. In 1940, when A. W. Conway became president of the College, Nolan succeeded him as registrar, and the administrative responsibilities of this post gradually curtailed his opportunities for research.

A member of the Royal Irish Academy from 1920, he became secretary in 1923, a position which he retained until his election as president in 1949; thus for almost thirty years he served the Academy. He guided its fortunes during the formative years of the young Irish State and ensured that it retained in the learned life of the new Ireland the position to which its long and distinguished tradition entitled it. Nolan's work on atmospheric electricity had given him an interest in other aspects of geophysics, and it was largely the advice he had given to successive Irish Governments which led Mr. de Valera, as head of the Government, to establish in 1947 a School of Cosmic Physics in the Dublin Institute for Advanced Studies. Nolan became the first chairman of the governing board of the new School.

A silent and reserved man, Nolan nevertheless possessed a devastating wit which he exercised in congenial company. Always courteous and even-tempered, he rarely offered advice; but when he did, his balanced judgment and shrewd Ulster common sense invariably produced advice which it was unwise to disregard. A man of wide culture, in