ON KEEPING MEDUSAE AND OTHER FREE-SWIMMING MARINE ANIMALS ALIVE IN SMALL AQUARIA.

ALTHOUGH many marine animals, more especially those which live between tide-marks, or in shallow water near the shore, can without great difficulty be kept in a healthy state in confinement, this is by no means the case with those invertebrates whose natural habit is to swim freely in the sea, and previous attempts to rear pelagic larvae to the adult stage have only rarely been attended with much success. A method of overcoming some of these difficulties, which should prove of considerable use to marine naturalists, has recently been in use at the Plymouth Laboratory, and is described by Mr. E. T. Browne in the *Journal* of the Marine Biological Association (vol. v. No. 2).

Mr. Browne arrived at the idea of the apparatus as the result of repeated attempts to keep medusae alive in confinement. It was noticed that when recently captured medusae were put into clean sea-water, though they at first swam vigorously about, they invariably became sluggish in the course of a few hours, even if the water were constantly changed, settled to the bottom and finally died. When watching medusae in the sea it was observed that they simply float along with the tide without often pulsating the umbrella. It was therefore thought that if a movement in the water of an aquarium could be obtained, which would keep the medusae constantly floating about independently of their own pulsation, better results might be obtained; and this has proved to be the case. A suitable movement of the water can be conveniently brought about by means of a glass plate made to rise and fall slowly through the water.

A motion of this kind can be arranged in many different ways, the apparatus, illustrated in Fig. 1, being the form originally designed by Mr. Browne in conjunction with the Director of the Plymouth Laboratory, which has now been continuously working for a year. The sea-water, obtained from the open sea at some distance from shore, is contained in a glass bell-jar of about 10 gallons capacity, provided with a wooden cover made in two halves. A glass plate is suspended in the water by means of a glass rod passing through a hole in its centre, the other end of the rod being attached to one end of a light wooden beam. This beam works on a hinge at the centre, and from its other end a small tin bucket is hung. The bucket is fitted with a self-emptying siphon, and is supplied with a slight stream of water by means of a rubber tube attached to the fresh-water supply. The weights of the bucket and glass plate are so adjusted that the plate moves up and down in the sea-water as the bucket alternately fills and empties. Extra weight is added when required by placing shot in a small bottle hung at one end of the beam. In this way a delicate adjustment can be made, and the plate caused to travel as slowly as is desired. The length of the stroke is regulated by two stops, and a slit in the cover of the bell-jar, through which the glass rod passes, prevents the plate from striking the sides of the jar.

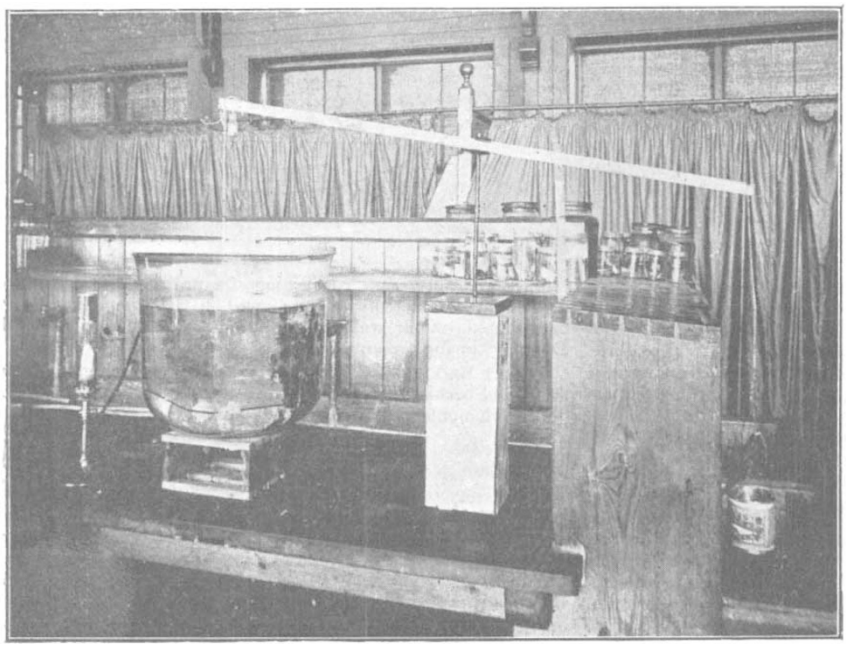

FIG. 1.—Bell-jar with glass plunger.

Arrangements have since been made in the laboratory, by which a large number of glass plates, or "plungers" as they have been named, can be worked in a similar way. A modified form of the apparatus, in which the glass plate is replaced by a glass funnel with a small hole in its top, has also been used with advantage. The funnel is fixed so that it is brought out of the water by the upward stroke of the plunger. At each downward stroke it carries with it a funnel-full of air, which escapes by way of the hole, and bubbles through the water.

Amongst the medusae which were successfully kept in the bell-jar were *Phialidium buskianum*, which grew and developed fresh tentacles, *Phialidium cymbaloideum*, which in twenty-five days added five new tentacles and five marginal bulbs, and a species of *Margelis*, which in seventeen days added two new tentacles in each of the four marginal groups, and the oral tentacles twice dichotomously divided. Two medusae of *Cladonema radiatum* were placed in the same bell-jar in the summer of 1897, and in the following spring several colonies of the hydroid of this species appeared. During the present summer (1898) these colonies have freely budded off medusae, several hundreds being seen in the bell-jar at one time.

Crustacean, annelid and molluscan larvae were put into the bell-jar from time to time (together with Copepods), as food for the medusae. Many of the larvae, which escaped capture by the medusae, continued to develop and attained the adult form. Amongst these were *Chaetopterus variopedatus* (the tube of an adult worm from an 1897 larva being about four inches long in June 1898), *Capitella capitata*, *Polynoe* sp., *Nika edulis*, *Portunus* sp., as well as small Gasteropods, Hermit-crabs, and Barnacles. Colonies of hydroids were also found to flourish well when kept in similar aquaria and plentifully supplied with Copepods, which they capture and devour in large numbers. E. J. A.

PHYSICS AT THE AMERICAN ASSOCIATION.

THE Physics Section (Section B) of the American Association was organised with Vice-President Prof. F. P. Whitman in the chair. His vice-presidential address, on colour vision, printed in the issue of *Science* for September 9, was well received, and constitutes a valuable *résumé* of the subject.

The programme of the Section included titles of fifty papers, of which forty were read. Many of these papers were of a very high order, and almost every one of them was creditable and interesting. Brief abstracts of some of them are subjoined.

"A redetermination of the ampere," undertaken, under a grant from the Association, by Prof. G. W. Patterson and Mr. Karl E. Guthe, of Ann Arbor. This work, for which an accuracy of about one part in 8000 is claimed, gives 0·0011192 grammes for the electro-chemical equivalent of silver, and reconciles almost exactly the mechanical equivalent of heat as obtained by electrical methods with Prof. Rowland's corrected