in her. Her sailing qualities do not at all unfit her for our work. Her cabin has ample accommodations for four persons, and could stow eight; and the cuddy forward has room and all the utensils for the cook: so that cruises to a distant dredging-ground can be undertaken without inconvenience, by a fair-sized party.

Of the usefulness of the Chesapeake zoölogical laboratory we may feel assured, though it is still in its infancy. It has held six sessions. During that time there has been a total attendance of fifty, of whom fourteen have been in attendance at least two sessions. These fifty men have been gathered from more than twelve different colleges, and are at present located in fourteen different states, besides two who came from Canada, one from Cambridge, Eng., and one from Japan.

In 1879 the laboratory was in co-operation with the Maryland fish-commission; and Dr. Brooks devoted most of his own time during the season to a study of the oyster, with especial reference to its embryology and its artificial propagation. The theoretical results of his work are of the greatest significance; but he succeeded in artificially fertilizing the oyster's eggs, and shedding such light upon the habits of reproduction that the greatest interest was aroused, and zeal in the search for some practicable method of oyster-culture, to replenish the waning oyster-beds. This interest has resulted in the discovery of a practicable method.

I will not recapitulate all the scientific papers published as resulting from work done in the laboratory: suffice it to say, that important memoirs have been published upon Lingula, Squilla, Leucifer, Renilla (the last two being published in the *Philosophical transactions* of the Royal society), Thallasema, and a monograph, not yet complete, of the Hydromedusae of the south coast. Beside these memoirs, the various members of the laboratory have written numerous shorter papers, which have been published in the *Quarterly journal of microscopical science*, the university *Studies*, and Carus's *Zoologischer anzeiger*. These articles, embodying the results of the laboratory's work, number, in all, fifty-nine separate titles.

For the most part, the laboratory has been morphological in the aspect of its work; not exclusively so, however, for both in 1881 and 1883 Dr. Sewall worked there upon selachians with reference to the equilibrium-sense function of the semicircular canals.

Last summer (1883), after three years at Beaufort, the laboratory was moved back to the Chesapeake Bay, and located in a building rented from the Hampton normal school. The location was in many respects not a good one, for it was far away from the best collecting-grounds and supplies of pure salt water; but it was selected to permit the laboratory to co-operate with the Maryland state oyster commission in experiments upon artificial propagation, and other expedients for a rapid and reliable method of restocking the oyster-beds in Chesapeake Bay. Lieut. Winslow, U.S.N., detailed for special service, was with us during most of the summer; and in the early part of the season the oyster-police boat, Gov. Hamilton, was stationed at the lower end of the bay.

The results of the season's work are not yet so far worked up as to permit one to speak about them. We had among us Mr. William Bateson of Cambridge, Eng., who came over to work upon Balanoglossus. His work includes a more thorough knowledge of the larval history of Balanoglossus than has been hitherto attained, and promises much that will be of greatest interest in respect to that most problematical creature. HENRY L. OSBORN.

THE DETERMINATION OF THE OHM.

THE importance of having a uniform standard of electrical resistance is so apparent, that the establishment of a unit which shall be suitable for practical work, and will also satisfy the demands of electrical science, has for a number of years been regarded by all electricians as of the first importance.

The requirements of such a standard are, that it shall be easily reproduced or verified; that it shall have a simple relation to the units of work, heat, etc., and therefore be based on the fundamental units of length and time; and, finally, that it shall be of so great resistance as to be suitable for all ordinary practical work.

In the year 1862 the British association decided that a unit of resistance based simply on the earth quadrant, or ten million metres, as the unit of length, and the second as the unit of time, would be of such a magnitude as to best satisfy the requirements of the case. Experiments were then undertaken by a committee of the British association with a view to the construction of standards which should accurately represent this unit of resistance, or *ohm* as it was called. Owing to some minor defects in experimentation, and to an unaccountable error in the determination of the coefficient of self-induction of the revolving coil, their result was in error. This standard British association unit, as it is now called, is confessedly too small; but it is the basis of the

so-called ohm-coils that are in current use. The latest experiments indicate that the value of the British association unit is .9867 ohms; this result having been obtained by Lord Rayleigh by two distinct methods, and by Mr. Glazebrook by still another method. But different observers still differ quite widely in their results.

The International committee on electrical units, which met in November, 1882, in Paris, in view of the present unsettled state of the case, and the necessity for the speedy adoption of a suitable standard, decided that when the length of a column of pure mercury of one square millimetre section, and having a resistance of one ohm, shall have been determined to within one part in a thousand, the ohm shall then be defined as the resistance of such a column of pure mercury of the determined length; and the different governments represented were urged to prosecute experiments for the accurate determination of this length. For this purpose, among others, an appropriation of twelve thousand five hundred dollars was made by the last Congress of the United States. The work on the unit of resistance is under the charge of Professor Rowland of the Johns Hopkins university; and the experiments are being carried on in Baltimore, both at the university and at Clifton Park, two miles from the city. Owing to some unexpected delays in the construction of necessary apparatus, the work that has been undertaken first is the determination of the specific resistance of mercury in British association units. This has been experimented upon by measuring the resistance of columns of pure mercury contained in glass tubes of various calibers and lengths, so that the resistances of the columns experimented upon range from one to ten British association units. The remaining part of the work is the determination in ohms of the resistance of the British association standard used in this determination of the specific resistance of mercury. Two principal methods will be employed for this purpose.

First, the resistance will be found by means of the mechanical equivalent of heat. The apparatus used by Professor Rowland, in his well-known work on that subject, has been set up for this purpose. It is proposed to heat some non-conducting liquid, such as alcohol or turpentine, by means of the heat developed by the passage of the current of electricity in a conductor whose extremities are kept at a known difference of potential. The same heating will then be produced, under the same circumstances, by purely mechanical means; and the resistance of the conductor will thus be determined directly from the work-equivalent of the heat developed in the conductor.

The second method to be used is that of Kirchoff, as modified by Rowland in his determination of the ohm in 1876. The instruments will, however, be in large part new, and constructed expressly for this research; so that a new set of instrumental constants will be involved. A third method, the earth-inductor method of Weber, will also be used if time permits.

For these experiments it is proposed to use, as a source of electricity in the calorimetric method, fifty Planté cells charged by a small dynamo machine. For measuring large currents of electricity an electrodynamometer has been constructed, with the Helmholtz arrangement of two large coils and a single small suspended coil. The diameter of the large coils is about one metre: that of the small suspended coil is about twenty-five centimetres. There are two sets of large coils, — one wound with large wire, about no. 8; and the other with much smaller, about no. 15. There are also two small suspended coils wound to correspond. This arrangement gives the instrument great power and range. The divided circle was made by Fauth & Co. expressly for this instrument. Four induction-coils are to be wound in four parallel equidistant grooves, turned on the outside of a brass cylinder about one metre in diameter. These coils will each consist of about two hundred turns of no. 15 copper wire. This arrangement will afford great variety in the manner in which the several coils may be combined; for the inductive action of each coil upon each of the others may be taken, giving three simple combinations for each coil.

The trustees of the Johns Hopkins university have kindly placed the Clifton House at Professor Rowland's disposal for the conduct of these experiments; and, as it stands in extensive grounds at a considerable distance from the road, it will be peculiarly suitable for delicate electrical experiments. Piers have been built for the different instruments, and a small steam-engine set up for supplying the power necessary for running the dynamo machine and the mechanical equivalent of heat apparatus. The actual experimentation will be carried on, under Professor Rowland's direction, by A. L. Kimball, assisted by H. R. Goodnow and Ensign Louis Duncan, U.S.N.; the latter having been specially detailed for the work by the Navy department.

It is hoped that a satisfactory conclusion will be reached by September, 1884.