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The Hopkins Seaside Laboratory.

One of the earliest ideals cherished by the biological members of the faculty of the newly opened Leland Stanford Jr. University in 1890–'91 was the establishment of a marine biological station on the Pacific coast, in which might be utilized to the best degree its wonderful natural richness. The consideration of various points along the coast from the standpoints of faunal and floral resources,

Hopkins Seaside Laboratory from the East.

accessibility and living accommodations was at once undertaken by Professors C. H. Gilbert and O. P. Jenkins, with the result that Pacific Grove, a small village on the southernmost headland of Monterey Bay, was selected as most suitable.

Upon the announcement of their plans the projectors met with most liberal co-operation from the citizens of Pacific Grove, the Pacific Improvement Company, and especially from Mr. Timothy Hopkins, to whose generous appreciа-

tion of biological research the laboratory owes its existence to-day. As a slight recognition of his aid and sympathy the name of the Hopkins Seaside Laboratory was given to the institution. Upon a site donated by the Pacific Improvement Company the first building was erected and ready for occupancy by June, 1891, and to it was added the second building in 1894. The site is one of the most favored that could be selected there, being upon Point Aulon, a rocky headland jutting out into the bay, and at the same time but a short distance from the center of the town.

Rocky Shores.

The bay itself is about twenty miles wide at its entrance, the broad sweep of sandy beach, broken here and there by rocky cliffs, extends almost uninterruptedly from Santa Cruz on the north around to Monterey on the south. At Monterey, two miles from Pacific Grove, the character of the shore changes, rugged granitic points jutting out into the bay at intervals, varied here and there by sheltered sand beaches or rocky coves. Here in the countless tide pools are the favorite shore collecting grounds. As the difference between highest and lowest tidal levels often reaches ten feet or more during the spring tides, a wealth of littoral life is rendered accessible.

In one of these coves, fifteen minutes walk along the shore from the labora-

Tide Pool.

tory, is located the picturesque and odoriferous Chinese fishing village which has proven the means of securing much of value from the waters of the bay. Though representing the lowest type of Cantonese, many of these fishermen can be turned into excellent collectors, if the financial consideration be large enough. However, their regular fishing is so profitable—especially during the salmon season—that it often requires an infinite deal of patience and perseverance to get anything from them at all. It was through the most intelligent of these fishermen, Ah Tuck Lee, that Dr. G. C. Price secured the first embryos of *Polisto-*

trema (*Bdellostoma*) *stoutii*, followed later by Dean, Ayers and Doflein.

Beyond Point Aulon the same general character of shore continues, the cliffs becoming higher and more precipitous, with several rocky islets detached from them, the abode of countless gulls, cormorants and pelicans, who noisily contest possession with occasional seals and sea lions. Beyond Cypress Point, the restricted home of the weird *Cupressus macrocarpa*, another smaller bay opens, Carmelo Bay, at the mouth of the Carmel river. The rugged Point Lobos forms its southern boundary, beyond which the cliffs become sheer rock walls, rising abruptly from the ocean for hundreds of feet.

The two buildings of the laboratory are simple, unpretending structures, but admirably adapted for the purpose. The older one is sixty feet long by twenty feet wide. Its lower story is divided into two large laboratories, a store room, engine room and a dissecting room with concrete floor, suitable for work upon the larger marine animals. The second floor contains a general laboratory running the entire length of the building, and six private rooms for investigators. The second building contains a large, well-lighted basement with concrete floor at present used as a physiological laboratory. Above this the first story is divided into a large laboratory for advanced students, and six private rooms. The upper floor has a large room fitted with blackboard and book shelves, used for lecture room and library, five private laboratories and a dark room for photography.

Cormorants near Point Aulon.

Each private room and laboratory is fitted with aquaria, small and large, and all the necessary glassware and reagents. An abundant supply of excellent microscopes, dissecting and compound, together with all needed physiological apparatus, is brought each summer from the University, and its library is drawn upon for the books and periodicals needed.

The salt water supply is pumped by a windmill into a 20,000 gallon tank, from which it is led into the two buildings and distributed to each room. The older building is piped with galvanized iron, the newer one with block tin, the stop cocks being of rubber. By this means a supply of perfectly pure sea water is assured. The fresh water supply is furnished by the excellent water system of the Pacific Improvement Company and is brought from the head waters of the Carmel river, twenty miles distant.

The usual supply of trawls, dredges and nets of various kinds and two boats are at the disposal of students and investigators. At present the laboratory does not own a steam launch, but for several years a gasoline one has been readily obtainable for dredging, and a new forty foot one is now owned in Pacific Grove, which may be chartered whenever occasion demands. The shore collecting,

however, has been of such surprising richness and has offered such a variety of problems that extensive dredging operations have not been necessary.

In the foundation of the Hopkins Seaside Laboratory the directors have had in mind three different but very closely related fields of usefulness, the same being filled so admirably on the Atlantic coast by the Marine Biological Laboratory under the able direction of Dr. C. O. Whitman. On a coast but scarcely

Chinatown Landing and Fishing Boats.

touched by the investigator of biological problems a most inviting field is offered, and it is the intention of the directors to give every opportunity in their power to men qualified for this work. To such the privileges of the laboratory are offered free of charge, and any assistance possible is gladly rendered.

The financial condition of the University during its first decade prevented the extension of any aid to the laboratory other than the loan of books, microscopes and other apparatus, so that the running expenses had to be met by students' fees for the most part. Hence it has been of course impossible to have the retinue of servants, collectors and fishermen, such as may be found in many European stations where each table is endowed, often with a large sum. With but one exception the investigators who have availed themselves of the opportunities here offered have appreciated these conditions fully and have entered into the spirit of the laboratory completely.

A Chinese Fishing Boat.

The second aim of the laboratory is to supplement the work given during the remainder of the year in the regular courses

of instruction in zoölogy, botany and physiology at the University, by affording the students the opportunity of seaside study and to enable the more advanced to begin various lines of investigation under proper guidance.

A not less important field finally is the endeavor to raise the standard of scientific instruction in the public schools of the state by giving teachers and others facilities for becoming acquainted with the marine fauna and flora and the best methods of their study. For students receiving instruction, a fee of twenty-five dollars is charged for the session, to investigators the laboratory is free. A regular summer session of six weeks is held, beginning early in June.

The courses offered vary somewhat from year to year, those of the session of 1901 being the following:

I. General Zoölogy. Dr. G. C. Price. Lectures, laboratory dissections and field work upon representative forms of each of the larger groups of marine animals. In addition to the anatomical work the embryology of several forms is briefly followed.

II. Elementary Botany. Dr. G. J. Peirce. Lectures and laboratory work mainly upon the morphology and physiology of the marine and fresh water algæ, together with collecting and field study.

III. Advanced Course on the Structure and Physiology of the Algæ. Dr. G. J. Peirce. Character of the work to be determined largely by the previous training and inclinations of the student.

IV. Embryology. Dr. G. C. Price. Principally devoted to the development of the vertebrates.

V. Comparative Morphology and Histology of the Nervous System and Sense Organs. Dr. F. M. McFarland. Lectures and laboratory work upon a series of vertebrate and invertebrate forms.

VI. Advanced Invertebrate Zoölogy. Dr. F. M. McFarland. Detailed study of the morphology and classification of one or more groups of marine invertebrates.

VII. General Ornithology. Mr. J. Grinnell. Lectures on distribution, migration, moult, classification and economic relations of birds. Field study upon notes and habits, and laboratory work upon bird anatomy, plumage structures, identification of specimens and the preparation of study skins.

In addition to the above courses supervision of those beginning investigation in Embryology, Plant Physiology, Histology and Cytology was given by Drs. Price, Peirce and McFarland.

The following statistics of attendance during the first decade of the laboratory's existence shows a most encouraging condition:

Year.	1892	1893	1894	1985	1896	1897	1898	1899	1900	1901
Investigators and Instructors in private rooms . . .	6	6	8	7	11	7	15	16	11	12
Students taking regular courses	13	25	46	43	19	46	54	52	48	40
Totals	19	31	54	50	30	53	69	68	59	52

Though the regular instruction is limited to six weeks, the laboratory is open all summer and work may be continued independently without extra charges. Investigators desiring to use the laboratory during the winter months may readily make arrangements to that end with the directors, Drs. Jenkins and Gilbert.

Any attempt to give an adequate idea of the richness and variety of the fauna and flora of Monterey Bay would far exceed the limits of this article. Only the more striking forms may be touched upon here in passing. The most conspicuous of the marine algæ belong to the group of the *Phæophyceæ*, the gigantic *Nereocystis* and *Macrocystis* forming floating beds along the coast, sheltering numerous animal forms. *Postelsia palmæformis*, the sea palm, flourishes upon its rocks in the midst of the wildest surf, while acres of *Fucus* and *Lami-*

Chinatown and Boat Landing.

naria are exposed at low tide. The more delicate forms of red and green algæ are rarer and search for them must be made in more sheltered places.

The few classes of animal forms which have been studied in detail show a surprising wealth and variety. The lower Invertebrates, such as sponges, cœlenterates and worms, are especially abundant. Of the chitons twenty-five species have been recorded, among them the giant *Cryptochiton stelleri*, reaching a length of ten to thirteen inches, *Katharina tunicata*, several species of *Mopalia* and *Ischnochiton magdalenensis*, the development of which forms the subject of a recent very accurate study by Dr. Heath. Other forms of Mollusca are equally well represented; for example, some sixty species of Opisthobranchiata have been taken without any extended dredging. *Loligo* and *Octopus* are very common, the giant *Archoteuthis californica* somewhat rarer. The capture of squid for export to China for food and as a fertilizer upon the rice fields forms one of the principal industries of the Chinese fishing village, and after a favorable night tons of the animals may be seen spread out to dry in the sun. The squid are taken

during the dark of the moon, being attracted by pitch-pine fires built on iron cranes suspended over the water from a boat's side, while other boats encircle the inquisitive cephalopods with nets.

Echinoderms are abundant, among them ophiuroids, *Astrophyton* and at least seven species of holothurians. The occurrence of the hag fish has been noted

A Night's Catch of Squid.

Drying Squid.

already, and a Chimæra, *Hydrolagus colliei*, has furnished to Dr. Bashford Dean the first embryological material of this family.

The pelagic fauna is variable, but at times the surface is swarming with *Noctiluca* and other Protozoa, while Ctenophoræ, Pteropoda and long chains of *Salpa* are characteristic.

The zoölogical department of the University of California, under the energetic direction of Prof. W. E. Ritter, has for several years maintained a summer

Drying Squid.

Drying Fish.

biological laboratory, the site being shifted from year to year, at present, however, being located in more permanent quarters at San Pedro. To the northward Columbia University maintained for a short time a temporary laboratory on Puget Sound at Port Townsend, but other than this the Hopkins Seaside Laboratory and the San Pedro Laboratory stand alone in offering to the investigator and student facilities for attacking the many biological problems presented by the Pacific coast.

F. M. McFarland.

Leland Stanford Jr. University.