

II.

A Californian Marine Biological Station.

THE European zoologist who visited the Pacific states would be very apt to find his way to the old Spanish-Californian town of Monterey, and to the Marine Laboratory of the Leland Stanford Junior University. As this station, however, seems to the present writer surprisingly little known in proportion to its deserts, a brief account of its equipment and surroundings may prove of interest to the readers of *Natural Science*.

This at the present time is the only permanent biological station on the American side of the Pacific. Temporary stations have indeed been established within recent years. The University of California has several times carried on a seaside school of zoology, both at Pacific Grove near Monterey, and on the Santa Catalina Islands in the region of Santa Barbara. Further northward, in Puget Sound, Washington, a local society, that of the Young Naturalists of Seattle, has done excellent faunal work during its camping seasons; and in the same region during last summer Columbia University of New York established a laboratory at Port Townsend.

The Stanford, or the Hopkins Laboratory, as it is called, is both an annexe and an integral part of its university. It was, indeed, contemplated as early as the time of the building of the university, when it was decided that a portion of the studies in zoology and botany might be carried on during the summer, the students to be given the regular credit for their work as in the winter courses. It was, accordingly, with a summer laboratory in view, that in 1891 two of the Stanford professors, Drs O. P. Jenkins and C. H. Gilbert, visited the region of Monterey (which had indeed been known to Dr Gilbert previously during his studies on the fishes of the Pacific), and made a reconnaissance to determine the particular point of the bay which was best suited to the needs of the collector and investigator. The site they then determined upon was at Pacific Grove, a few miles westward of Monterey. Here, in the first place were found most favourable fields for collecting. The shores were unshifting, the coast was rugged, while huge rock masses and bluffs alternated with sheltered harbours and beaches, rich in forms of animals and seaweed life. The locality seemed also a particularly convenient one on account of its facilities for the lodging and living

of students, a summer settlement of possibly five hundred people being in the immediate neighbourhood. It was here finally that land was obtained, a gift of the Pacific Grove Improvement Company, and the buildings were shortly put up and equipped, thanks to the generosity of Mr Timothy Hopkins, after whom the laboratory has been named.

The buildings are shown in the adjoining figure (Fig. 1), but



FIG. 1.—The Hopkins Seaside Laboratory, near Monterey, California. East view.*

the picture gives only a slight idea of their surroundings; thus they are seen to be built on a level field, and there is but a glimpse of the sea in the background. One needs, therefore, to imagine the laboratory site as a small treeless plateau, on the top of an abrupt rocky point which terminates about a hundred yards to the right in the picture. The sea surrounds the buildings, therefore, on three sides. In front there is a sheltered harbour and a small sandy beach, furnishing an admirable landing place for the boats; at the back the surf is breaking on the rocks thirty feet below—hardly far enough away as it has been proved, for in the winter storms the waves have threatened to overturn the buildings, and have rendered necessary the additional braces which one sees at the corners of the building. From its position the laboratory becomes a prominent feature of the entire neighbourhood. The visitor will not fail to notice it even at the incoming of his train, for he naturally will be looking seaward after his three hours' journey from San Francisco. He will just have passed through the hot and dusty valley country, but his interest revives as the train emerges on the sea-coast at Monterey, thence to skirt the shore of the bay during the few final minutes of the trip.

The bay of Monterey appears not unlike that of Naples. There is the same long curving beach, broken with rocky points, the clear

* The illustrations have been prepared by Mr Percy Buckman from photographs taken by the author.

blue water, and the same setting of half tropical vegetation, although the mountainous background is lacking. The climate is here less variable than at Naples; the temperature remains almost constant throughout the year, each day averaging about 60°F., and during six of the months outdoor life is not interrupted by rain. The railroad line terminates at Pacific Grove. Here on one side of the railroad are bluffs and the rocky point on which the laboratory is situated, while on the other a tidy little town, with well kept villas, bright shops, lines of tents for the summer campers, a good hotel, and a small park-like square, rich in the deep greens and light olives of Californian plants. All about are scattered forest trees—live oaks, tall pines, eucalyptus and palms. With these are numerous trees and hedges of the Monterey cypress (*C. macrocarpa*), whose very restricted range gives it an especial interest.

Point Aulon, the little promontory on which the laboratory is situated, juts out from the western end of the town. It has been

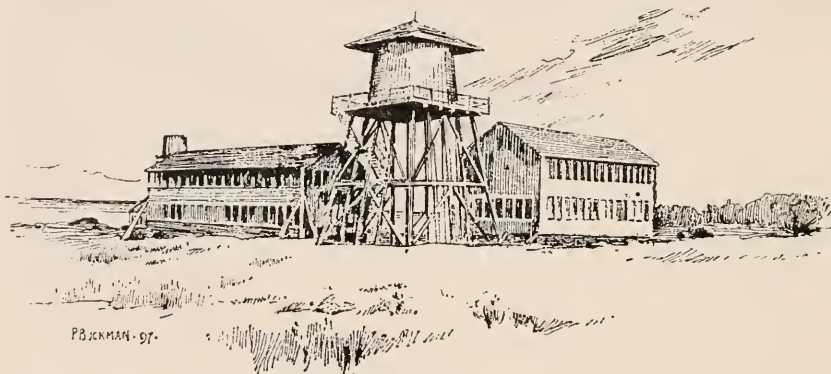


FIG. 2.—The Hopkins Laboratory. West view.

fenced off as a kind of marine park for the cottagers; and here at all times throughout the summer may be seen clusters of people, old and young, idling away their holidays, clambering about the rocks, or watching the ceaseless strings of cormorants, or the doings of the little school of boats huddled closely together off the point salmon catching, or the return of the little fleet of Chinese fishermen, whose curious town may be seen on a projecting coast point in the direction of Monterey. Such a thing as the sight of an occasional whale or sea-lion, and these will come surprisingly near the point, or even the loss of a straw hat, will cause a flutter of excitement among the summer visitors, diverting their attention, as a student will uncharitably believe, from their attempts to invade the penetralia of the laboratory.

Our second illustration (Fig. 2) gives a west view of the two buildings. The older, used during the first and second sessions of the summer school in 1892 and 1893, stands to the left, long, and

with many windows. It measures sixty feet long by twenty feet wide. The newer, smaller, but more substantial building measures forty by twenty-six feet. From the figure one may also see the two large salt-water tanks, which have been so arranged that each can supply either building. The older building is now used mainly for the classes of elementary students. It has two laboratories on the ground floor, a small engine room, and a concreted workshop, which serves as a dissecting room for the larger marine beasts. Upstairs a long laboratory faces the east, and on the south side a series of small separate rooms have been arranged for investigators. In the newer building a laboratory occupies the rear end of the ground floor, used during last summer mainly for students in the botanical courses; and on the floor just above there is a room of the same size, with blackboards, cases, and portable tables, used both as a lecture room and laboratory. The front part of the house in both storeys is divided by partitions into a dozen rooms for investigators, and it has, in addition, a photographic dark room. Throughout both buildings the fittings are simple but adequate. There is an abundant supply of microscopes, reagents, glassware and the usual set of dredges, tangles, and nets, a small beam-trawl, and apparatus for sounding and temperature-taking. At present the boat facilities include only a rowing boat and a small sailing boat, the latter almost too small for dredging or trawling, except in comparatively shallow water. Hitherto, however, the laboratory seems scarcely to have needed collecting facilities for the deeper water—enough at least to warrant the support of a steam vessel. The shore fauna has been of the richest, and dredging in shallow water could well be done with the boat at hand. As a convenient means of collecting in the shallow rocky bays a water-glass has been found of great service, especially in securing conspicuous forms such as echinoderms and holothurians, and has to a certain degree served as a substitute for diving apparatus, which here, as at the French marine station at Banyuls, might well prove of the greatest value. The station has never found difficulty in securing an abundant supply of fish material, thanks to the Chinese fishermen of the neighbouring village.

A whole article might be written on this small Chinese village near Monterey. It is but a quarter of an hour's walk from the laboratory, approached along the ledge of the railroad on the seaside rim of the town—a daily walk for a number of the students, who have come to have the greatest faith in the fishing powers of the heathen. This walk is by no means an uninteresting one; the sea-birds are around, whitening the tall rocky ledges, and on every hand there are quantities of little ground squirrels—a species of sperophile—which sit up before the visitor like little prairie dogs.

The village itself looks as though it has been imported from China in its present condition, a huddled little town of unpainted shanties sprinkled closely along a crowded street, with a few shops, a joss-house, and a sky-line of picturesque scaffolding for fish-drying. There will be a crowd of mushroom-hatted fishermen, a din of chaffering, a mixture of nets, trawl lines and baskets, distinctly unpleasant odours, placards of crimson and tinsel spattered with Chinese characters. The people are Cantonese, many of whom have been living here for two generations. They are classed as a peculiar poor grade of Chinaman, and are, I am told, looked upon at home as mere barbarians, if for no better reasons, that they have lived in China only two or three centuries, and are unable to trace their descent for more than seven generations. To the stranger, however, they certainly appear very industrious, honest (except in bargaining), kindly and painstaking. They are excellent fishermen, and in



FIG. 3.—The Chinese Fishing Village at Monterey. A corner of the beach.

several instances very intelligent collectors. Their little fleet of boats is often out before sunrise; between seven and ten they have become scattered along the coast, and their trawl lines are put out, often six or more (each about five-eighths of a mile long) to a boat; about noon-time they return, their skiffs sometimes gunwale-deep with fish—rock cod, black bass, flounders, mackerel, with an occasional wolf-fish,¹ their little latteen sails making the picture a still more foreign one. In a few moments after landing, the fish are carried off in shoulder baskets, to be shipped to San Francisco, and the boats are drawn high up on the beach (Fig. 3). The little colony also carries on a very successful squid-catching industry, so that at night there is often as much life and excitement in Chinatown as during the day. The amount of a catch will often be measured by tons.

¹ *Sebastes (nebulosus)* and *melanops*, *Scomber (colias)*, *Platichthys*, *Anarrhichthys*.

The boats go out with nets and red pine fires, which are hung cresset-wise over the sides of the boats to lure the squid. Some of these are intended to be cleaned and dried on latticed trays as a staple article of diet in Chinese markets. The bulk of the catch is, however, spread over the fields for drying, then to be packed in matting bags for export to China, as a rich fertilizer for the rice fields. Another phase of their industry is that of collecting abalones, *Haliotis*, these also to be dried for export. The people have their usual Oriental thrift,—they are infamous at a bargain, but make up this deficiency by the skill with which they separate the fertile or unfertile eggs of sharks or *Bdellostoma*, and recognise what they refer to as the 'hen' or 'rooster' sharks or rat-fish (*Chimaera*).

There is also another little imported village in this neighbourhood, nearer Monterey, namely, a settlement of Portuguese, who, like the Chinese, have retained minutely their foreign ways. Their boats are precisely those one would see in the Tagus, and, judging from the writer's experience in Portugal, he believes that the immigrants have not improved in the way of zoological collectors.

The laboratory has now completed its fifth season, and the work of last year seems to have been carried on very much in the lines of former years. There is a class in the dissection of types, and in the study of methods, limited to twenty or thirty students, each paying a stated fee for a term of six weeks. A second class includes advanced students in zoology, mainly from Palo Alto. The investigators, finally to be mentioned, occupy the private rooms in both buildings. These are afforded their quarters, reagents, and collecting facilities gratuitously. Class instruction is carried on by the professors of the Stanford University, during the present year by Doctors Jenkins, Shaw, and Wilbur. Among the investigators of the past summer were W. R. Shaw, working on the development of conifers, E. P. Wheeler, on the embryology of *Dicyema* and on diptera, D. A. Saunders, on the brown seaweeds, H. Heath, on the anatomy and development of *Chiton*, O. P. Jenkins, on contractility of muscles and conductivity of nerve-tissues in invertebrates, H. P. Johnson, on the annelids, and W. E. Ritter, on the ascidians, W. A. Setchell, on (laminarian) seaweeds, and the present writer, on the development of *Chimaera* and *Bdellostoma*. Many of these investigators have previously spent summers at the laboratory. Among the workers of former seasons might be mentioned H. Ayers, whose lecture on *Bdellostoma*, published in the volume of zoological lectures of Wood's Holl Laboratory (1893), has merited wide attention. Dr C. H. Gilbert, as the director of the station jointly with Dr Jenkins, has also been a constant visitor, and has here prepared no little part of his studies on the ichthyology of the Pacific. Dr E. C. Price, also one of the zoological staff at Palo Alto, was the

first of the several workers at the laboratory to secure embryos of *Bdellostoma*; while on the botanical side F. M. M'Farland and L. H. Campbell have been in frequent attendance. President Jordan has also taken the warmest personal interest in the work of the station, and although his researches have hardly been carried on at Pacific Grove, he has, nevertheless, been a constant visitor.

It is evident, perhaps, from the foregoing pages that the zoological station of the Stanford University has neither the equipment nor the subsidies of the Stazione at Naples, or even, as yet, of the laboratory at Wood's Holl; but the zoologist will certainly find there all of the facilities for his work which can reasonably be needed. The warm interest which Dr. Jenkins has shewn in the welfare of each worker of the station will not be forgotten; and it is doubtless due in no small degree to this care that the visitor



FIG. 4.—The Coast of the Pacific at Cypress Point, near Monterey.

takes away with him the kindest recollections of Stanford's hospitality. The richness of the fauna and flora of this little nook in the Pacific cannot fail to leave the strongest impression upon the visitor's mind. He will remember the rugged shore line, with its stunted and twisted cypresses (Fig. 4), the sunken rocks bristling with the largest sea-urchins, the bright-coloured star-fishes, the orange-red *Cucumaria*, a yard in length. So too the tidal rocks covered with *Pollicipes*, the clumps of palm-tree-shaped *Postelsia*, the tangled masses of bull-kelp (*Nereocystis luteana*), whose stems are often many fathoms in length; the field-like areas of *Macrocystis* (*M. pyrifera*); the rich molluscan fauna, including the red shelled *Haliotis*, to be found even at the base of the laboratory rocks, *Cryptochiton* (*C. stelleri*) seven inches long, and abundant nudibranchs. There is a wealth of ascidians, annelids and hydroids. Nor does

this neighbourhood represent the vertebrates in a less interesting way. Mr Leverett M. Loomis, curator of the California Academy of Sciences, tells the writer that the coast line at Monterey is particularly prolific ornithologically; it includes among its common birds, cormorants, pelican, auklets, murre, and albatross. Among fishes there are several forms of especial interest. A species of *Chimaera* (*Hydrolagus collicii*) is plentiful in deeper water, twenty or more being a not unusual catch by a single boat. The hag-fish (*Bdellostoma stouti*) is one of the most common forms of the bay; and in some localities it is so abundant that it becomes a serious nuisance to the fishermen.

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