

THE MARINE BIOLOGICAL STATIONS OF EUROPE.*

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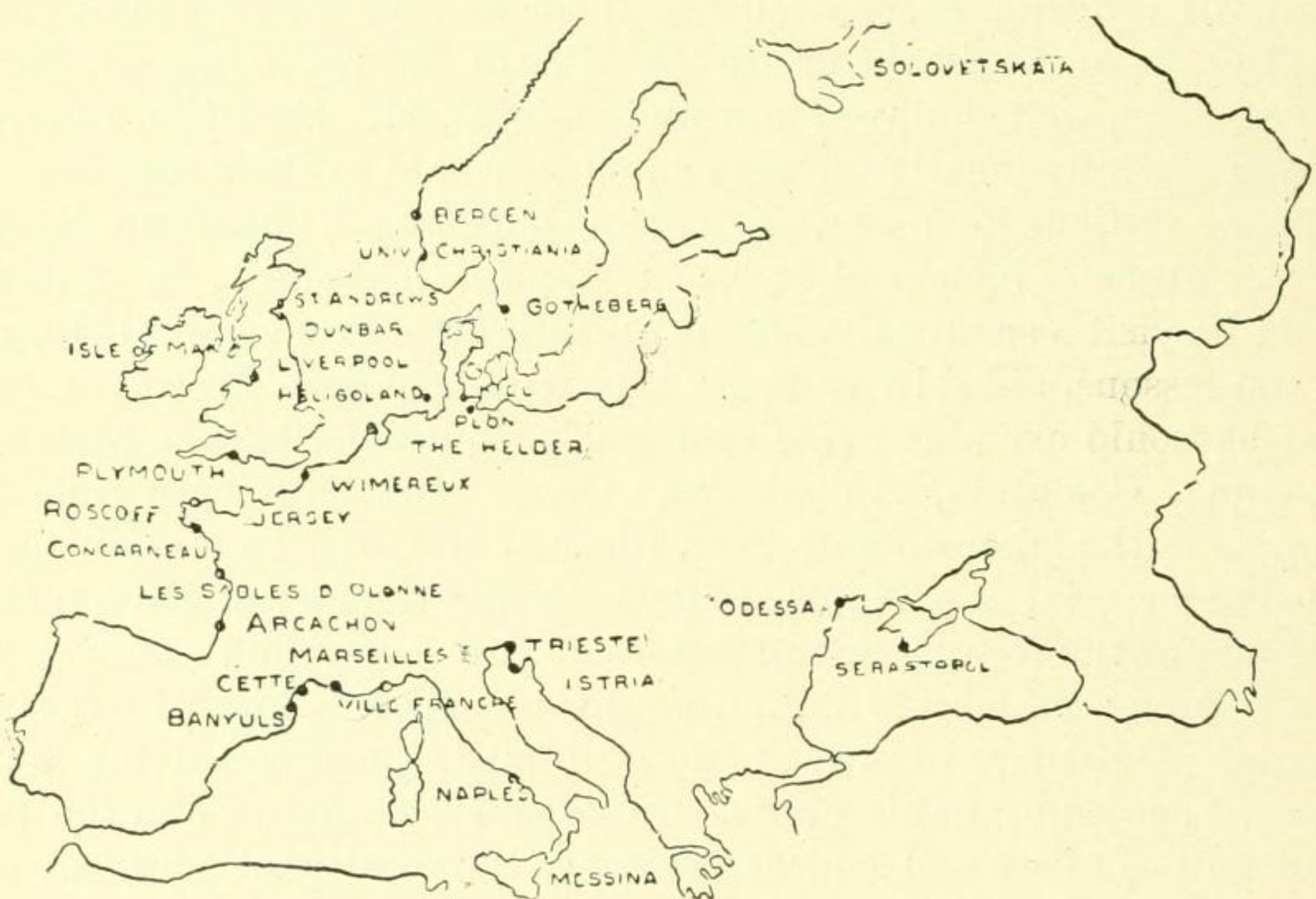
Among European nations the marine laboratory has long been recognized as an important aid to the advancement of biological studies. Groups of universities, centralizing their marine work in convenient localities, have caused the entire coast line of Europe to become dotted with stations, well equipped and well maintained. Societies, individuals, and not infrequently governments contribute to their support.

Marine stations have become distributing centers, important equally in every grade of biological work or training. A student, for example, should he visit a small university in the interior of France, would receive his first lessons, aided by material sent regularly from Roscoff or Banyuls; he would examine *living* sponges, pennatulids, beroës, hydroids, *Loxosoma*, *Comatula*, *Amphioxus*. Or, at Munich, remote from the coast, as in the laboratory of Prof. Richard Hertwig, he is enabled by means of material from Naples to demonstrate the larval characters of ascidians or the fertilization processes of the sea-urchin. During his winter studies the marine station would thus provide him with the best material—sometimes preserved and well fixed, sometimes living, to be prepared according to his wants. In summer it affords him the best opportunities to see and collect his study types without physical discomforts and with the greatest economy of time. To the investigator the station has become, in the broadest sense, a university. He may there meet the representative students of far and wide, fellow-workers perhaps in the very line of his own research, and must himself unknowingly teach and learn. He finds out gradually of recent work, of technical methods which often happen most pertinent to his needs. He carries on his work quietly and thoroughly; his works of reference are at hand; he has the most necessary comforts in working, and is untroubled by the rigid hours of demonstrations or lectures. The station becoming a literal emporium, cosmopolitan, bringing together side by side the best workers of many universities, tends moreover to make

*In the main as published in the Biological Lectures, 1893, of the Woods Hole Marine Laboratory. (Boston: Ginn & Co.)

observations upon the best material sharper by criticism, most fruitful in results. It has often been remarked how large a proportion of recently published researches was dependent, directly or indirectly, upon marine laboratories.

A brief account of the more important of these stations should not prove lacking in suggestions; especially as in America the work of the marine laboratory is often imperfectly understood. Its aims have been associated popularly with those of practical fish culture; and even among the trustees of universities a disposition has often been to regard an annual subscription for a work place in a summer school as among the little-needed expenditures of a biological department. So little important has a marine station seemed that the greatest difficulties have ever been encountered to insure the support of an American table at Naples, although it was well known how large a number of our investigators were each year indebted to foreign courtesy for the privileges of this station.



General interest in the advancement of pure science has in Europe become a prominent feature of the past decade, and there can be no doubt of the importance that has come to be attached to studies bearing upon the problems of life, evolution, heredity. Nor, at the same time, does it appear that matters relating to practical fisheries have in any way lost their interest or support. To these, on the contrary, the rise of pure biology has often given important aids. What has appeared abstract theory to-day has often been converted into practice to-morrow. And even so ardent a partisan of pure biology as Prof. de Lacaze-Duthiers does not hesitate to urge this, as sufficiently important in general argument, to vindicate the governmental support of the laboratories of Roscoff and Banyuls. "Facts have been found at every step of science which were valueless at their discovery, but which, little by

little, fell into line and led to applications of the highest importance—how the observation of the tarnishing of silver or the twitching leg of the frog was the origin of photography or telegraphy—how the purely abstract problem of spontaneous generation gave rise to the antiseptics of surgery.

As a preface to the present discussion the general number and location of the European marine stations might conveniently be indicated in the accompanying outline map.

I.—FRANCE.

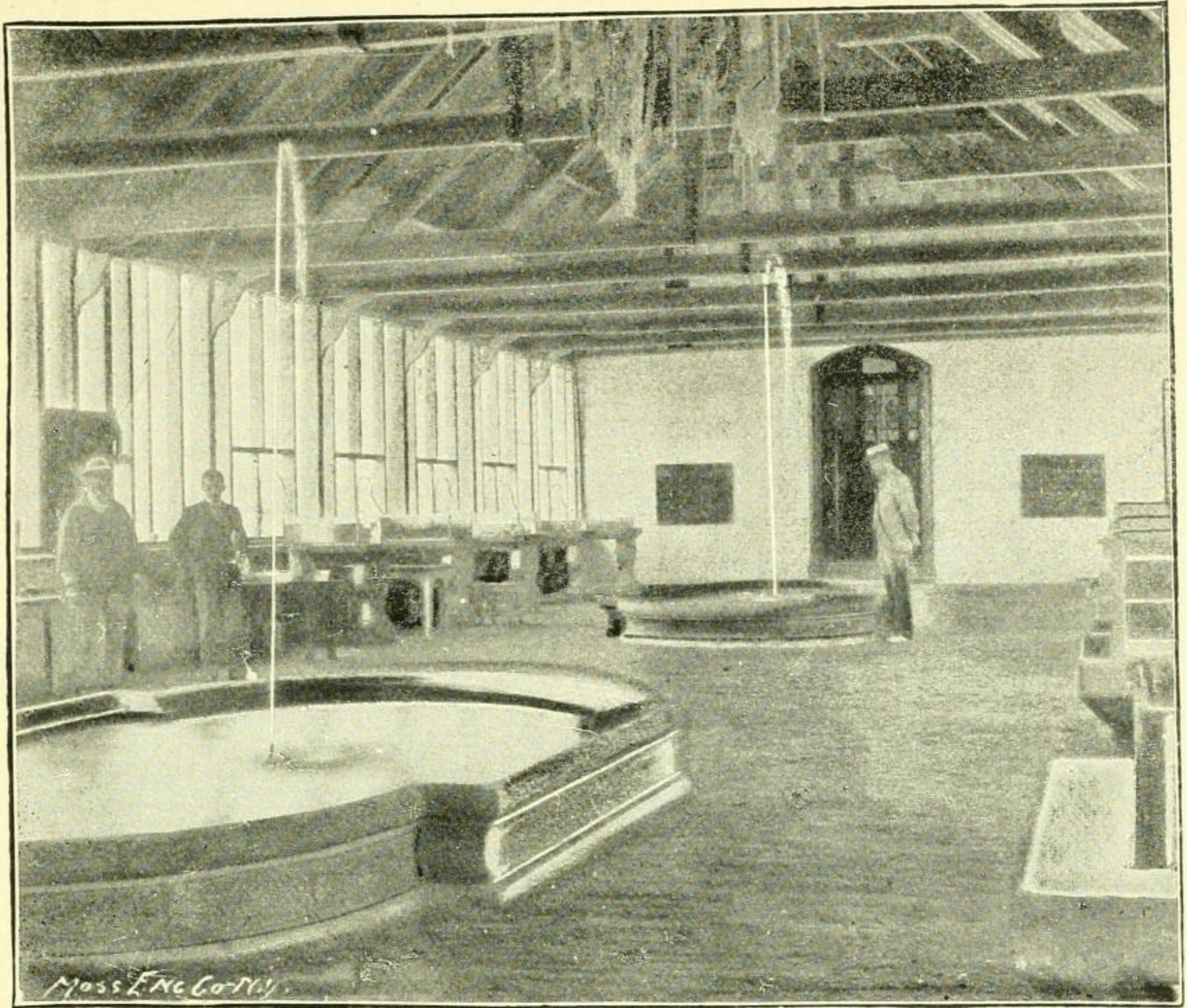
The extended sea-coast has ever been of the greatest aid to the French student. Along the entire northern coast the channel is not unlike our Bay of Fundy in the way it sweeps the waters out at the lunar tides. The rocks on the coast of Brittany, massive boulders, swept and rounded by swift running waters, will at these times become exposed to a depth as great as 40 feet. This is the harvest time of the collector. He is enabled to secure the animals of the deep with his own hand, to take them carefully from the rocky crevices where they would ever have avoided the collecting dredge. From earliest times this region has not unreasonably been the field of the naturalist. It was here that Cuvier, during the Reign of Terror, made his studies on marine invertebrates which were to precede his *Règne Animal*. The extreme westernmost promontories of Brittany have, for the last half century, been the summer homes of de Quatrefages, Coste, Audouin, Milne-Edwards, and de Lacaze-Duthiers. Coste created a laboratory at Concarneau, but this has come to be devoted to practical fish culture, and is, at the present day, of little scientific interest. It is owing to the exertions of Prof. de Lacaze-Duthiers, of the Sorbonne, that the two governmental stations of biology have since been founded. The first was established at Roscoff, in one of the most attractive and favorable collecting regions in Brittany, and has continued to grow in importance for the last twenty years. As this station, however, could be serviceable during summer only, it gave rise to a smaller dependency of the Sorbonne in the southernmost part of France, on the Mediterranean, at Banyuls, which had the additional advantage of a Mediterranean fauna.

To these French stations should be added that of Prof. Giard, at Wimereux, near Boulogne, in the rich collecting funnel of the Straits of Dover; that of Prof. Sabatier, at Cette, not far from Banyuls, a dependency of the University of Montpellier; that of Marseilles, and the Russian station at Ville-Franche, near the Italian frontier. An interesting station, in addition, is that at Arcachon, near Bordeaux, founded by a local scientific society. Smaller stations are not wanting, as at the Sables d'Olonne.

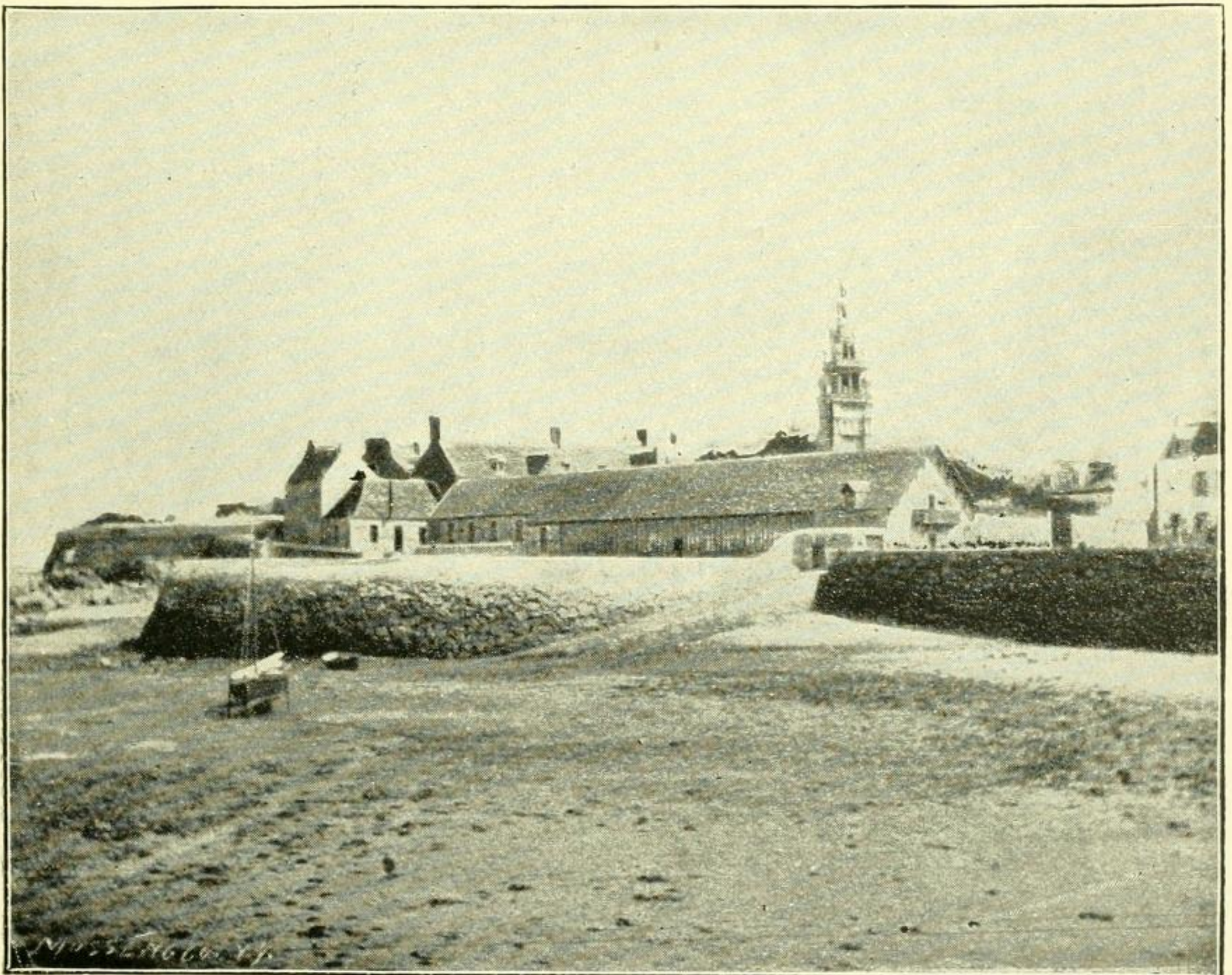
At Roscoff the laboratory building looks directly out upon the channel. (Pl. XXVI.) In its main room, on the ground floor, work places are partitioned off for a dozen investigators; this on the one hand leads to

a large glass-walled aquarium room, seen in the accompanying figure, while on the other opens directly to adjoining buildings, which include lodging quarters, a well-furnished library, and a laboratory for elementary students. Surrounding the building is an attractive garden, which gives one anything but a just idea of the barrenness of the soil of Brittany. From the sea wall of the laboratory one looks out over the rocks that are becoming exposed by the receding tide. A strong inclosure of masonry serves as a *vivier* to be used for experiments as well as to retain water for supplying the laboratory. The students are, in the main, those of the Sorbonne, and under the direction of Dr. Prouho, their *maître de conférences*. They are given every opportunity to take part in the collecting excursions, frequently made in the laboratory's small sailing vessels, among the rocky islands of the neighboring coast. Strangers, too, are not infrequent, and are generously granted every privilege of the French student. Liberality is one of the characteristic features of Roscoff. The stranger who writes to Prof. de Lacaze-Duthiers is accorded a work place which entitles him gratuitously to every privilege of the laboratory—his microscope, his reagents, even his lodging-room should a place be vacant. It seems, in fact, to be a point of pride with Prof. Lacaze that the stranger shall be welcomed to Roscoff, and upon entering the laboratory for the first time, feel entirely at home. He finds his table in order, his microscope awaiting him, and the material for which he had written displayed in stately array in the glass jars and dishes of his work place. So, too, he may have been assigned one of the large aquaria in the glass aquarium room—massive stone-base stands, aerated by a constant jet of sea water. He finds a surprising wealth of material at Roscoff, and his wants are promptly supplied.

At Banyuls (Pl. XXVII), the second station of the Sorbonne, the buildings are less imposing than those of Roscoff. It is a plain, three-story building facing the north, at the edge of the promontory which shelters the harbor at Banyuls. The *vivier* is in front of the station, behind is a reservoir cut in the solid rock, receiving the waters of the Mediterranean and distributing it throughout the building. On the first floor is a large aquarium room lighted by electricity, well supplied with tanks and decorated not a little with statuary donated by the administration of the beaux-arts. The bust of Arago occupies an important place, as the laboratory has been named in his honor. A suit of a diver suggests the different tactics in collecting made necessary by the slightly-falling tides of the Mediterranean. The wealth of living forms in the aquaria shows at once by variety of bright colors the richness of southern fauna. Sea lilies are in profusion, and are gathered at the very steps of the laboratory. The work rooms of the students are on the second floor, equipped in a manner similar to those of Roscoff. The director of this station is Dr. Frédéric Guitel. It is usual during the



ROSCOFF. INTERIOR OF AQUARIUM ROOM. (JULY, 1891.)



FRENCH MARINE STATION AT ROSCOFF.

holidays at fall or winter for the entire classes of the Sorbonne to spend several days in collecting trips in the neighborhood. The region with its little port is famous for its fisheries, and one in especial is that of the angler, *Lophius*, a fish that would not be regarded as especially dainty on our side of the Atlantic.

The station on the Straits of Dover, at Wimereux, has earned a European reputation in the work of Prof. Giard. It is but a small frame building, scarcely large enough to include the advanced students selected from the Sorbonne. The laboratory is, in a way, a rival of Roscoff, and it is noteworthy that its workers seem to make a point of studying the laboratory details of the German universities.

The marine laboratory of Arcachon, one of the oldest of France, was built in 1867 by the local scientific society, and was carried on independently until the time of the losses of the Franco-Prussian war. Its management was then fused with that of the faculty of medicine of Bordeaux, with whose assistance, aided by that of a small subsidy from the Government, the work of the institution was carried on. Arcachon, near Bordeaux, is in itself a most interesting locality. It has become a summering place, noted for its pine lands and the broad, sandy *plage*, picturesque in summer with swarms of quaintly dressed children, the local headdress of the peasant mingling with the latest toilet from Paris. Here and there is to be seen that accompaniment of every French watering place, the goat boy in his smock and berret, fluting to his dozen charges, who walk in a stately way before him. The Bay of Arcachon is a small, tranquil, inland sea, long known for its rich fauna. In large part it is laid out in oyster parks, which constitute to no small degree the source of wealth of the entire region. Shallow and warm waters seem to give the marine life the best conditions for growth and development. The laboratory is placed just at the margin of the water. It includes a dozen or more work-places for investigators, well supplied with aquaria, a library on the second floor, a small museum containing collections of local fauna, including numerous relics of Cetaceans that have found their way into this inland sea. A small aquarium room, opened to the public, is well provided with local forms of fishes, and like that of Naples, is eagerly visited. Those who are entitled freely to the use of the work-places are instructors in French colleges, members of the society, and all the advanced students from the colleges of the State. For other students work-place is given upon the payment of a fee whose amount is regulated each year by the trustees. As at Roscoff, material is plentifully supplied.

The zoological station at Cette is a direct annex of the University of Montpellier, and it will be gladly learned that its temporary building is being replaced by one of stone, which will enable Prof. Sabatier to add in no little way to the working facilities of his students. The region, in every essential regard, is similar to that of Banyuls.

The station at Marseilles is devoted in a great part to questions relat-

ing to the Mediterranean fisheries, and owes, in a measure, its financial support to this practical work.

Villa Franca (Ville-Franche), between Nice and Mentone, is one of the most interesting points of the Riviera. Its laboratory is situated directly on the mole, a large one-storied building of masonry, with a small garden, and with several shops and out-houses. It is supported essentially by Russians, and its description has recently been published by Prof. Alexis Korotneff (Russian text, Cracow), one of whose figures is here reproduced. The station has had as a constant visitor Prof. Carl Vogt, of Geneva, and is well known through the work of Dr. Bolles Lee.

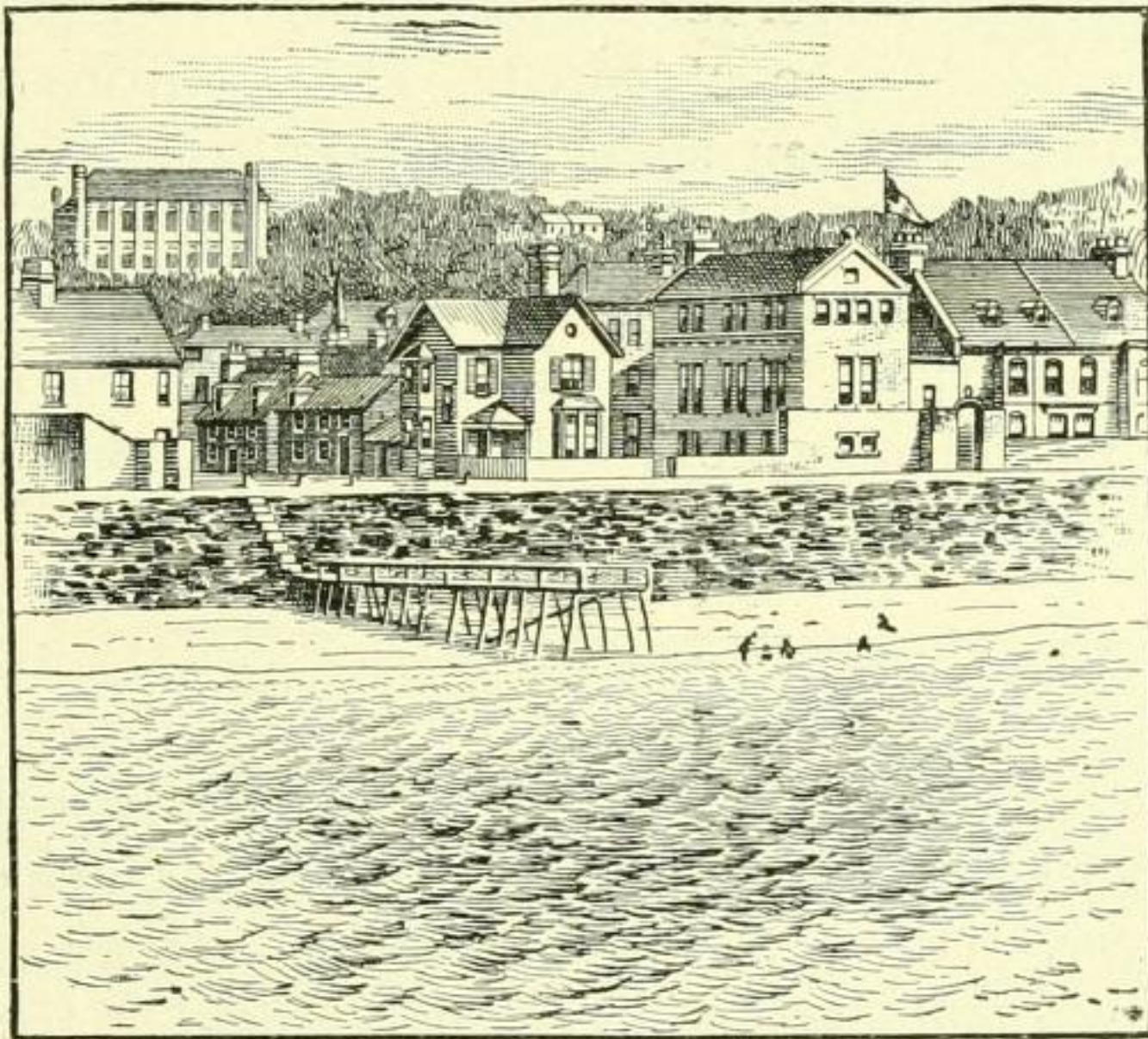
II.—ENGLAND.

The laboratory at Plymouth is quite a recent one, its foundation due in the first instance to the efforts of Prof. Ray Lankester. Its building, first opened in 1888, is, in many regards, hardly second to Naples. This locality was found well suited for the needs of an extensive marine station. Opposite Brittany it takes advantage of the same extremes of tide, and the rocky Devonshire coast affords one of the richest collecting grounds. The situation of the building is a remarkable one; it stands at one end of the ancient Hoe of Plymouth—a broad, level park whose high situation looks far off over the channel. At the rear of the building are the old fortifications of the town. As shown in the illustration (Pl. XXIX, fig. 2), the building is, at the ends, three-storied. On the ground floor is the general aquarium room, well supplied with local marine fauna, and open to the public. The laboratory proper is upon the second floor, divided into eleven compartments, the work places of the students. A series of small tanks passes down the middle of the room. In the western end are the library, the museum, the chemical, photographic, and physiological rooms; in the eastern are the living quarters of the director. The water supply of the laboratory is contained in two small reservoirs directly between the building and the fortifications, and is carried throughout the building by gas engines. Tidal aquaria are in constant use for developmental studies. The collecting for the laboratory is aided by a 38-foot steam launch.

The present support of the station is not, unfortunately, as generous a one as might be desired. The station is obliged to consider in the work of its director matters relating to public fisheries, and is only enabled by this means to secure governmental assistance. The building itself was constructed by the efforts of the Marine Biological Association of the United Kingdom, under whose auspices the present work is being carried on. The investigators' tables are occupied by any founder of the association, or his representative, by the naturalist, or institutions who have rented them. The subscription price per year of an investigator's place is £40, but tables may be leased for as short a time as a month. The laboratory provides material for investigation and the

ordinary apparatus of the marine laboratory, excluding microscopes and accessories. The use of the larger tanks of the main aquarium is also permitted to the working student. The work of the laboratory includes investigation of fishery matters, the preservation of animals to supply the classes of zoology in the universities and the formation of type collections of the British marine fauna. The naturalist of this station has been for a number of years Mr. J. T. Cunningham, whose experiments upon the hatching of the sole have here been carried on.

Other British marine stations are those of Puffin Island, Liverpool, and St. Andrews, northeast, and Dunbar, southeast, of Edinburgh. The work of these stations, it is understood, is only in part purely biological. The practical matters of fisheries must be considered to insure financial support. In addition to these is to be mentioned a station, recently equipped, on the Isle of Man. Still another has recently (the latter months of 1893) been established at Jersey, in the Channel Islands.



Zoological station at St. Hélier, Isle of Jersey.

The foundation of this station has been entirely due to private enterprise, and its management seems both independent and practical. The proprietors, Messrs. Sinel and Hornell, add to the station's revenue by providing alcoholic material for class work, anatomical preparations, serial sections. They also edit and publish an interesting little quarterly, *Journal of Marine Zoology and Microscopy*.

The station will doubtless prove a welcome need to the traveling biologist who finds, at a half day's journey from England, a richer fauna than even Plymouth can offer. It is readily open to investigators upon payment of a small weekly fee. Of the building and its equipment, a brief description might here be given. It is situated east of St. Helier, at a ten-minute's walk from the town, facing the main road, La Collette, overlooking a picturesque and rugged shore. It is but 18 feet above tidal mark, and at low water, especially at lunar tides, is immediately adjacent to a rich collecting ground. Twelve square miles of "zostera prairie" are there exposed, and may be visited

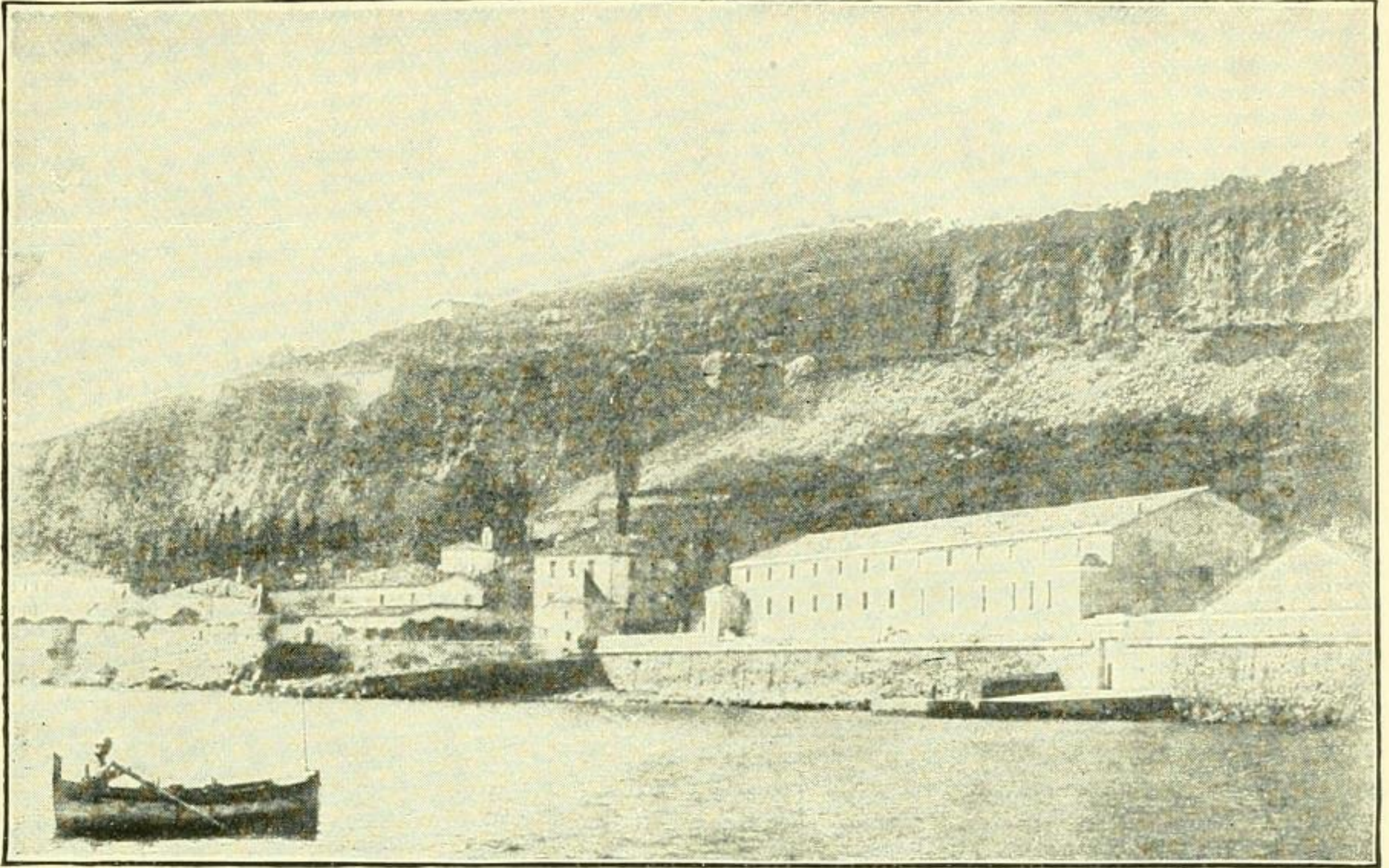
afoot. And the Minquier reefs, of especial biological interest, are but 9 miles to the southward.

The station is a stone building of three stories. The aquarium, on the ground floor, is mainly for purposes of exhibition, its adjoining room serves to receive and assort the collected material. The second story contains the museum and library, serving at the same time as a demonstration hall, and upon the third floor are the partitioned compartments for the use of students and investigators.

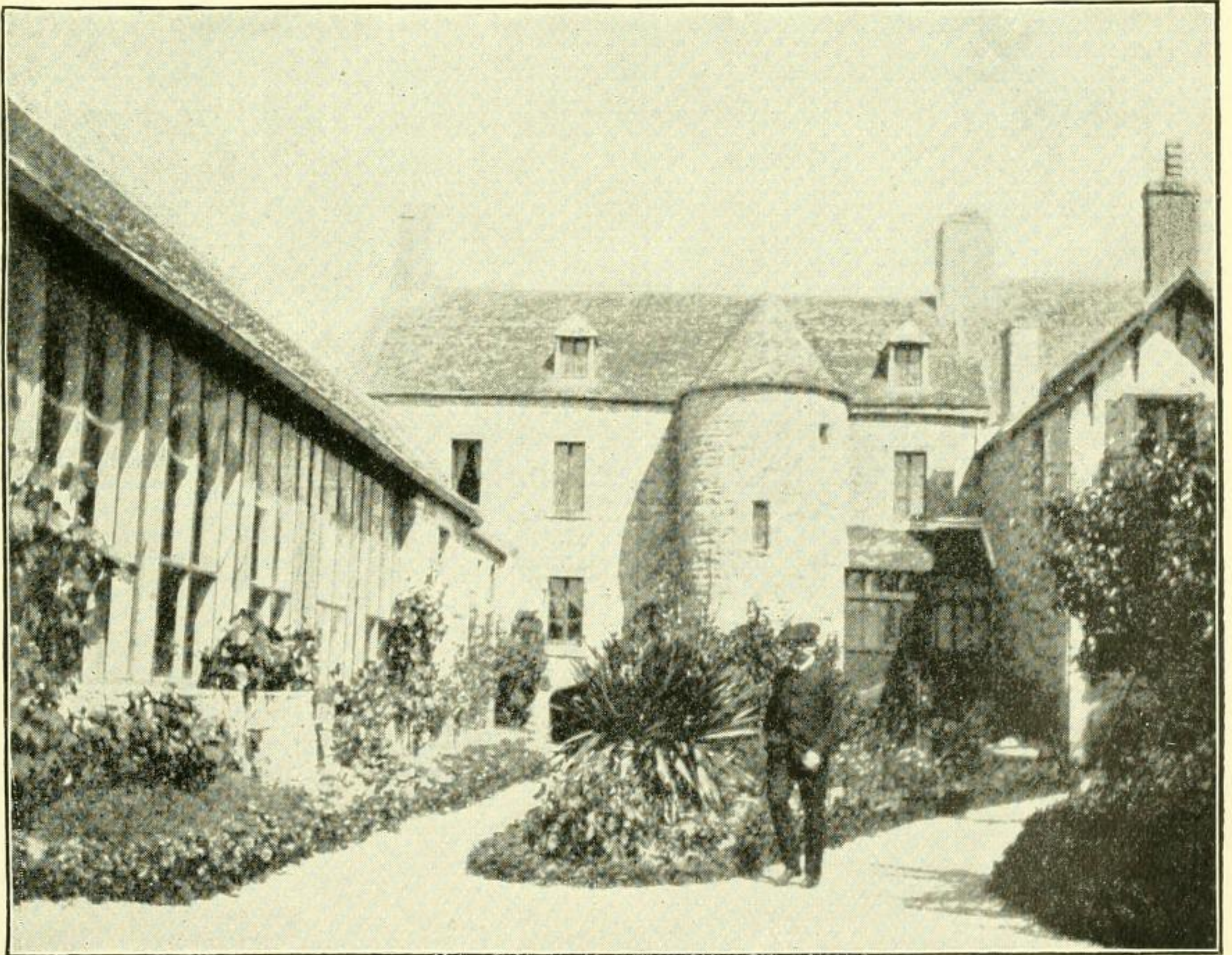
At St. Andrews, Prof. Macintosh has studied the questions relating to the hatching and development of the North Sea fishes. Its situation upon the promontory leading into the Firth of Forth seems to have been especially favorable for the study of the North Sea fauna, notably of larval and embryonic stages of fishes, and the locality, moreover, from its northern position represents a number of boreal forms. The importance of St. Andrews is at length better recognized, and a substantial grant from the Government will enable a large and permanent marine station to be here constructed. The facilities for work have, up to the present time, been somewhat primitive—a simple wooden building, single-storied, has been partitioned off into small rooms, a general laboratory, with work places for half a dozen investigators, a director's room, aquarium, and a small out-lying engine house with storage tanks. To the laboratory belongs a small sailboat to assist in the work of collecting.

III.—HOLLAND.

Holland, in the summer of 1890, opened its zoological station in the Helder, a locality which, for this purpose, had long been looked upon with the greatest favor. (Pl. xxx, fig. 2.) There is here an old town at the mouth of the Zuyder Zee, the naval stronghold of Holland, a station favorable for biological work on account of the rapid-running current renewing the waters of the Zee. The station was founded by the support of the Zoological Society of the Netherlands, whose valuable work by the contributions of Hubrecht, Hoek, and Horst, has long been known in connection with the development of the oyster industry of Holland. The work of the society had formerly been carried on by means of a portable zoological station which the investigators caused to be transplanted to different points along the East Schelde, favorable on account of their nearness to the supplies of spawning oysters. The present station at the Helder is situated directly adjoining the great dike, a small stone building, two story, surrounded by a small park, as seen in the adjacent figure. In itself the laboratory is a model one. The rooms are carefully finished, and every arrangement has been made to secure working conveniences. A large vestibule leads directly into two laboratory rooms and, by a hallway, communicates with the large, well-lighted library and the rooms of the director. The aquarium room has,



RUSSIAN STATION AT VILLE-FRANCHE, FRANCE, NEAR THE ITALIAN FRONTIER.



ROSCOFF, BRITANY. VIEW OF COURT YARD OF BIOLOGICAL STATION.

for convenience, been placed in a small adjacent building. The director of this station is Prof. Hoek, and the president of the society is Prof. Hubrecht.

IV.—NAPLES.

The Stazione Zoologica at Naples during the past twenty years has earned its reputation as the center of marine biological work, publishing in its *Mittheilungen* the results of its researches, and in its *Jahrsberichte* a summary of the year's contributions to biological sciences. It has afforded a locality most favorable for marine research, and has offered every convenience for continued studies; it has been the supply center for living and preserved material for the majority of the European universities; it has published the results of its investigations in its monographs and bulletin in a way that has left little to be desired; the range of its researches has been of the widest and most varied interest, botanical, zoological, developmental, physiological, morphological. Indeed it may strictly be said that within an equal period of time it has contributed more to the advancement of pure biology than has any other institution in the world.

The success of the Naples station has doubtless been aided by the richness of the fauna of the gulf, but is mainly and unquestionably due to its energetic and careful administration. The director of the station, Prof. Dohrn, deserves no little gratitude from every worker in science for his untiring efforts in securing its foundation and systematic management. Partly by his private generosity and partly by the financial support he obtained, the original or eastern building was constructed. Its annual maintenance was next assured by the aid he obtained throughout (mainly) Germany and Austria. By the leasing of work tables to be used by the representatives of universities a sufficient income was maintained to carry on the work of the station most efficiently. A gift by the German Government of a small steam launch added not a little to the collecting facilities.

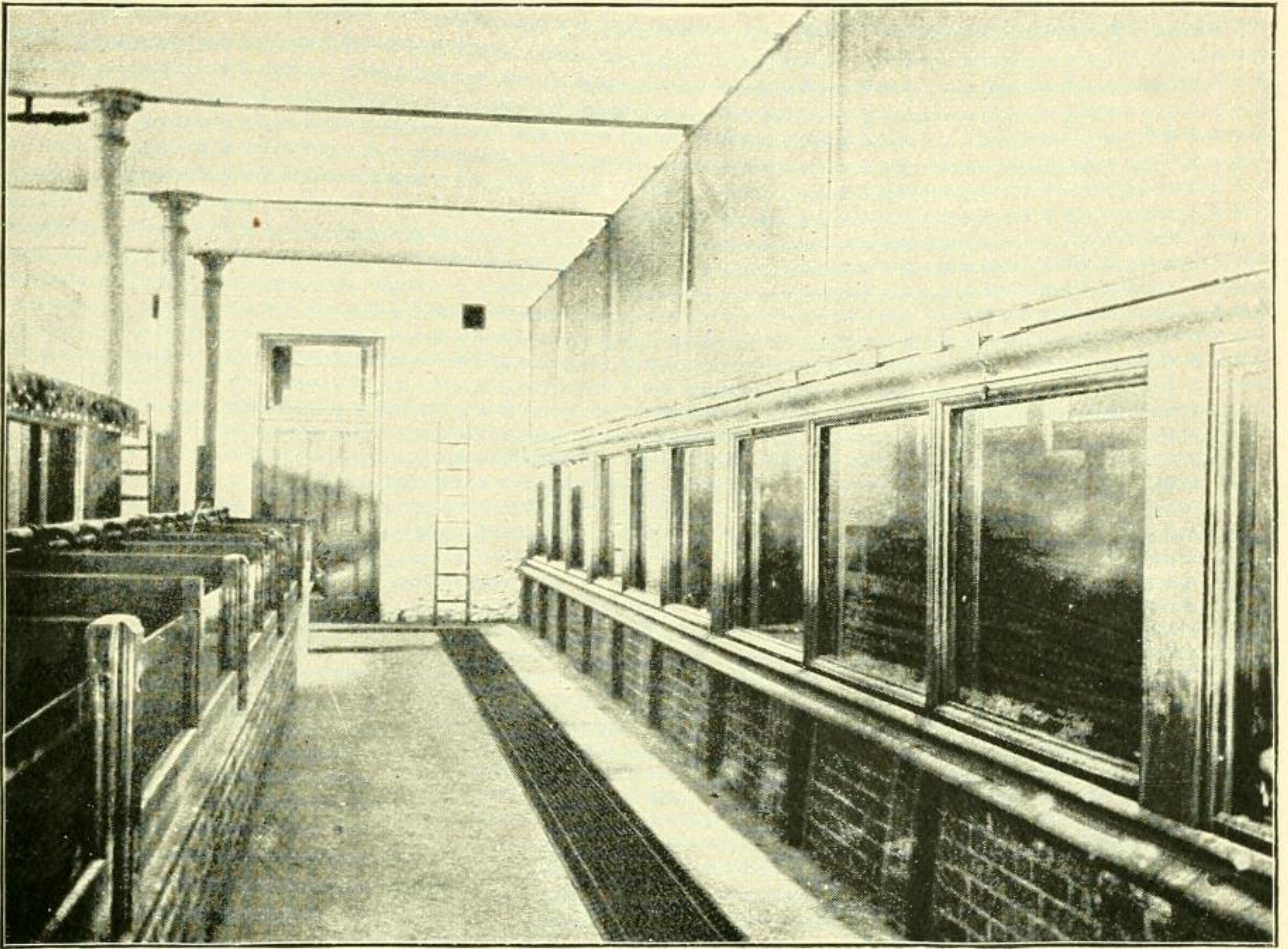
Attractiveness is one of the striking features of the Naples station. It has nothing of the dusty, uncomfortable, gloomy air of the average university laboratory. Its situation is one of the brightest; it has the gulf directly in front, about it the city gardens rich in palm trees and holm oaks. The building itself rises out of beds of century plant and cactus like a white palace; the fashionable driveway alone separates it from the water's edge. In full view is the island of Capri, to the eastward is Vesuvius—a bright and restful picture to one who leaves his work for a five minutes' stroll on the long covered balcony which looks out over the sea.

The student, in fact, knows the Naples station before he visits it, although he can hardly anticipate the busy and profitable stay that there awaits him. He has received the circular from the secretary of

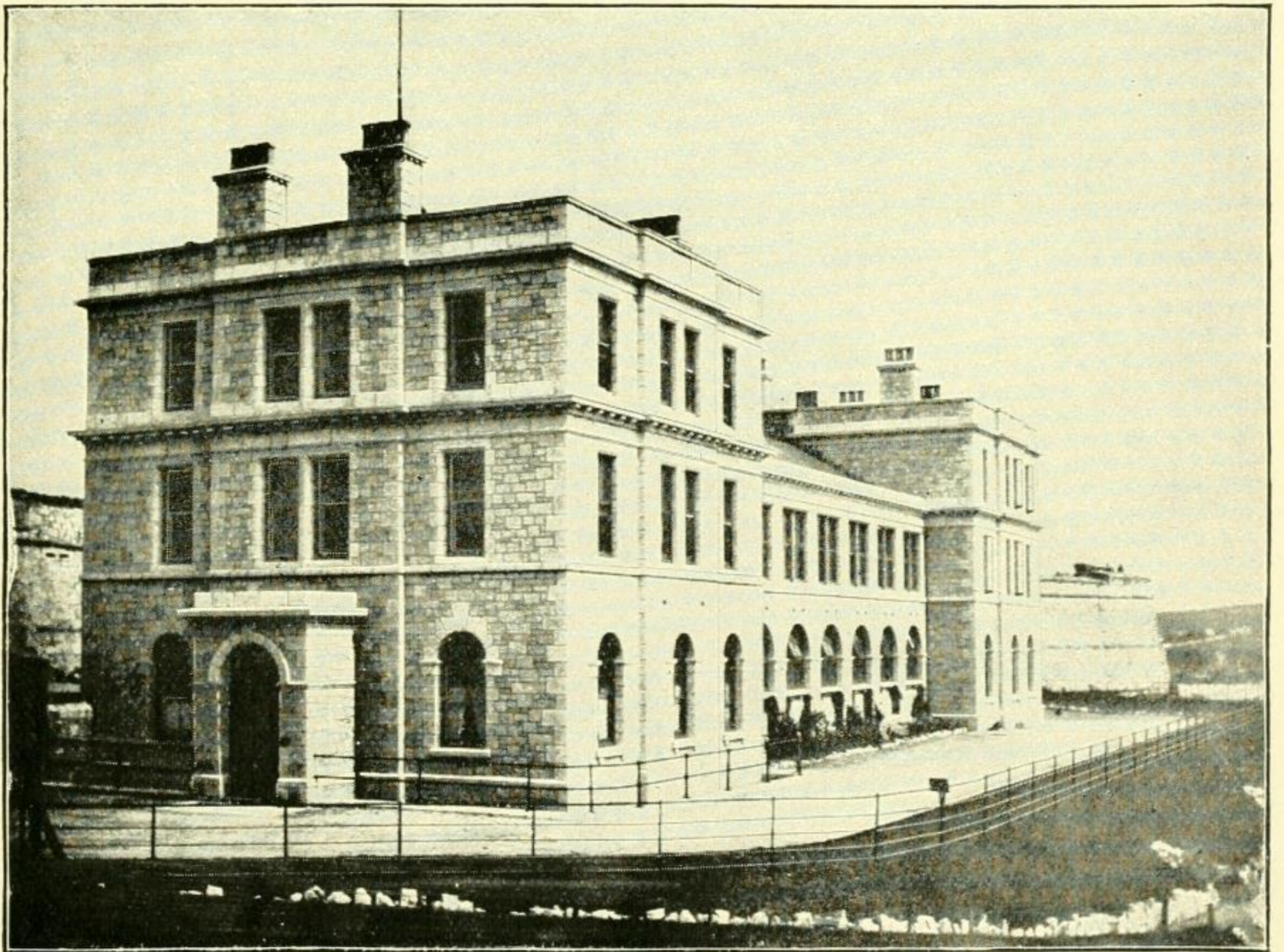
the laboratory while perhaps in Germany, when he secured the privilege of a table. He is told of the best method of reaching Naples, the precautions he must take to secure the safe arrival of his boxes and instruments. He is told to send directions as to the material he desires for study; he is notified of the supplies which will be allowed him, and of the matters of hotels, lodging, and banking, necessary even to a biologist. At the first sight of the building he is impressed most favorably, and it is not long before he comes to look upon his work-place as his particular home, open to him day, night, and holiday. He likes the general air of quietness—in no little way significant of system in every branch of the station's organization; his neighbors are friendly, and he feels that even the attendants are willing, often anxious to give him help.

At present the station at Naples consists of two buildings, the first, shown in the foreground in the accompanying illustration (Pl. XXXI), is the older, the main building; behind it is the newly built physiological laboratory. In the basement of the main building is the aquarium, well managed, open to the public, and eagerly visited. Passing into the aquarium room from the main entrance, one descends into a long, dark, concreted room, lighted only through wall tanks brilliant on every side with varied forms of life. There are in all about two dozen large aquaria embedded in the walls of the sides and of the main partition of the room. The water is clear and blue. The background in each aquaria, built of rock work, catches the light from above and throws in clear relief the living inmates. The first tank will perhaps be full of starfish and sea urchins, bright in color, often clustered on the glass each with a dim halo of pale, thread-like feet. In the background may be a living clump of crinoids, flowering out like a garden of bright-colored lilies.

In a neighboring tank, rich with dark-colored seaweeds, will be a group of flying gurnards, reddish and brilliantly spotted, feeling cautiously along the bottom with the finger-like rays of their wing-shaped fins. Here, too, may be squids, delicate and fish-like, swimming timidly up and down; perhaps a series of huge triton snails below amid clustered eggs of cuttlefish. In another tank would be a bank of sea anemones with all the large and brilliant forms common to southern waters. Here may be corals in the background and a forest of sea fans in orange, red, and yellow, with a precious fringe of pink coral, flowering out in yellow star-like polyps. There may again be a host of ascidians, delicate, transparent, solitary forms, the lanky *Ciona*, the brilliantly crimson *Cynthia*, and huge masses of varied, compound forms. Swimming in the water may be chains of *Salpa* and occasionally a number of *Amphioxus*; the latter, as they from time to time emerge from the sandy bottom, flurry about as if with sudden fright, quickly to disappear. Variety is one of the striking characters of neighboring tanks. In one, brilliant forms will outvie the colors of their neighbors; in another, the



PLYMOUTH. INTERIOR OF AQUARIUM ROOM.



BRITISH MARINE LABORATORY, PLYMOUTH. (AUGUST, 1892.)

least obtrusive mimicry will be exemplified. The stranger has often to examine carefully before, in the seemingly empty tank, he can determine on every side the living forms whose color characters screen them effectively. Thus he will see sand-colored rays and flounders, the upturned eyes of the curious star-gazer almost buried in the sand, a series of mottled crustaceans wedged in a rocky background, an occasional crab wandering cautiously about, carrying a protective garden of seaweeds on his broad back; odd sea horses posing motionless mimicking the rough stems of the seaweeds. In the larger tank sea turtles float sluggishly about; and coiled amid broken earthen jars are the sharp-jawed murrays, suggestive of Roman dinners and of the cultural experiments of Pollio. Aëration in the aquaria is secured effectively by streams of air which are forced in at the water surface and subdivide into bright clouds of minute silvery bubbles. The tanks are cared for from the rear passageways; attendants are never seen by visitors, and constant attention has given the aquaria a well-earned reputation. Well-illustrated catalogues in French, German, English, and Italian enable the stranger to be better appreciate the aquarium.

To the remainder of the building strangers are not admitted. A marble stairway leads from the door of the aquarium to a loggia which opens into the territory of the students. A long pathway of grating extends across the open center of the building—whose skylight top admits the light to the aquarium below. On the one hand is the main laboratory room, on the other the library and separate rooms intended for more fortunate investigators. One enters the main laboratory, passes a wall of student aquaria, and sees a series of alcoves formed by low partitions, each work-place with its occupant, his apparatus, his books, his jars—altogether often a picture not of the utmost tidiness. A small iron staircase leads to a gallery, which gives a second tier of work-places and doubles the working capacity of the room. Here, side by side, will be representative workers from universities of every country of Europe.

The library room adds not a little to the attractiveness of the Naples station. (Pl. XXXI, fig. 1.) It is a long room, and, as shown in the figure, is adorned with frescoes in a truly Italian style. It looks out into a long *loggia* with view of the sea and Capri, where the student is wont to retire in after luncheon hour with easy chair and book. The working library is of the best, and is sure to contain the results of the most recent researches. The desk shown in the figure is one on which each day is to be found the latest publications. In the upper pigeon holes are the cards prepared for each investigator on his advent to Naples; with these he replaces the volumes which he has taken to his work place. Every division of the laboratory is carefully organized, and is under the charge of a special assistant. Prof. Hugo Eisig, the assistant director, has taken the welfare of each student under his personal

charge, and it is not until the end of his stay that the visitor recognizes how much has been done for him.

There is no more interesting department of the station than that of receiving and distributing the material. Its headquarters is in the basement of the physiological laboratory, and here Cav. Lo Bianco is to be found busy with his aids and attendants amid a confusion of pans, dishes, and tables, encountering the Neapolitan fishermen who have learned to bring all of their rarities to the station. The specimens are quickly assorted by the attendants; such as may not be needed for the immediate use of the investigators are retained and prepared for shipment to the universities throughout Europe. The methods of killing and preserving marine forms have been made a most careful study by Lo Bianco, and his preparations have gained him a world-wide reputation. Delicate jelly-fish are to be preserved distended, and the frail forms of almost every group have been successfully fixed. The methods of the Naples station were kept secret only until it was possible to verify and improve them, as it was not deemed desirable to have them given out in a scattered way by a number of investigators.

Lo Bianco has made the best use of the rich material passing daily through his department, and has been enabled to prepare the most valuable records as to spawning seasons and as to larval conditions. He knows the exact station of the rarest species, and it seems to the stranger a difficult matter to ask for a form which can not be directly or indirectly procured. It adds no little to the time saving of the student to find each morning at his work place the fresh material which he has ordered the day before, often in embarrassment rather than dearth of riches.

A collecting trip often occurs as a pleasant change from the indoor work of the investigator. An excursion to Capri may be planned; the launch will be brought to the quay near the station, and the party will embark. The collecting tubs are soon scattered over the deck, and filled with the dredge contents. Some of the passengers are quickly at work sorting out their material, one seizing brachiopods, another compound ascidians, another sponges. Others will wait until the surface nets have been brought in and the contents turned into jars. All will depend upon Lo Bianco as an appellate judge in matters of identification.

Many Americans have availed themselves of the privileges of Naples, and the former lack of support of an American table needs little comment. Of those who have hitherto visited Naples more than three-quarters have been indebted to the courtesies of German universities. At present, of the two American tables one is supported by the Smithsonian Institution, the other by gift of Mr. Agassiz.

The entire Italian coast is so rich in its fauna that it is due perhaps only to the greatness of Naples that so few stations have been founded. Messina has its interesting laboratory well known in the work of its

director, Prof. Kleinenberg. The Adriatic, especially favorable for collecting, has at Istria a small station on the Dalmatian coast, and at Trieste is the Austrian station.

V.—TRIESTE.

Trieste possesses one of the oldest and most honored of marine observatories, although its station is but small in comparison with that of Naples, Plymouth, or Roscoff. Its work has in no small way been limited by scanty income; it has offered the investigator fewer advantages and has therefore become outrivalled. During the greater part of the year it is but little more than the supply station of the University of Vienna, providing fresh material for the students of Prof. Claus. Its percentage of foreign investigators appears small; its visitors are usually from Vienna and of its university.

Trieste is, in itself, a small but busy city, growing in active commerce. Its quays are massive and bristle with odd-shaped shipping of the eastern Mediterranean. Its deep and basin-like harbor affords a collecting ground as rich as the Gulf of Naples.

The station has been located at a quiet corner of the harbor, just beyond the edge of the light-house. (Pl. XXXII, fig. 2.) Its building is somewhat chalet-like, situated on a small, well-wooded knoll, as seen in the adjacent figure. About it are trellis-covered grounds inclosed by high walls, and separated from the harbor only by the main roadway of the quays. One enters the laboratory garden through a large gateway and passes into a courtyard whose outhouses disclose the pails and nets of the marine laboratory. Perhaps an attendant will here be sorting out the rarities which a bronze-legged fisherman has just brought in.

A library and the rooms of the director, Dr. Graeffe, are close by the entrance of the building. In the basement is the aquarium room—somewhat dark and cellar-like; its tanks small and shallow, their inmates representing especially stages of Adriatic hydroids and anthozoans. On the second story are the investigator's rooms—large, well lighted, looking out over garden and sea. Near by is a museum of local fauna, rich in crustaceans and in the larval stages of Adriatic fishes.

VI-IX.—GERMANY, NORWAY, SWEDEN, RUSSIA.

The German universities have contributed to such a degree to the building up of the station at Naples that they have hitherto been little able to avail themselves of the more convenient but less-favorable region of German coasts. The collecting resources of the North Sea and of the Baltic have perhaps been not sufficiently rich to warrant the establishment of a central station. On the side of the Baltic, the University of Kiel, directly on the coast, may itself be regarded as a marine station. At present the interest in founding local marine laboratories has, however, become stronger. The newly acquired Heligoland has become

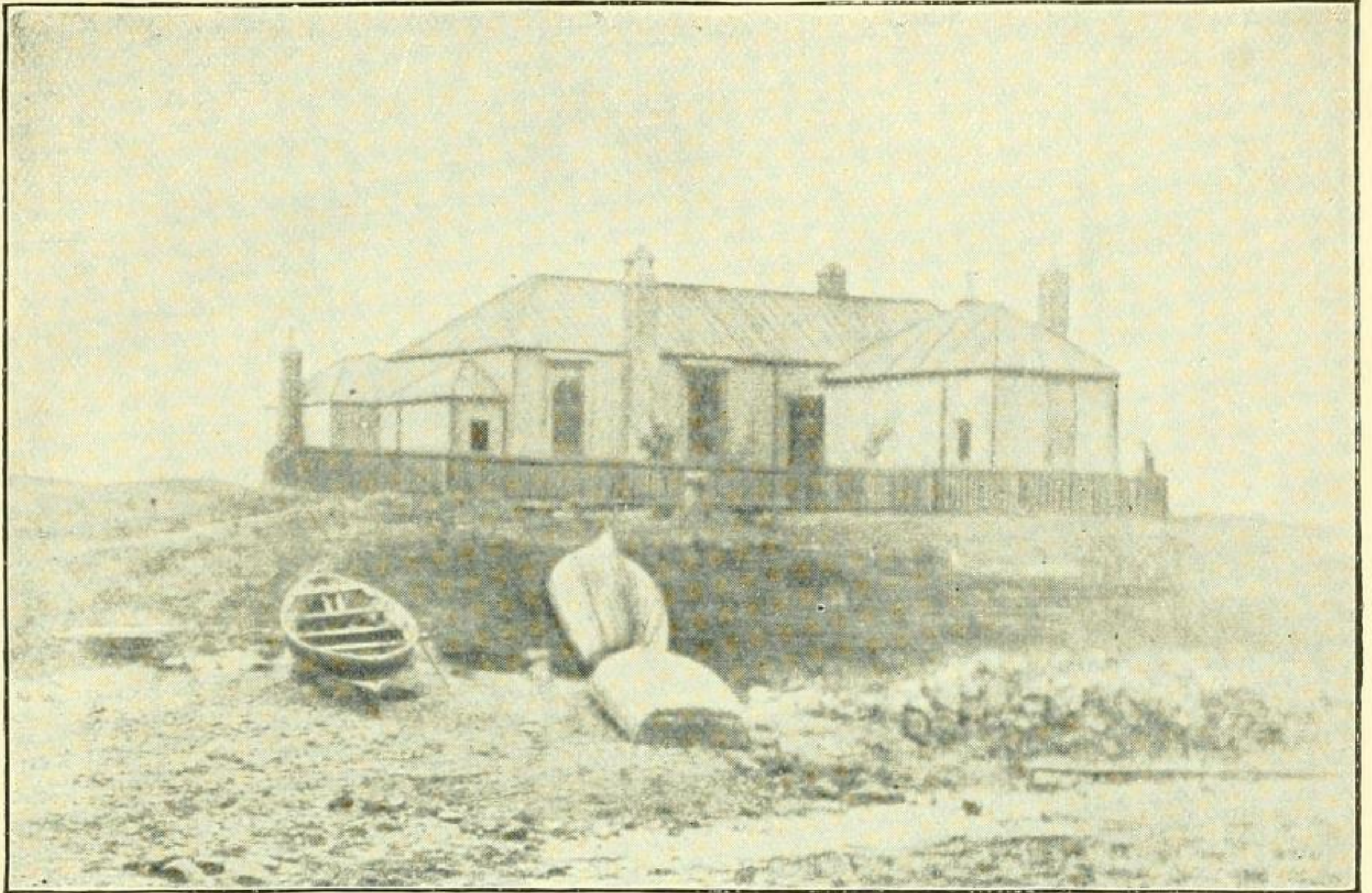
the seat of a well-equipped governmental station. (Plate XXXIII.) The island has been long known as most favorable in collecting regions, and its position in the midst of the North Sea fisheries gives it especial importance. Its present building is three-storied, of stone, situated near the water in the small town on the Jutland side of the island. As yet the station has not to compete with its larger rivals, but its work has been so designed on the sides of pure biology, botany, and practical fisheries, that its growth seems an assured and speedy one. Work-places are provided for four investigators. Its director is Dr. F. Heinke; his assistants, Drs. Hartlaub, Ehrenbaum, and Kuckuck.

The Istrian laboratory at Rovingo, a favorable collecting point on the Adriatic, is to be included among the German stations. It was destined by Dr. Hermes, its founder, as the supply depot of the Berlin aquarium. Of its work-places, two have been rented by the Prussian Government, and a third is at the disposal of Dr. Hermes.

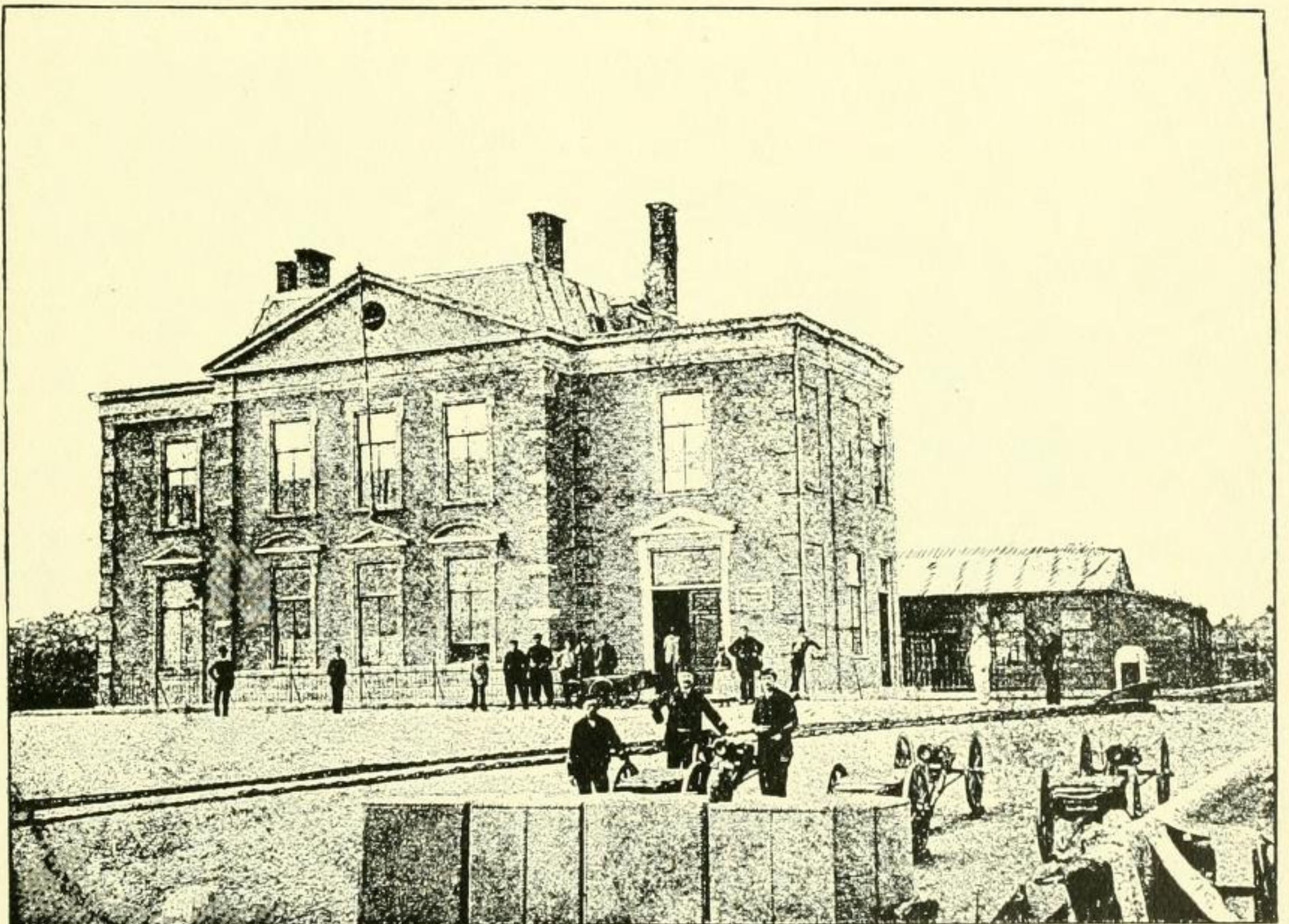
Germany, however, is *facile princeps* in its active aid in the promotion of fresh water stations; that situated on the margin of the lake of Plön, in Holstein, near the Baltic, deserves, even in this connection, a passing notice. Its building and equipment are certainly as complete as of the best class of marine laboratories (Pl. XXXIV); its management is an entirely similar one, and its director, Dr. Otto Zacharias, has given it every care to make its success permanent and increasing. The publication of its *Forschungsberichte* has already given it a prominent place among the stations of biological research.

Norway, like Germany, is strengthening its interest in local marine laboratories. Two permanent stations have quite recently been established, one at Bergen, the other at Dröbak, a dozen miles south of Christiana. The former is the larger, a dependency of the museum of Bergen. It is under the charge of Dr. Brunchorst, to whom its foundation is due, and Drs. Appellöf and Hansen. Its two-storied villa-like building provides work places for eight investigators. A well-maintained aquarium on the first floor is open to the public. The second and smaller station is devoted almost exclusively to research in morphology. It is a dependency of the University of Christiana and is under the directorship of one of its professors, Dr. Johan Hjort. With the richest collecting resources these new stations may naturally be expected to yield most important results.

The Swedish station has long been associated with the work of its late director, Prof. Loven. It is situated on the west coast near the city of Gothenburg. Its three original buildings, a laboratory and two dwelling houses, were constructed about fifteen years ago by a gift of Dr. Regnell, of Stockholm. The laboratory is a wooden building well furnished with aquaria, provided in its second story with separate work-places for investigators. It is at present maintained by governmental subsidy. Its recently appointed director is Dr. Hjalmar Theel, of the State Museum at Stockholm. Its students are mainly from the Uni-

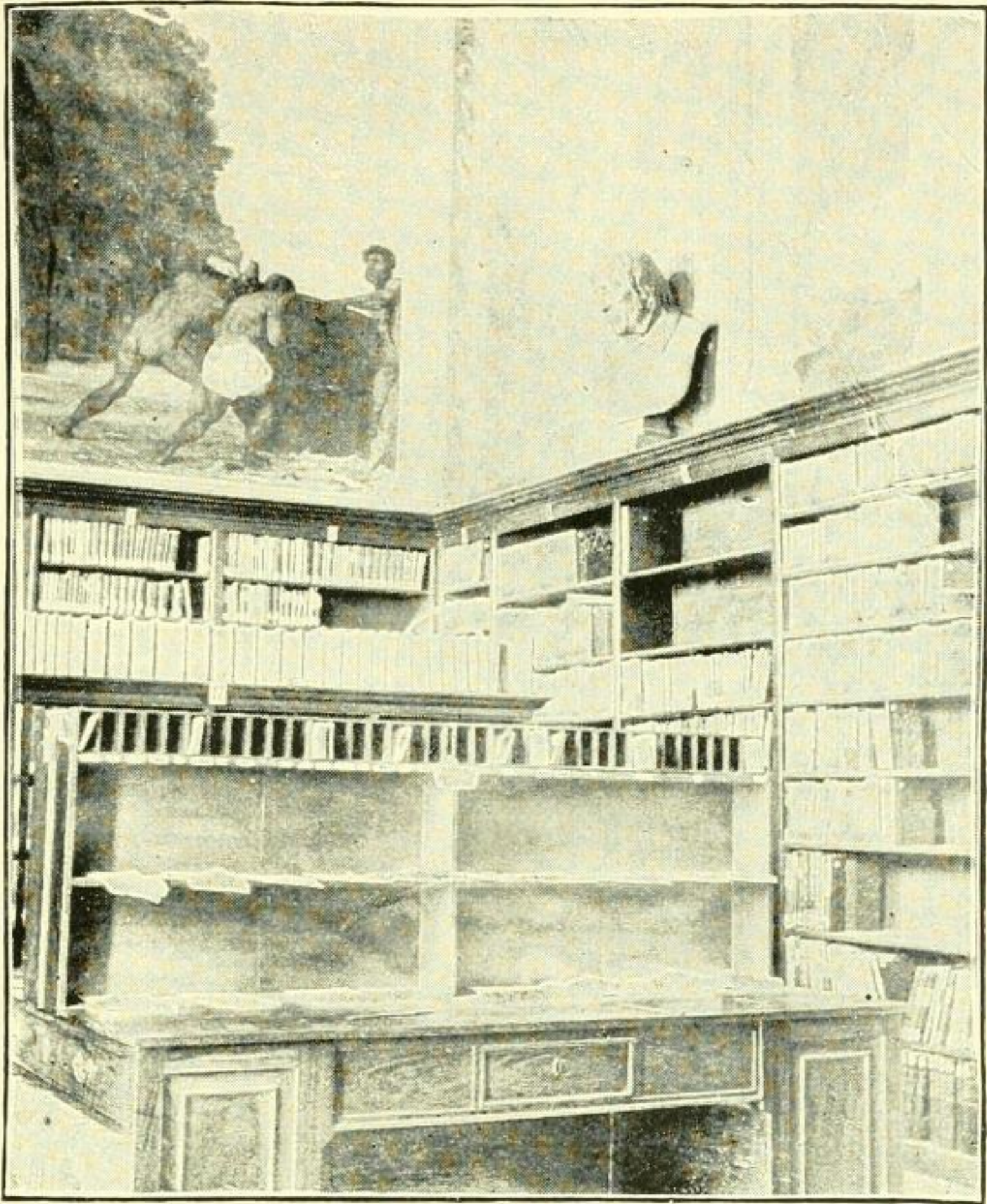


ZOOLOGICAL STATION AT ST. ANDREWS, SCOTLAND.

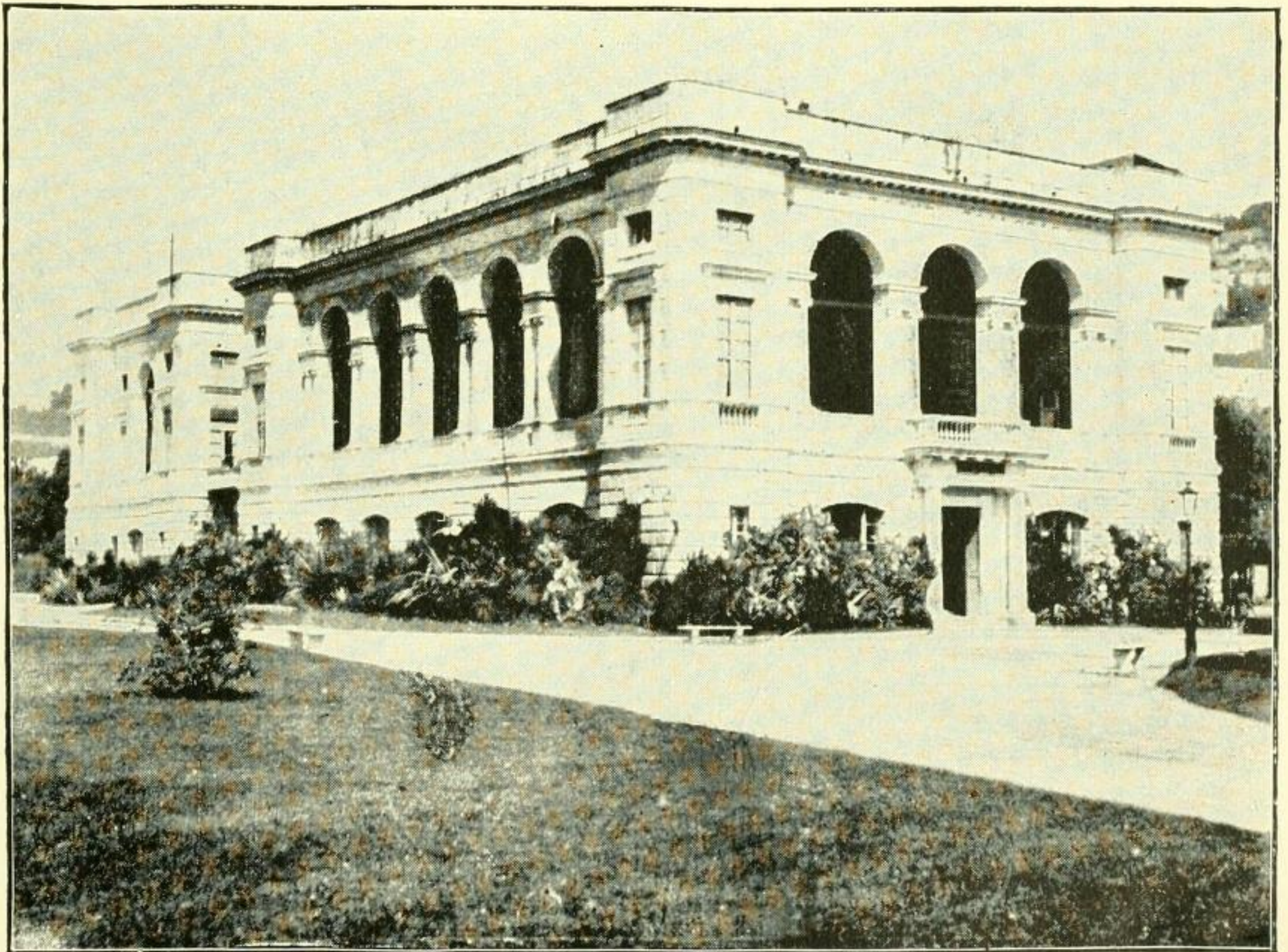


DUTCH ZOOLOGICAL STATION AT THE HELDER.
Figure from Tijdschr. d. Ned. Dierk. Vereen, 5 Juli, 1890.

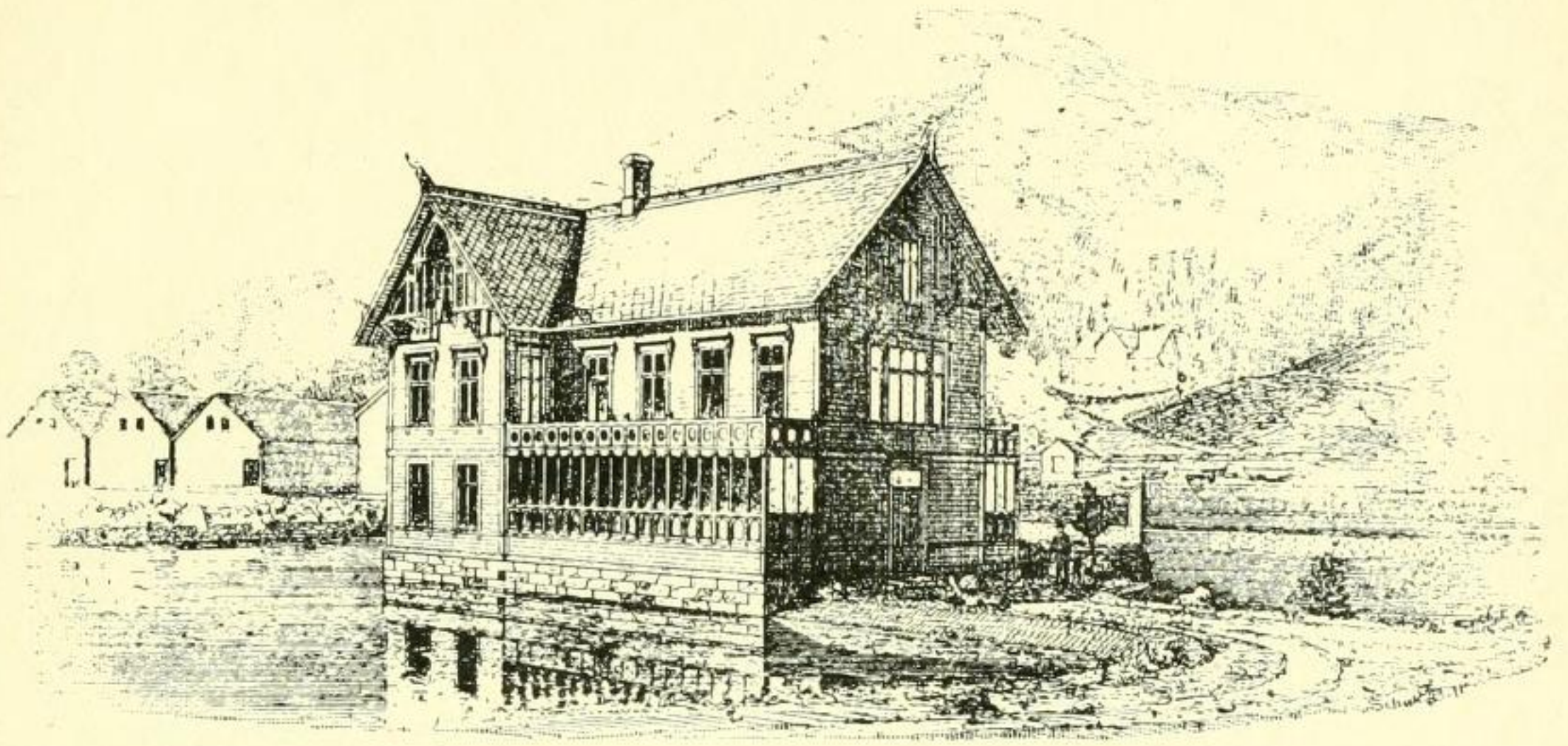




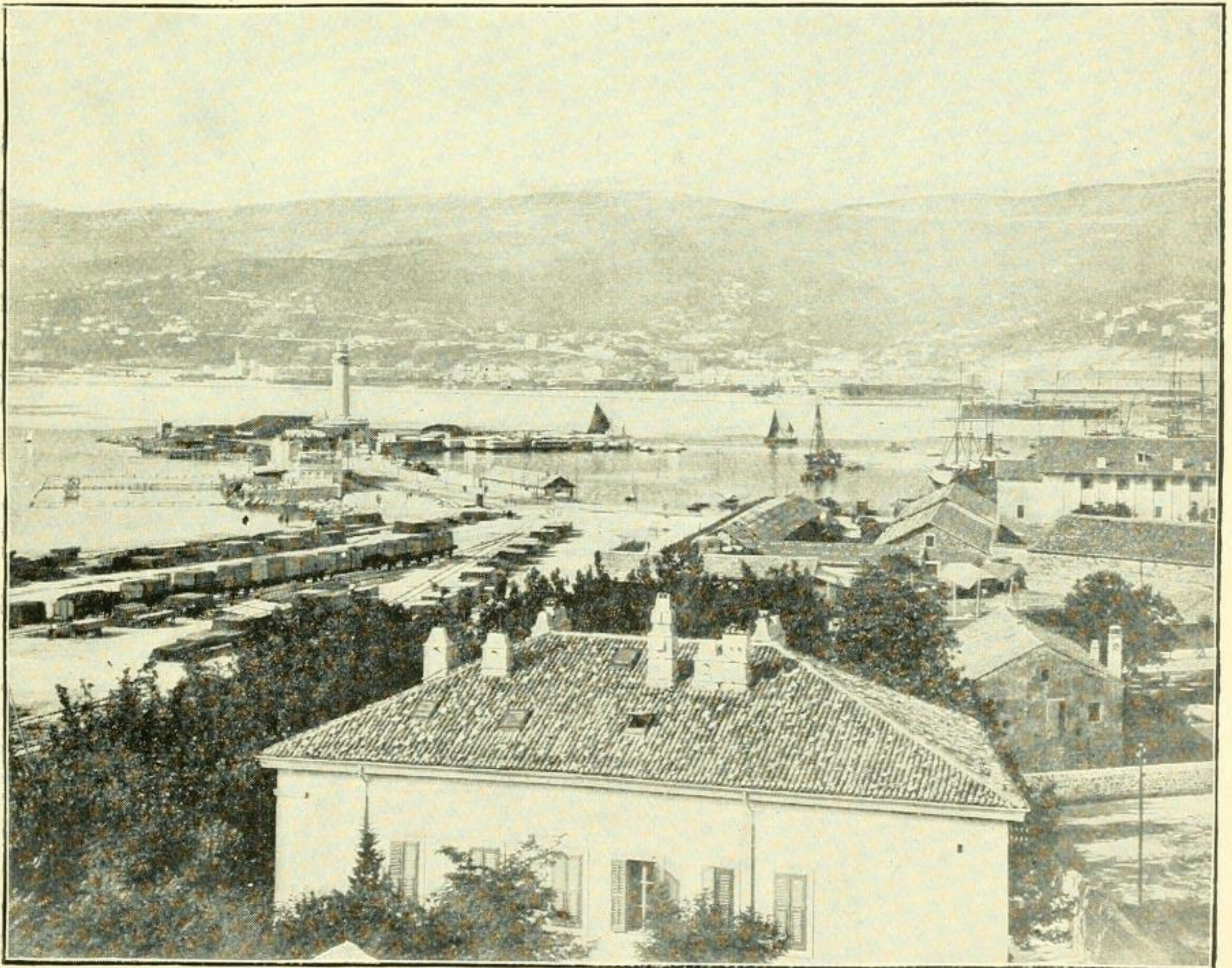
THE LIBRARY OF THE NAPLES STATION. (JUNE, 1892.)



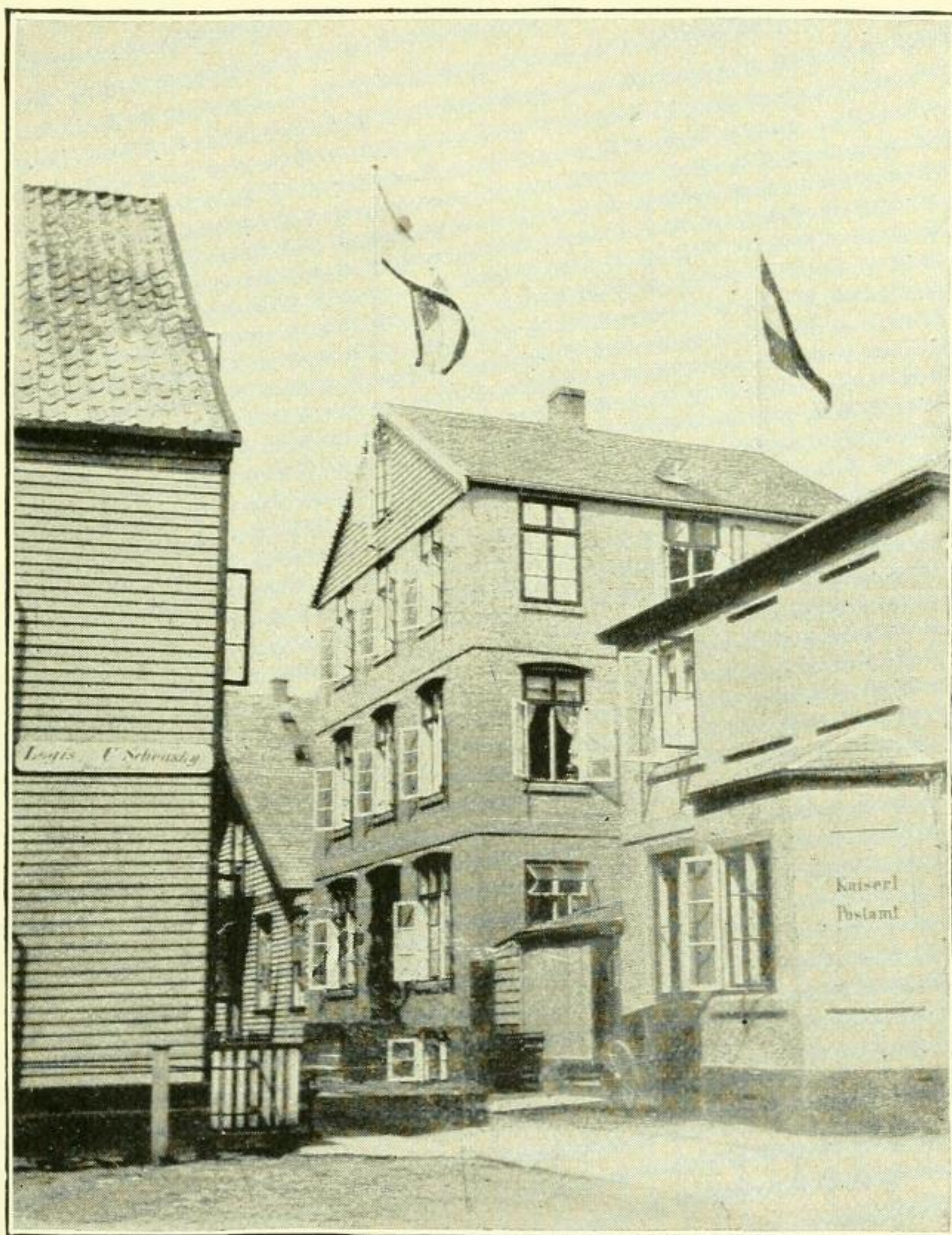
THE ZOOLOGICAL STATION AT NAPLES. (MAY, 1892.)



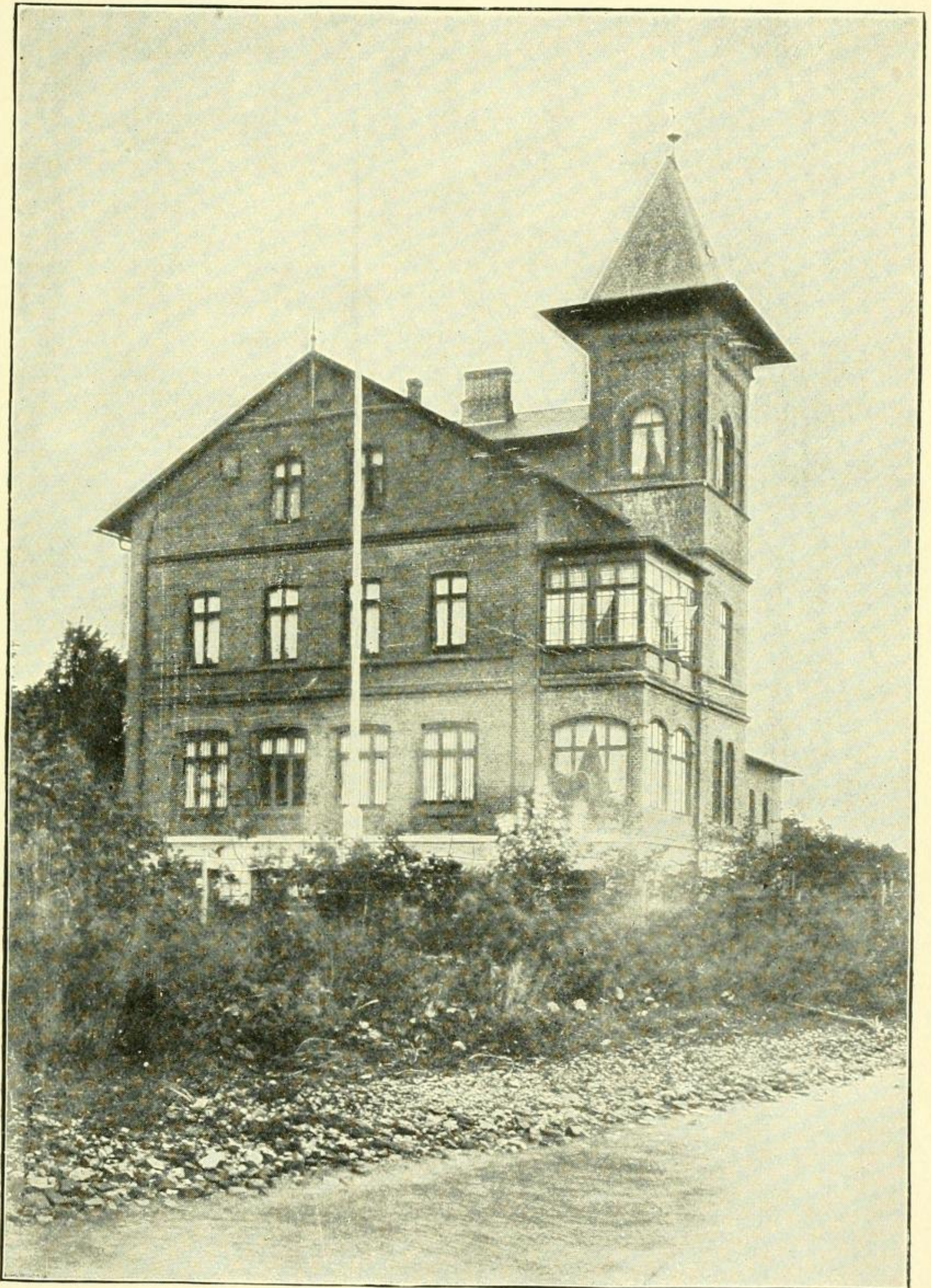
BIOLOGICAL STATION AT BERGEN, NORWAY.



THE STATION AT TRIESTE.



THE STATION AT HELIGOLAND.



BIOLOGICAL STATION ON LAKE OF PLÖN (HOLSTEIN) NEAR KIEL.

versity of Upsala. Up to the present time foreigners have not been admitted.

Russians have ever been most enthusiastic in marine research, and their investigators are to be found in nearly every marine station of Europe. The French laboratory on the Mediterranean at Ville-Franche is essentially supported by Russians. At Naples they are often next in numbers to the Germans and Austrians. The learned societies of Moscow and St. Petersburg have contributed in no little way to marine research. The station at Sebastopol, on the Black Sea, has become permanent, possessing an assured income. That near the Convent Solovetsky, on the White Sea, though small, is of marked importance. It is already in its thirteenth year. Prof. Wagner, of St. Petersburg, has been its most earnest promoter as well as constant visitor. He, in fact, caused the superior of the convent to become interested in its work and secured a permanent building by the convent's grant; he was then enabled by an appropriation from the Government to provide an equipment and is now agitating the matter of the appointment of a permanent director. The annual maintenance of the station is due to the Society of Naturalists of St. Petersburg. Solovetskaia is said to possess the richest collecting region of the Russian coasts. Its laboratory is certainly the only one which has at its command a truly Arctic fauna.

