

those by Dr. Fontoura da Costa on "Portuguese Maritime Science in the Age of Discoveries", summarising the contributions made by the Portuguese to cartography, navigation technique and other nautical sciences; by Dr. Ricardo Jorge on "The Place of Medicine and Doctors in Portuguese Expansion", particularly interesting for its discussion of the exchange between East and West of drugs and diseases; and by Dr. Arlindo Monteiro on "Portuguese Influence on Japan". They showed how fundamental scientific and technical advances are to overseas discovery and what complex repercussions the discoveries had on European learning.

Among the other papers illustrating this general theme of the movements of learning were those by Dr. Fernando Correia on "Portugal in the History of Public Health", and more specialised studies by Dr. Max Meyerhof, M. Tricot-Royer, Dr. H. Renaut, M. Quido Vetter and Dr. Joachim de Carvalho. It is intended to publish these and other papers presented to the Congress shortly.

The social success of the Congress was due to the well-conceived plans of the secretary, Dr. Alberto Pessoa, and the genius which the Portuguese possess for cordial hospitality. The opening session was held

at Oporto, which gave the members of the Congress an opportunity to see the Colonial Exhibition and the impressive historical procession through the city illustrating Portuguese expansion which marked the end of the exhibition. After a reception by the municipality in Oporto and excursions to Gaia and the wine vaults, the Congress travelled to Coimbra and held its main sessions in the beautiful buildings of that old University, in the library of which a special exhibition of medical books of the sixteenth and seventeenth centuries had been arranged. Official receptions were given by the Rector of the University and by the municipality. The members of the Congress then travelled by motor coach to Lisbon, visiting the monasteries of Batalha and Alcobaça, and being officially received by the municipality of Caldas da Rainha. The closing session at Lisbon was followed by a reception by the municipality. In this way, members of the Congress were enabled to see very fully the richness of the historical remains in Portugal and to appreciate the greatness of its colonial past and present.

The International Academy decided to hold its next Congress in Prague in 1937, under the presidency of M. Quido Vetter.

Bearing Metals

IT is now nearly a century since Isaac Babbitt introduced a bearing comprising a liner of a relatively strong and rigid material coated with a thin layer of white metal. The advantages of this combination have proved of great importance in engineering practice, but more attention has been directed to the metallurgy of the white metal coating than to the mechanics of the bearing as a whole.

The advent of the high-speed aeroplane has brought in its train certain difficulties, particularly a type of cracking of the white metal which has been generally ascribed to 'fatigue', though the evidence for this has not been conclusive. The Institute of Metals at its meeting in Manchester on September 4 devoted considerable attention to this question. D. J. Maonaughtan, director of the International Tin Research and Development Council, presented a general discussion of this type of cracking and for the first time provided a rational explanation of the stress conditions under which the fatigue is set up. In essence, the explanation depends upon the simultaneous action in the white metal of a varying compressional stress and a tension which appears to be mainly due to the different coefficient of contraction of the bearing metal and the liner into which it is cast.

From this work the conclusion may be drawn that the fatigue range of the antifriction metal is the mechanical property of prime importance, though the coefficient of expansion of the liner, by determining the value of the tension, plays an important part. The author showed that in a series of copper, antimony, tin alloys with 3.5 per cent of copper, the fatigue range increases as the antimony content is raised up to about 10 per cent. It is generally recognised that in similar materials the tensile strength and the fatigue range follow more or less parallel curves, whilst in addition the Brinell hardness number would be expected to follow a similar course. The confirmation that in the white bearing metals these three properties are interconnected results in the tensile strength and the Brinell hardness, which are

relatively easily determined, representing reasonable qualitative measures of the fatigue limit.

This paper was followed by an account of three researches on the general behaviour of white bearing metals when subjected to various deformation tests. Part 1, by A. S. Kenneford and Dr. H. O'Neill, dealt with the measurement of hardness and, quite apart from the specific application of this work to the bearing metals themselves, forms a very valuable contribution to the general question of the measurement of hardness of soft metals. If one particular section of this research may be picked out for special reference, it is the use of cones of the alloy, chill cast with an angle of 60°, which are compressed under known loads. The degree of compression gives a measure of the hardness of the material, whilst the cracking, or absence of it, of the lip extruded at the top, provides qualitative information regarding its ductility.

The tensile strength at ordinary temperatures of a number of typical white metal bearing alloys cast at different temperatures and into moulds at different temperatures, are recorded in a paper by R. Arrow-smith. The strongest alloy was found to be one containing about 10 per cent of antimony and 4 per cent of copper hardened by the addition of 1 per cent of cadmium. The best casting conditions were a pouring temperature of 450° C. into a mould at about 200° C.

The third and last section of the work dealt with pounding tests by H. Greenwood. Despite the obvious practical importance of a test of this character, very little work has previously been done and even this is by no means free from criticism. Greenwood has shown that the rate of deformation—after a preliminary period due to the bedding-in of the indenting tool into the bearing—is constant, and may be employed to give a strictly quantitative measure of the resistance of the alloy to pounding stresses. The alloy which gave the highest tensile strength was also found to be most resistant to this type of deformation. These tests have been carried

out at temperatures up to 160° C. using 100,000 blows from a modified Stanton impact testing machine as standard.

The results published in these papers represent a preliminary survey of the mechanical properties of white bearing metals which is essential if the effect on the standard alloys of other additions is to be measured. The work, which has been carried out in the Metallurgical Department of the University of Manchester, has been rendered possible by financial assistance from the International Tin Research and Development Council, and is, even in its present stage, one of the most comprehensive examinations of these alloys which has yet been undertaken. F. C. T.

The Origins of Plankton

IN the course of a discussion on the "Biological Problems of Fresh Water" before a joint meeting of Sections D and K of the British Association at Aberdeen (NATURE, Sept. 22, p. 467), Prof. F. E. Fritsch pointed out that one of the outstanding problems confronting workers in this field is that of discovering the origins of the many recurrent cycles of free-floating organisms (plants and animals) that occur in the surface layers of standing waters and at times populate them in such enormous numbers that they lend a definite colour to the water.

Such populations, constituting the plankton, often last only for a few weeks and then vanish completely, only to reappear each year usually at approximately the same time. They are often a source of considerable trouble in reservoirs. On the other hand, the plankton is also of great economic importance in that, directly or indirectly, it constitutes an important part of the food-supply of fish.

A small number of the manifold plants (algæ) of the plankton, at the end of their period of abundance, form special resting-stages (spores) which gradually sink to the bottom or into the deeper waters, but there is no evidence that this is of general occurrence. Most species must persist from one season to the next in the form of occasional unaltered individuals. The problem at issue is whether such persisting individuals and spores remain viable wherever they are deposited, or whether it is only those that settle in the shallower waters round the banks that retain their vitality and give rise to a fresh crop in the next season. It is known that some of the diatoms of the plankton are bred in the shore waters and from there gradually spread into the general body, but for the vast majority of plankton algæ there is no evidence that this happens, and it is likely that many are derived from spores or persisting individuals which have lain dormant at the bottom under the deeper waters during their period of absence from the surface layers. This is particularly likely to be true of the numerous blue-green algæ of the plankton. These forms owe their buoyancy to the development of minute cavities, containing gases, in the protoplasm of their cells. Continental workers have found some evidence that these so-called gas-vacuoles are a result of the fermentation processes which are believed to take place in the cells in the absence of oxygen, when such forms—either as individuals or spores—are resting at the bottom. The production of gas renders them buoyant so that they float to the surface and appear in the plankton, while new spores

which lack the gas-vacuoles are heavier than water and again sink to the bottom.

It is thus probable that the plants of the plankton are recruited from two sources, in part from resting-stages or persisting individuals lying on the bottom under the deeper waters, and in part from similar stages that survive near the banks. The degree of importance of the latter element will depend on the extent of the shallow water near the banks and the facilities for the distribution of the forms growing there into the open water.

Much detailed research is still requisite before precise knowledge on these matters is available, research which is of fundamental importance in all aquatic biological investigations. G. A. S.

University and Educational Intelligence

CAMBRIDGE.—J. S. Turner of Selwyn College has been appointed University demonstrator in botany.

L. J. Audus of Downing College has been appointed to the Frank Smart University studentship in botany.

At Queens' College the following have been elected into reserved fellowships:—F. Goldby of Gonville and Caius College, University demonstrator in anatomy; J. A. Ramsay of Gonville and Caius College. At Downing College, E. B. Verney, Shield reader in pharmacology, has been elected into a professorial fellowship.

LEEDS.—Dr. L. H. Stickland has been appointed biochemist in the Cancer Research Laboratories, in succession to Dr. Havard, who has resigned.

LONDON.—The Surrey County Council has decided to make a grant of £50,000, payable over ten years and subject to the approval by the County Council each year of the inclusion of the amount in the annual estimates, towards the erection of the University buildings in Bloomsbury. A grant towards the same purpose of £10,000, payable over ten years, has also been made by the Hertfordshire County Council. The Worshipful Company of Turners has made a donation towards the Ceremonial Hall.

FOREIGN students in the United States in 1931 numbered more than eight thousand according to a report recently published by the Federal Office of Education, as Pamphlet No. 48 on "Residence and Migration of College Students". A similar report published in 1926 as Bulletin No. 11 gave the number of foreign students in 1923 as 6,692. Although the two sets of statistics are not strictly comparable, it seems clear that there has been a substantial increase in the number of students resorting to the United States from other countries for post-secondary education and for research. Analysing the figures according to the students' home-residence, one finds noticeable increases under Canada (from 1,251 to 1,896), Mexico (298 to 402), Central America (118 to 187), Colombia (40 to 67), Scotland (26 to 55), Ireland (32 to 59), Belgium (30 to 51) and Italy (35 to 82), but decreases under China (1,605 to 1,317), Japan (583 to 502), India (288 to 235), Russia (190 to 153), South Africa (130 to 73), Argentina (51 to 29), Chile (60 to 36) and Peru (54 to 25).