

interferential methods to the study of the spectrum of the Orion nebula by Fabry, Buisson, and Bourget, work which, among many other interesting results, revealed the existence of the element of atomic weight 3, previously predicted on theoretical grounds by Prof. Nicholson.

MARINE BIOLOGY AT PLYMOUTH.

IN the latest number (vol. x., No. 4) of the Journal of the Marine Biological Association there are two papers of very considerable interest. Of these, the first deals with experiments in the rearing of plankton animals (Crustacean larvæ and Copepoda) which are of importance as a food supply for fish. The author is Mr. L. R. Crawshaw. Plymouth Marine Station is justly celebrated for the invention by its director, Dr. Allen, of the method of rearing various types of marine larvæ by feeding them with pure cultures of the diatom *Nitzschia*. By this method the larvæ of Echinodermata, Mollusca, and Annelida have been reared until they attained the adult condition. Mr. Crawshaw has endeavoured to extend the method to Crustacea. He has made some interesting discoveries. Thus he finds that in spite of sterilised water and abundant food, Copepoda live a very short time unless the culture flask be kept cool and the temperature remains constant. Then he finds that the harmful action of bacteria has been much exaggerated. There are only one or two varieties which are fatal to Copepoda, but these are of infrequent occurrence. When he had arranged for a good food supply and a constant temperature, he was able to keep the delicate pelagic form, *Calanus finmarchicus*, alive for months, and to rear the nauplii of *Pseudocalanus* through all stages of development until the attainment of the adult condition. When this method has been perfected it will be possible to study the life-histories of the economically important Copepoda in detail in the laboratory, instead of, as now, piecing the development together from scattered observations of plankton.

The second paper to which we wish to direct attention deals with twin larvæ of the starfish *Luidia*. These larvæ developed from eggs which were artificially fertilised at Plymouth. When the eggs had attained the blastula stage they were sent in sea-water in a thermos flask to the author, Dr. Gemmill, lecturer in embryology in the University of Glasgow, by whom they were reared further. Dr. Gemmill ascribes the formation of twins to the shaking which the blastulæ endured on the journey from Plymouth to Glasgow; this seems to have caused partial rupture of the blastulæ at a time when the tissues are equipotential, and the partially separated fragments have each striven to produce a perfect larva.

Besides these papers the volume contains a valuable list of the Annelida found in the neighbourhood of Plymouth by Dr. Allen. There is also a paper by Miss Olwen Rees, which we hope is the first of a series, which records the results of a systematic investigation of the internal anatomy of the British members of the Actinozoon family Sagartidæ. Too often accounts of the internal anatomy characteristic of a group have been founded on the dissection of a single "type" to the structure of which the other members have been assumed to conform.

At a time when the war threatens the continued existence of such celebrated stations as Naples and Trieste, it is important to be reminded of the asset which British zoology possesses in the Plymouth Station, and of the necessity of making every effort to sustain it during this arduous time.

E. W. M.

THE TAPPING OF RUBBER TREES.

THE Ceylon Department of Agriculture has issued a number of circulars on the tapping of individual and groups of *Hevea* trees and the effect of such operations on the storage of plant food. All the experiments and observations are based on *Hevea brasiliensis*, most of the trees dealt with being of considerable age. The papers are by Mr. T. Petch (mycologist) and by Mr. L. E. Campbell (rubber research chemist).

The first circular gives the results obtained by tapping one old *Hevea* tree for four years and nine months. The tree was planted in 1877, and is surrounded with other trees of the same species. It is a tree of an unusual type in so far that the main stem branches into two at about 10 ft. from the ground. In a way it is a famous specimen, and has been much photographed in past years. In four years nine months this tree has given 392 lb. 7 oz. of dry rubber: a most phenomenal crop. The rubber was obtained from the original and renewed bark on the basal portion of the stem.

The other circulars dealing with *Hevea* tapping results cover two distinct periods; first from 1911 to 1913 and second 1914. Experiments were made to determine the yield obtained by different frequencies of tapping and by different systems. Pricking and paring knives were also experimented with. The account of experiments for the period 1911-13 is largely statistical, very few deductions being drawn from the tabulated statements. The account of results for 1914 forms a continuation of those already referred to. While it would be too early to draw trustworthy practical conclusions from the results obtained, there are one or two points which become evident to the reader. They confirm previous results in so far that the yield per tapping increases as the time interval between consecutive operations is increased. The yield, however, in a given time is greatest with the more frequent tapping. It is further suggested that prolonged tapping on a single section, when cuts are 2 ft. apart, has a detrimental effect on the yield.

Reference is made to the fact now generally recognised that results of tapping experiments hitherto conducted are of little value because no count was taken of the varying capabilities of different tappers who do the work. In the circulars we now review this cause of variation was allowed for.

Mr. Campbell's circular on the effect of tapping on the storage of plant food in *Hevea brasiliensis* is exceptional in character. In tapping operations the living cortex of the tree is cut away in order that the latex may freely exude. This destruction of living tissue is made good by rapid cambium activity which soon results in the production of a thick renewed cortex, except in those cases where the tappers have damaged the cambium. The renewed bark is conceived to be formed largely at the expense of reserve foods in the plant. Mr. Campbell has selected the starch grains as a reserve food, the fluctuation in quantity of which might indicate the varying effects of tapping operations. The author made a study of the bark of tapped areas, and by an ingenious method determined the number of starch grains in a given area. The work indicates that the effect of careful tapping is localised. This is not in accordance with the general view on the subject. The local effects are especially apparent in a horizontal direction, and the author suggests that by changing tapping from one part of the tree to another at intervals the resting period of each area so tapped is nearly as effective as if the whole tree were rested. The "change over" system is becoming quite common on a number of Ceylon estates.

H. W.