These experiments throw an interesting light on the problem of the so-called sympathetic coloration in insects, and suggest a promising line of research. It was, however, somewhat unexpected that the green colour of environment is not imitated by hoppers, though they often become green on almost any background. Detailed experiments on the production of green coloration showed that it develops when hoppers are kept in a humid atmosphere and supplied with abundant moist food. However, attempts to discover chlorophyll in green hoppers failed, and the problem awaits further investigations.

Another interesting point raised with regard to the brown locust is the ability of its eggs to lie dormant for extremely long periods, up to 37 months after oviposition. A number of other equally interesting and important observations and experiments are recorded in the paper, which contains also a discussion of the bearing which these laboratory results have on the actual locust problem in the field. The knowledge of the phase transformation is already applied in practice in South Africa, and a careful watch for incipient congregations of solitary locusts in the field is kept. All such congregations are destroyed, with the result that the swarming phase has not appeared for several years. Further field ecological work will help in defining more precisely the areas favourable for the production of the swarming phase, and this will facilitate the anti-locust work still more, placing it entirely on the basis of prevention of outbreaks.

Prof. Faure's paper is exceptionally well documented by exact descriptions of experiments, tables of results and extremely well-reproduced coloured plates showing the remarkable range of the variation connected with the phase transformation of the species discussed. The results recorded constitute a great advance in our knowledge of the locust problem, and, moreover, they should go far towards demonstrating to biologists in general the outstanding interest of these insects, on which a number of fundamental problems can be studied better than on any other material.

B. P. UVAROV.

Obituary

PROF. JOHANNES SCHMIDT

THE science of oceanography has lost one of its most outstanding leaders by the death of Prof. Johannes Schmidt, director of the Carlsberg Physiological Laboratory, which occurred at Copenhagen on February 22 at the age of fifty-six years. His loss will leave a host of friends and colleagues all the world over with a sense of personal bereavement and regret, for being himself a great traveller with his home in Copenhagen, the headquarters of the International Council for the Exploration of the Sea, with which he was intimately associated, he was in close and frequent contact with all who were interested in the science of the sea. He was a man of quite exceptional charm, with a genius for friendship, always eager to help the work of others and to appreciate any help which others could give him in the execution of the bold schemes of research which he planned.

The name of Johannes Schmidt will no doubt be chiefly remembered for his solution of the age-old mystery of the life-story of the eel, but this success represented but a small part of his scientific activities and personal achievement. His versatility and breadth of view were striking. Starting his career as a botanist, his first expedition was to Siam in 1899, when he was editor and joint author of a report on "The Flora of Koh Chang". In 1910 he began at the Carlsberg Laboratory a series of investigations on hops (*Humulus lupulus* Linn.), publishing reports on their growth, biochemistry, and occurrence in the wild state in Denmark, and superintending researches on their fertilisation, development and the production of hybrids.

Later, under the inspiring influence of the late Dr. C. C. Joh. Petersen, and helped no doubt by his own enthusiasm for the sea—for first and last and always he was a good sailor-man—Schmidt became attached to the scientific staff which was carrying out Denmark's share of the programme of the International Council for the Exploration of the Sea. The importance of the fisheries at Iceland and the Faroes caused the Danish research vessels to go farther afield than those of the other powers, and the steam trawler *Thor* carried out regular cruises from Copenhagen to the northern waters of the Atlantic.

This was Schmidt's training ground for the extended expeditions in small vessels which he eventually undertook. At first he concentrated on the description of post-larval and early adult stages of fishes, especially of the cod family, and their distribution and migrations in relation to temperature and other physical characteristics of the sea-water. This was necessary pioneer work which has stood the test of time.

In May, 1904, Schmidt was collecting young fishes with large pelagic nets, and captured in the North Atlantic west of the Faroes one specimen of the *Leptocephalus brevirostris*, which Grassi and Calandruccio in 1896 had proved to be the larva of the common fresh-water eel. In the following year (1905) the *Thor* succeeded in capturing, at the end of May, a small number of specimens of *Leptocephalus* over the deep water off the west of Scotland, and still farther south the numbers increased over depths of 1,000–1,500 metres, until, in water of this depth in the central part of the plateau off the mouth of the English Channel, up to 70 per two hours' haul were obtained with nets towed with about 300 metres of wire. A few hauls taken in September, west of the Hebrides, showed that the larvæ were already beginning to meta-

morphose, and would soon completely change into elvers or glass-eels.

To determine where the eels actually spawned it remained to find the earliest larval stages and the eggs. This involved a search extending all over the whole southern and western part of the North Atlantic. Only after years of persistent effort was it possible to reach a full and satisfactory solution of this aspect of the problem. Successful cruises were made in the *Thor* to the Straits of Gibraltar and the Mediterranean (1908–10). Arrangements were made with Danish ship-owners for nets to be towed from steamers crossing the Atlantic by different routes. In 1913 a small sailing schooner, the *Margrethe*, was equipped and cruised in the Atlantic as far as the West Indies, when it was found that the smallest sizes of the larvæ were all taken west of a line drawn from Newfoundland in a south-easterly direction towards Cape Verde. In 1920 a large schooner, the *Dana*, replaced the *Margrethe*, which had been wrecked. After two years it became possible to map out the breeding grounds by a study of the distribution of the earliest larval stages, less than 10 mm. in length, which had all been taken in a comparatively small area, the centre of which lay midway between the Leeward Islands in the West Indies and Bermuda. By these researches Schmidt may be said to have solved the main problem of the life-history of the eel.

With this extension of his cruises into the Atlantic Ocean, the scope of Schmidt's oceanographical work became enormously enlarged, and had developed into an important study of the great oceans. The Danish Government secured a large steam trawler, also named *Dana*, and equipped her as a research vessel. In this ship he undertook a number of voyages in the Atlantic Ocean, the Pacific and the Mediterranean, and finally made the great two years' voyage around the world in 1928–30, an account of which he published in NATURE of March 21 and 28, 1931.

Schmidt's study of the geographical distribution and life-histories of fishes led him, at an early date, into researches on fundamental biological problems concerning the nature of species, of races and of heredity, and his success as a biometrician and as a student of genetics was almost as striking as that which he achieved in oceanography. Biometrical studies on races of fish had formed a feature of his early work on gadoids and eels. Later, in a series of papers published between 1917 and 1922 in the *Comptes-Rendus* of the Carlsberg Laboratory and in the *Journal of Genetics*, the subject was developed on both statistical and experimental lines. Striking results were obtained with the viviparous blenny (*Zoarces*). He was able to show that in some of the Danish fiords the average number of vertebræ in populations of this fish living at the upper ends of the estuaries is significantly lower than that of the populations in the estuary mouths, the latter again being lower than that of populations living outside in the Kattegat. The averages varied progressively from 108·0 to 117·3. The question whether these fluctuations were due to heredity or to environment, or to both these factors, was made the subject of a well-devised series of experiments. A comparison of the average number of vertebræ in 857 mothers, with the corresponding number in 8,570 individuals of their offspring, showed that the values for the offspring continuously increased as the maternal numbers increased from 107 to 119. The conclusion was drawn that such a conformity could not appear if the number of vertebræ in an individual were determined by the environmental conditions existing during development alone. The number of vertebræ must therefore be, in part at any rate, a hereditary character. Experiments were then made by keeping samples of 300 specimens of each of two different populations of *Zoarces* in an enclosed area near the mouth of Ise Fiord in large, perforated wooden boxes, with the result that the difference in the numbers of vertebræ in the two populations did not disappear in the offspring. On the other hand, two samples of the same population, allowed to develop under different environmental conditions, did show a smaller, but significant difference in the number of vertebræ of the offspring.

In continuation of work on race problems, Schmidt carried out many breeding experiments on trout, and on the fresh-water tropical fish *Lebistes reticulatus*, as well as on poultry.

Such a wide and varied field of fruitful effort leads one to ask, what qualities in the man lay at the root of his success? First, I think, a broad, clear outlook on the problems he hoped to solve was followed by a bold but simple and straightforward plan of attack: then, steady, hard, persistent work, carried on year after year with no turning aside, every detail carefully thought out, every operation accurately performed until at last the answer came. He was a fine organiser and knew how to get the best from those who helped him. The brilliant school of young marine biologists in Denmark, who will continue the work that he began, is his true memorial.

E. J. ALLEN.

DR. ALFRED RÉE

IN the death of Dr. Alfred Rée at Withington on February 26, at the age of seventy years, both chemical industry and the profession of science lose an acknowledged leader and one whose wide outlook and sympathy had won universal respect. Dr. Rée was born at Leeds and educated at the Bradford Grammar School and later at the Universities of Geneva and Munich. He was a Doctor of Philosophy of the University of Berne and had travelled widely on the Continent and in the United States, to which circumstance no doubt his interest in international affairs was partly due. He was a warm supporter of Lord Derby when he was forming the English