ranges of books in existence on servo technique, is still available in the Ministry of Supply.

In conclusion, Prof. Hayes, commenting on the general nature of servo mechanism theory, said that the testing techniques evolved are being used to examine the nervous and muscular response of human beings, and that Prof. Tustin has suggested that the theory will predict the oscillations of an economic system.

The two papers which followed were more specialized. Dr. Uttley's paper directed attention to the great utility of servo mechanisms in the field of automatic spectrophotometry and, therefore, followed on very fittingly from the general discourse given by Prof. Hayes.

Dr. D. Gabor's paper, "Microscopy by Wave-Front Reconstruction" (see also *Nature*, **161**, May 15, 1948), was not related directly with those which had preceded it. The new method of obtaining increased resolving power is expected to be of great importance in electron microscopy; and calculations show that it should be possible to obtain a resolving power of one Angstrom unit—which would make it possible to resolve the atomic structure of molecules which are not suitable for the usual methods of structure analysis. An interesting demonstration of the method, using an optical model, was given later in the day.

A. J. YOUNG

OBITUARIES

Prof. Johan Hjort, For.Mem.R.S.

THE scientific work of Prof. Johan Hjort, who died on October 7, shows three overlapping phases. As a young man, after his university training at Oslo and Munich, he spent some time at the Zoological Station in Naples (where he met MacBride and Boveri) investigating a problem of pure zoology, the development of the bud in the ascidian *Botryllus*, with special reference to the germ-layer theory, then in full vogue. His paper, published in 1896 (*Zool. Res. Norwegian North Atlantic Expedition*), is still regarded as outstanding by modern experts on the group. Until 1900 he was lecturer in zoology at the University of Oslo and seemed headed for an academic career. But even in this first phase his interests turned to the sea and its practical problems, for it was in 1897 that he made his first discoveries about the Norwegian prawn and its commercial possibilities.

His great period as a marine biologist and fishery expert began in 1900, when he was appointed director of fisheries in Norway, a post he held until 1916. He had at his disposal an excellent research vessel, the *Michael Sars*, and made extensive cruises in her, not only in Norwegian waters but also so far afield as Spitsbergen and Jan Mayen. Hjort was always happy in a ship. His investigations were not only scientific but also practical, for he had always the welfare of the fishermen at heart. By charting the distribution of the pelagic eggs of the cod, he was able to discover lucrative banks that had never been fished before, the high concentration of eggs indicating the presence of great spawning shoals; the results of this early work were published in "Fiskeri og Hvalfangst i det nordlige Norge" (Bergen, 1902). He advised the International Council to undertake a co-operative study of the spawning areas of the Gadoid fishes, and was largely responsible for organising the research, which resulted in the publication in 1909 of the classical report of "Committee A" (*Rapp. Proc. Verb. Inter. Council*, **10**).

Hjort's greatest achievement in this brilliant period was his elucidation of the problem of good and bad years in the herring and cod fisheries of Norway. With the help of able assistants—Dahl, Damas, Lea and Sund—Hjort made a vigorous attack upon the practical problem of why these fisheries showed such big variations from year to year. It happened, fortunately, that at the time when Hjort's work started, the technique of age-determination in fish by means of scales and otoliths was just being worked out. Under Hjort's direction this method was applied with great success to the study of the herring, particularly by Einar Lea, and it soon became established that the main cause of the fluctuations in the great spring herring fishery was the success or failure of the individual broods or year-classes composing the stock. Thus it was found that the 1904 year-class was remarkably abundant, and predominated in the catches for many years, while succeeding year-classes were very poor. Similar methods applied to the Norwegian cod, supplemented by extensive measurements, demonstrated the existence of specially prolific brood-years, as, for example, those of 1904 and 1912, while other years contributed little to the stock. Preliminary results for the herring were published by Hjort and Lea in 1911 (*Pub. de Circ.*, No. 61) and a full study of the question by Hjort in 1914, in an extensive paper on "Fluctuations in the Great Fisheries of Northern Europe" (*Rapp. Proc. Verb.*, **20**). In 1914, at the request of the Canadian Government, he investigated on the spot the herring of the Gulf of St. Lawrence and adjacent waters, and found that their age-composition was similar to that of the Norwegian herring.

The study of fluctuations and their possible causes, initiated by Hjort, became a principal theme in all fishery and marine biological research for many years, and at Hjort's instigation it was frequently discussed at the International Council, particularly in the special scientific meetings which he introduced in 1926 (see, for example, *Rapp. Proc. Verb.*, **65** and **68**; 1930). Hjort returned again and again to this problem, right up to the last.

Hjort was above all a great biologist, with a profound interest in, and understanding of, the relations between the organism and its environment. This is made particularly clear in the chapter on general biology which he contributed to that admirable book "The Depths of the Ocean" (1912), familiarly known as "Murray and Hjort". This book was the outcome of a four and a half months scientific expedition in the North Atlantic in 1910 in the *Michael Sars*, chartered for the purpose by the famous oceanographer Sir John Murray. The cruise gave Hjort a renewed interest in the general problems of marine ecology.

After his retirement from the post of director of fisheries in Norway, Hjort became a professor at the University of Oslo, and the third phase of his scientific odyssey began. Though he still retained his keen interest in fishery problems and continued to be a dominant figure in the International Council, his mind turned more towards general scientific and social questions. He gave much time to private study, including a period spent at Cambridge.

In 1921 he published a small book on general scientific method, "The Unity of Science", and in 1931 a larger volume called "The Emperor's New

Clothes", in which he attempted to show that modern physical theories were nothing but fairy tales, inconsistent with experience and reason. Hjort was not at his best in abstract thinking, and his incursions into philosophy and scientific method were not, to my mind, altogether happy. In both books, however, as also in his later publication, "The Human Value of Biology" (Cambridge, Mass., 1938), the sections in which he expresses his ecological attitude to the problems of life are excellent.

But Hjort was much too practical a man to devote himself to purely philosophical studies, and as professor at Oslo he did not neglect research, much of it concerned with practical issues. He took up with vigour population studies in organisms so diverse as yeasts and whales, and with his fellow-workers published many important papers in the series of *Hvalrådets Skrifter* (see particularly No. 7; Oslo, 1933). The sigmoid curve fascinated him. His views on population growth and the social problems involved are set out in his Huxley Lecture of 1934 entitled "The Restrictive Law of Population". Arising out of his population studies he worked out, with G. Jahn and P. Ottestad, the theory of the 'optimum catch', of great importance in connexion with the signs of over-fishing which were becoming apparent in the intensive whale fishery (largely Norwegian) in the Antarctic. The study of the whale population in these waters engrossed him in later years, and his studies were not limited to statistics and reports; he went out to the Antarctic to see for himself what the conditions of the fishery really were —an action typical of the man. He played a considerable part in the international negotiations which led to some measure of control being imposed on the fishery, and kept the International Council in touch with whaling problems.

In 1936 Hjort was invited to attend the celebration of the three hundredth anniversary of Harvard University. He used this opportunity to demonstrate the accuracy of his prophecy that *Pandalus borealis* would be found on the western side of the Atlantic in exactly the same ecological conditions in which it occurred in Norwegian waters. Through the good offices of his friend, Henry B. Bigelow, he made a cruise in the *Atlantis* off the coast of New England and found quantities of this prawn just where he expected to find it. The story is told in his paper (jointly with J. T. Ruud) in *Hvalrådets Skrifter*, No. 17 (1938). This paper contains also a study of the over-fishing problem in relation to the prawn fishery.

About Hjort's social and political views, which he held strongly, it is unnecessary to say much here; they will be found set out particularly in his Huxley Lecture and in his later books and lectures. Suffice it to say that he looked at the problems of human societies with the eye of a biologist, and that he was a strong individualist, temperamentally averse from any form of restrictive control. The old Viking spirit still lived in him. His outlook on life in his later years is well summarized in his last published lecture (*J. Conseil*, **15**; April 1948), significantly entitled "The Renaissance of the Individual". Like us all, Hjort had his failings; his personality was so powerful and his views so decided that he was apt to impose them on others, and he was not very receptive of views that differed from his own. But he was a great figure whom his colleagues and friends regarded with respect, admiration and affection, even when they differed from him. E. S. RUSSELL

JOHAN HJORT was a personality in the sense that he could not be overlooked in any assembly of men; and he was a many-sided personality, man of science, philosopher, politician, diplomatist, administrator and, withal, a man of warm friendships. He had a great admiration and affection for the British race and actively sought to promote the best and closest relations between his country and ours. Of all the honours bestowed upon him, he treasured most his membership of the Royal Society.

Early in life he turned his attention to marine biology, and studied at Naples. This choice of a scientific career was almost inevitable. Norway, with its great length of coast-line and its famous seasonal fisheries for cod and herring, breeds especially seamen and fishermen. Fishing is the chief native industry of the country, and Norwegian biologists direct their attention, as one might say, automatically to the sea and all that therein is. Hjort, in particular, recognized the danger to which the fisheries were exposed by the mechanization of fishing, the ever-increasing power of mechanized fishing vessels and the rapid development of the efficiency of fishing instruments. He recognized, further, that the rational exploitation of fish stocks could be realized only in the light of wide knowledge of the complex ecology of marine life, including, of course, its physical environment. His voyage with Sir John Murray on the *Michael Sars* was one of his many excursions into this field of study.

In 1900 Hjort became director of fisheries in Norway, and in the same year began the movement, originating in Sweden, for the establishment of an international organisation for marine studies. When, in 1902, the International Council for the Exploration of the Sea was established, with its seat in Copenhagen, he was appointed Norwegian delegate, a position he occupied, in spite of his resignation of the post of director of fisheries some time after the First World War, until his death. From 1920 onwards he was one of the vice-presidents, who, with the president, constitute the Executive Committee of the Council, known as the Bureau, and, in 1938, he was elected president of the Council, a post he was about to surrender when death overtook him. Soon after the First World War he turned his attention to the machinery of the Council and, in close collaboration with the British president, devised a practical lay-out of regional and specific committees, the chairmen of which constituted a co-ordinating committee named the Consultative Committee, of which he became and, until he succeeded to the presidency, remained chairman. There is no possibility of doubt that this reorganisation of the machinery of the Council was mainly responsible for the great practical results achieved by co-operation between the member countries.

As director of the Norwegian fisheries, Hjort proved himself a competent and original administrator. He had also a wise belief in practical demonstration. When the naturalists of his department had discovered the existence in vast numbers in the deeper waters of many of the fjords of *Pandalus borealis*, now commonly referred to as the Norway prawn, the fishermen were disinclined to be interested. Hjort wasted no time in argument. He went prawn fishing, returned to harbour with a spectacular catch and dumped it on the quay. That was enough. With that practical demonstration he laid the foundation of an exceedingly profitable fishery and a flourishing export trade.

Cautious and precise as a man of science, Hjort was always apt to be impetuous in his relations with others. He had, in fact, a somewhat volcanic temperament which did not easily brook opposition. He was as apt to walk off stage as a film star, and it came about that he handed in his resignation of the post of director of fisheries in Norway once too often. The time came when the authorities did not ask him to reconsider, and accepted his resignation. But he became professor of zoology in the University of Oslo and remained a Norwegian delegate to the International Council. There, too, his volcanic temperament was sometimes active; but his fundamental friendliness always triumphed in the long run, and there is not one of his colleagues, national and international, who does not deplore the loss of a friend and a great man.

His diplomatic gifts were revealed in long and earnest endeavours to settle the vexed question, as between Norway and Great Britain, of the limits of territorial waters off the coasts of Norway. Indeed, if the last word had been with him the long negotiations would, almost certainly, have resulted in agreement; but his views were unacceptable in Norway and agreement seems to be as remote as ever. He attributed the failure to "the politicians". The trend of his political views is revealed in a remark he made to me. "No one," he said, "should be allowed to exercise the Parliamentary vote who has not passed an examination in biology, and members of Parliament, especially Ministers, should be required to have, if not a degree, at least a diploma in natural science. Then there would be no -isms, for none of the -isms will bear examination in the light of biological truth." Thus, picturesquely, he expressed the view that, inasmuch as the well-being of mankind is intimately bound up with the complex biology of all living things, political systems divorced from Nature are built on rotten foundations. But he did not believe that all wisdom was the exclusive possession of the scientific worker, as readers of "The Emperor's New Clothes" and of his Huxley Memorial Lecture, delivered in 1934, will be aware.

In recent years some of his friends have felt that his powers and, with them, his clarity of thought, were failing. But he had a long and useful life behind him, and the influence of the dynamic force he exercised in the field of science and the practical application of scientific findings will endure for generations to come. H. G. MAURICE

Mrs. Savage

MRS. E. J. SAVAGE (née Fry), whose death occurred recently, was an old student of the University College of Wales, Aberystwyth, graduating with first-class honours in botany in 1916.

Her early work concerned the "Cryptogamic Pioneer Vegetation of the Aberystwyth Shales", and later she carried out an investigation of rock floras in Caernarvon and Anglesey. She was able to add to our knowledge of the action of lichens in bringing about rock disintegration and soil formation. Several of her papers on this subject appeared in the *Annals of Botany*. During the First World War she carried out researches in anæsthetics and afterwards became a fellow of the University. In 1919, having obtained her M.Sc., she was appointed assistant lecturer in the Department of Botany at Aberystwyth. In 1925 she was appointed lecturer in botany at Westfield College, University of London, a post she held until her marriage to Mr. S. Savage, librarian and assistant secretary of the Linnean Society, in 1932. Afterwards she lived at Welwyn Garden City, where she soon became well known as an artist and miniature painter, some of her work hanging at the local art club's annual exhibition and also at the shows of the London Water Colour Society.

Mrs. Savage has left botanical records of value, carefully labelled and annotated with the meticulous care she bestowed on all her work, together with the memory of a charming personality which continued to survive the heavy trials of a long illness. Her husband has the sympathy of her many friends.

LILY NEWTON

NEWS and VIEWS

Nobel Prize for Chemistry: Prof. Arne Tiselius

THE recipient of the Nobel Prize for Chemistry this year is Prof. Arne Tiselius, who is well known to protein chemists in Great Britain. For many years he worked in the Physical Chemistry Institute of Prof. Svedberg at Uppsala, and became one of its most outstanding members. Recently a chair in biochemistry was created for him and a new Institute is in the course of construction. His greatest work, and that for which he is most widely known, was in the development of an apparatus for the electrophoretic analysis of biological substances. The apparatus, which now bears his name, has made possible accurate measurements of the electrical properties of proteins and has been most extensively applied both as a test of protein purity and to characterize the components of more complex systems. In this connexion, the application to normal and pathological sera is of great clinical importance. The apparatus is undoubtedly one of the most powerful tools ever developed in the field of protein chemistry. More recently, Prof. Tiselius has returned to the study of adsorption analysis, a subject which interested him in his earlier research years. Since the introduction of chromatography by Tswett, the method has been employed and developed on somewhat empirical lines. Prof. Tiselius and his school have studied the underlying principles involved in this type of separation and have developed elegant apparatus for the adsorption analysis of colourless substances. Many scientific men who have worked in his laboratory have benefited greatly by his patient application to their problems and by his wide knowledge. All who know him well will agree that this latest honour is indeed well deserved.

Biological Service in Great Britain: Capt. Cyril Diver

IN continuation of the announcement made in the House of Commons on April 27 that the Government accepted in principle the establishment of a Nature Conservation Board and a Biological Service under the auspices of the Agricultural Research Council, Mr. Herbert Morrison on November 1 stated in the House