THE MARINE LABORATORY OF THE JOHNS HOPKINS UNIVERSITY.

THE Chesapeake zoölogical laboratory was instituted by the trustees of the Johns Hopkins university as part of the biological department of that university in 1878, and Dr. W. K. Brooks was appointed director. Its purpose is twofold, — to furnish complete facilities for original studies in marine zoölogy, and a place for more elementary instruction. The fauna of the southern waters of the United States was selected for study. In providing thus a place for advanced work, this university has taken the initiative among American colleges; the various summer schools held along our coast being more particularly concerned in instruction than in investigation of new problems. The first and second sessions in 1878 and 1879 were held in the lower parts of the Chesapeake Bay. In 1880 the laboratory was moved to Beaufort, N.C.

Beaufort has been a favorite haunt of naturalists ever since 1860, when it was visited by Drs. Stimpson and Gill. No better place could be selected for the study of the forms of life in southern waters. It lies at the mouth of Old Topsail Inlet, ten miles west from Cape Lookout, protected from the ocean, except in its worst moods, by a broad sand-bar, and yet so near that an hour's sail carries one out upon the high seas. Owing to the configuration of the coast-line, the warm Florida current flows by and almost bathes the shore. This warm current, setting up from the shores of the Gulf, sweeps along with it many pelagic animals which belong to a hotter climate. Yet, while the ocean-life is decidedly southern, the climate of Beaufort is not oppressive: indeed, the place and its neighbor, Morehead City, are summer resorts. The town, standing almost in the ocean, is swept by nearly constant breezes, which temper the heats of July and August.

MARINE LABORATORY AT BEAUFORT.

The place is quite accessible, being only two miles from Morehead City, the eastern terminus of the North Carolina midland railway, and may be reached by steamer from Norfolk *viâ* Newberne, and by rail from points north and west *viâ* Goldsboro.

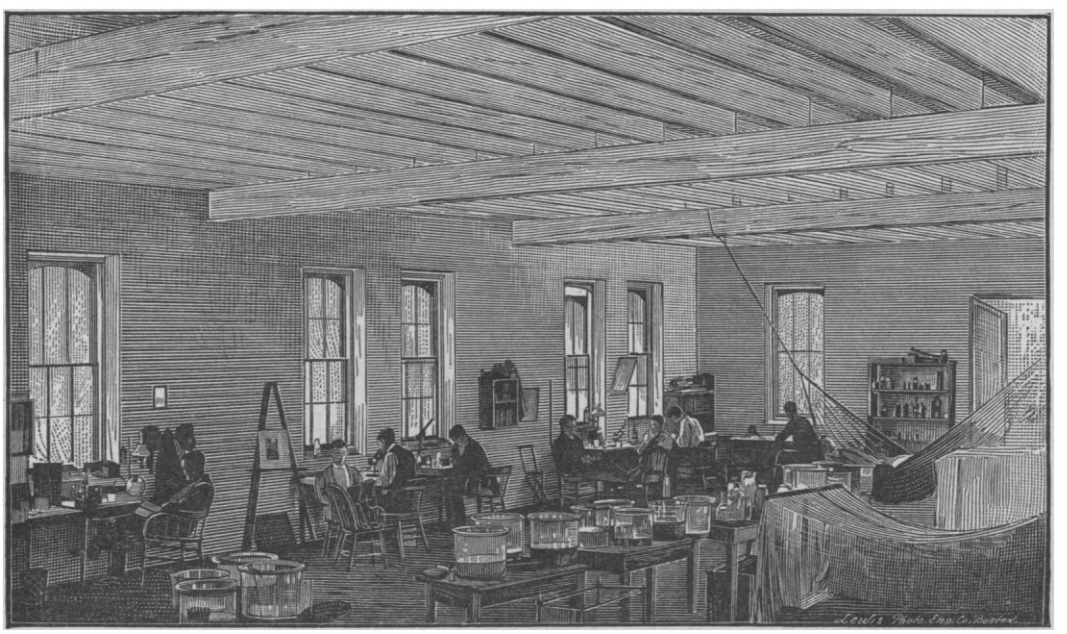
The site of the laboratory at Beaufort is most convenient, being at the very water's edge. A pier built out from the front gate to the deep water crosses a flat of black soft mud, bare at every low tide, and a place where the

specimen hunter is richly rewarded. A search here obtains for one crabs and hermits, Porcellana in tubes with Chaetoptorus, Alpheus, annelids, mollusks, echinoderms, ascidians, and barnacles upon the wharf-piles. The general student can here find material to illustrate his study of almost any of the larger groups literally within a stone's throw of his work-room. From the end of the wharf at high water the dip-net secures not only quantities of things to interest the general student, but crustacea, medusae, Sagitta, and larvae of the greatest interest to the specialist.

Across the channel which runs along the water-front is a large sand-shoal, uncovered during several hours every day; and here are the favorite haunts of myriads of interesting creatures. I say myriads advisedly, for one of the most striking features of the Beaufort fauna is the extreme abundance of almost all the forms which occur there at all. The inner side of this shoal is literally honeycombed by a colossal species of Balanoglossus often three feet long; and on the outer edge are to be found Mellita in great numbers, and dead shells of Mellita inhabited by Thallasema, as many as one has the patience to collect. All over the shoal creep Limulus. In the deeper water just off the shoal are Renillas without limit and the beautiful nudibranch Pleurophyllidia.

Trawling in the sound procures starfish, echinoids and ophiurans, Chiton, Fissurella, Leptogorgia, Astrangia, often with large masses of coral. High tides sweep in pteropods, Sagitta, Leucifer, Siphonophora, pelagic larvae, and medusae of great interest, such as Liriope and Cunina. The rocks upon the artificial breakwater furnish Penophora, tubularian hydroids, and several species of actinians. On shells inshore are found the known genera of entoproctan Bryozoa.

But I cannot give a complete list of the fauna here, nor even mention all the attractions. I have not tried to do so, but merely to intimate the exceeding variety and abundance of forms of the greatest interest. Though Beaufort has been the resort of naturalists for the last twenty-five years, it has not yet been to any degree exhausted.

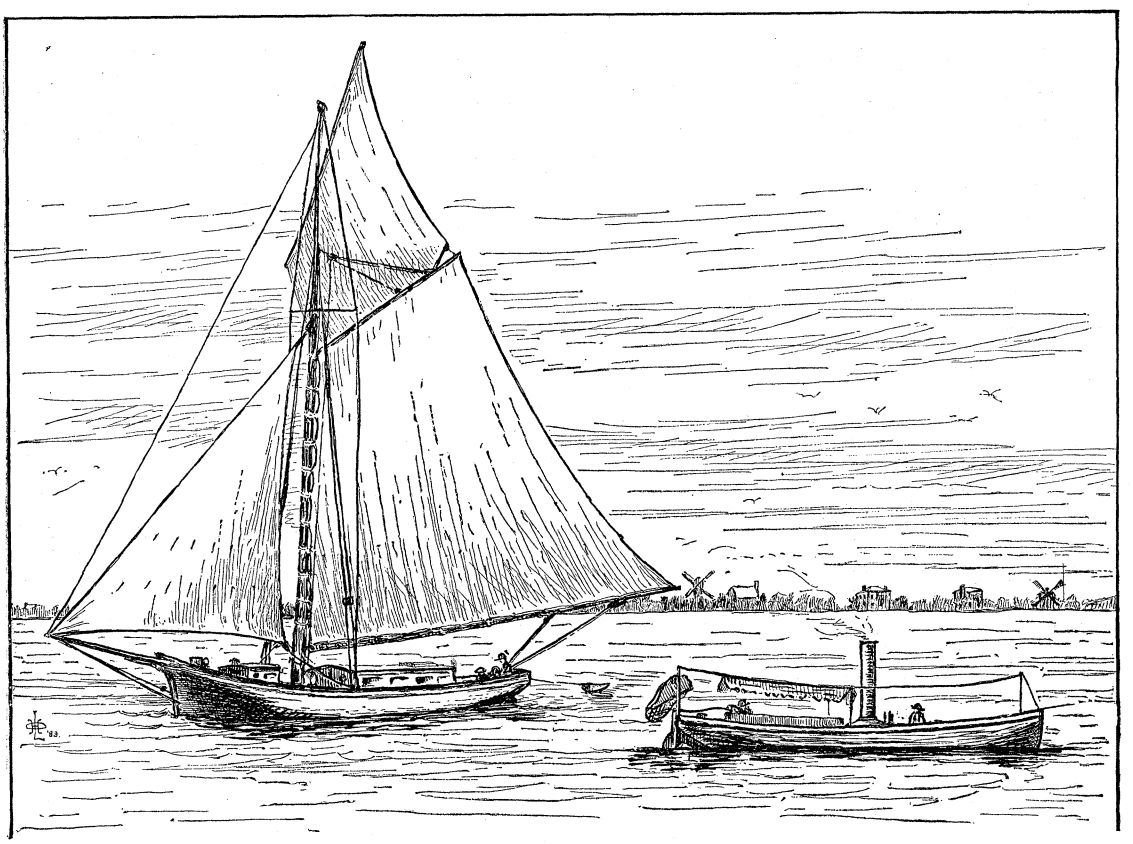


INTERIOR OF MARINE LABORATORY AT BEAUFORT.

Since Beaufort was felt to be a somewhat transient location for the laboratory, a permanent building, with all the modern conveniences for work, was not erected. A two-storied double house, with eight rooms, was rented for work-room; and houses adjoining were secured as living-quarters for the party. Thus, both in their work and in the life out of the shop, the party was kept pretty well together; and the members had that opportunity of forming personal acquaintance with one another, the

value of which does not require comment. The furnishing of the building was simple, — tiled tables, with lights only; and other luxuries were dispensed with. Not even were pumps erected to maintain a constantly renewed stream of salt water circulating through the aquaria. In their place was used the cheaper and very effective device of aeration by means of a stream of fresh air constantly forced through the aquaria by a Sprengel pump.

and with a draught of about thirty inches, capable of taking us to any points about the sounds and rivers, or even of venturing out to sea when Old Prob did not menace with danger-signals. The launch was most useful, and was in service almost every day for dredging, trawling, or carrying parties out to tow in the open ocean. She is, however, but a passing stage, as her name Nauplius implies; and we hope some day to possess a full-grown steam-



YACHT AND STEAM-LAUNCH OF JOHNS HOPKINS MARINE LABORATORY.

Facilities for work were not, however, in the least curtailed; and all the apparatus for capture and means for getting about were provided. The dredge and trawl, spade and sieves for bottom fauna, towing and dipping nets of silk bolting-cloth for surface forms, and many special traps devised for the capture of particular animals, formed a complete array of appliances. Besides its small boats, the laboratory has for several years possessed a steam-launch of Herreschoff pattern, twenty-seven feet long,

vessel, in which we can with safety explore the deeper waters offshore, which are as yet almost entirely unstudied.

During the past summer the navy has received an important addition in the form of a yacht, to be called the Zoea, though at present otherwise registered. She is a full-rigged sloop, forty-seven feet long, fifteen feet beam. She won a silver cup in a regatta upon the Potomac while in her former service, and her speed was a pleasant feature of collecting-trips

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