THE ZOÖLOGICAL STATION AT NAPLES.

STRETCHING along the water-front of the city of Naples are the beautiful gardens of the Villa Nazionale, a drive only separating them from the water's edge. In the afternoon this drive is the favorite resort of the gay world of Naples, and on fine days, between three and five, an observer from the gardens sees an unbroken procession of carriages rolling past, towards or from Posilippo. This afternoon whirl is a strong contrast to the morning quiet, when for hours together one often hears nothing but the surf breaking on the shore, unless the sirocco is blowing, and then the tumultuous voice of the sea lasts all the day long, as the great waves sweep in from the south, flinging themselves high above the sea-wall and scattering their spray over the road.

In these gardens, surrounded by flowers and fountains and statuary, is a large, imposing edifice often mistaken for a palace; and, indeed, rarely have palaces so fine a site. But, if you approach from the east, you soon see in large letters on its front, "*Stazione Zoologica.*"

To Neapolitans generally, as well as foreigners, there is something mysterious about this building; for of its dozens of rooms and its different stories there is only one room to which the public is admitted, and this is dimly lighted and lined with wonders, suggesting greater wonders above and below. This is the celebrated aquarium, which has nowhere its equal. On entering, the general darkness is relieved only by the light streaming through and illuminating the aquaria; bringing out in the most effective manner the gorgeous coloring of the various living creatures within, and producing the effect of a darkened theater, with its brilliantly lighted stage.

In one of the tanks several monstrous octopi, or devil-fish, are writhing their two yards of boneless arms upon the wall of glass, showing to good advantage those frightful suckers, which without any effort hold in a death-grip their unlucky prey. Numbers of others seem to be asleep on the rocks and under little caverns, but when feeding-time comes and the crabs appear, what a fearful waking up! They come in numbers from unseen quarters, and the very rocks seem turned into octopi, for, being much of the same color, when quiet they cannot easily be distinguished. Whether or not the humane keeper has killed or stunned the crabs, they make no resistance as the fatal arms noiselessly fold about them, but the struggle is fierce between the octopi themselves. Into another tank, from some unseen quarter, is sent a long stick, waking up from their quiet a number of cuttle-fish. For some minutes they flee from the pursuing stick, but becoming impatient and perhaps frightened, they make use of their ink-bag, and instantly what seems like clouds of dense smoke curling through the water hides them from sight.

Passing on to the other tanks, we come to the worms, which are a revelation of beauty, instead of being the object of loathing we have been accustomed to consider them. Some of them, standing up in their stem-like tubes, spread abroad their beautiful many-colored tentacles like the petals of flowers.

In a corner of one tank carpeted by a luxuriant and brilliantly tinted growth of flower-like animal life arises quite a grove of worms, resembling in miniature the palm-trees in the garden outside. The worm constructs a perpendicular tube for itself, which looks like a tall, straight, rugged pine trunk, at the top of which branch out the leaf-like tentacles, giving the effect of bright bushy foliage. The tentacles sway about in the water, much like branches moved by the wind, and in this way they sweep any morsel of food floating by to the mouth which the tentacles encircle. Flitting in and out through this curious animal grove, or resting on some brilliant animal slope, or perching on tiny rocks and precipices, may be seen a variety of strange and often most graceful creatures.

This morning, on their way from lunch, six of the *gelehrte* of the Station, who had passed into the aquarium to see what was new, might have been found standing for a long time at this spot. Three of them were watching the fantastic sea-horses. One of these curious creatures had stationed itself close under the expanded tentacles of an annelid, which suddenly contracted and drew itself, tentacles and all, far down the tube out of sight. The seeming astonishment of the hippocampus was highly amusing. It soon, however, seemed to recover itself, and came around peering with its nose into the tube down which the worm had disappeared. The animal was sufficiently interesting to hold our attention for a long time.

It is impossible even to enumerate the vast numbers of animals in the aquaria. The great hall of two hundred and sixty square meters is lined on three sides apparently by arms of

the sea, in the waters of which thousands of creatures are multiplying and living out their natural existence among the rocks and seaweed, and in half-hidden caverns closely resembling their native submarine haunts. From the graceful ethereal ctenophores and siphonophores reflecting all the colors of the rainbow, all varieties and classes of marine animals are to be seen, up to the gigantic turtles and anthropophagous sharks. The variety of fish is very great, and they are of all sizes and beautiful variegated hues, glistening like burnished silver and gold. How they seem to delight in existence! The pessimist would do well to stand for a time and mark their evident satisfaction and comfort,—more than that, their active joy as they gambol and play. While looking on here, life seems indeed a good thing.

Besides the tanks lining the walls of the aquarium, there are others running through the middle of the room, and lining the central court of the building. They number thirty in all. The smallest one contains over twelve hundred cubic feet of water, and the largest nearly four thousand, and the water is constantly being changed at the rate of over one hundred square feet an hour.

But the great public aquarium, which all the world may visit and enjoy, is but an insignificant and unimportant part of the Station. It was designed as an indirect means to subserve higher purposes.

The largest room on the north side of the building is the great laboratory, fitted up to accommodate a dozen workers. It is twenty-five feet high, and around three sides are galleries reached by an iron stairway, making a sort of second story within the room. Tall windows twenty feet high give an abundance of light. Along the north side of the room, a foot or two from the windows, are tables, drawers, shelves, and pigeon-holes, all so arranged as to divide the space into a number of alcoves, as it were, each fitted up as an independent laboratory. The outfit of each table is complete, with the one exception of the optical instruments, which the worker provides for himself. All the valuable reagents known are ready at hand in labeled bottles and in perfect condition. There are all sorts of vessels and appliances which can possibly be needed, even down to drawing materials and boxes of crayons and water-colors.

On a very short notice the investigator finds on his table the material he has been vainly trying, perhaps for years, to secure; he finds it not only both fresh and preserved in various ways, but also, as in the writer's own experience, in its different embryonic stages, so that on his arrival he can at once set himself to work without loss of time. Behind him, extending along the other side of the room, are aquaria, well lighted from all sides, for there are windows also on the southern side of the room, looking into the central court. The aquaria are admirably arranged for keeping alive and in flourishing state the animals under study. Scores of siphons are pouring their streams of fresh sea-water into the dozens of large and small tanks and basins; and when these fail to introduce sufficient air, ingenious contrivances secure an extra supply, so that each animal or ovum is kept in a healthful condition. Here may be found ova of every size and shape, in every stage of development, from the scarcely visible speck up to the great egg of the shark, with its curious transparent envelope, furnished with strings for attaching it in favorable localities. The development of animals from the earliest stage of the egg is at present, perhaps, the most important department of biological work. Many professors from the different universities of Europe, burdened with some embryological questions which at home they have no opportunity to solve, as soon as holidays give them their freedom make their way in haste to the Naples Station, hoping by means of the unequaled facilities there offered them to work out their problem.

The process of the formation of a highly organized animal from the almost invisible germ need only be understood to interest deeply people in general as well as the specialist. The building up of the various organs and parts of the body from cells and their products can be clearly followed. Strange mysteries and histories of living things have been brought to light, which, but for these embryological revelations, would have remained forever beyond our reach.

To assist each investigator in doing his best work, he is furnished with his own aquaria fitted to his own special work. Here you see an aquatic garden of sponges, of which the Mediterranean furnishes such a luxuriant variety. As the collection indicates, one of the staff is making them the subject of a monograph. Close by, a group of basins and jars contain a variety of mollusks and their ova, from which we may safely conclude that some one has mollusks in hand. On one side of the laboratory is a dark chamber, in which are small vessels filled with the plant-like gorgonias, which, notwithstanding all kindness and coaxing, sullenly refuse to help on embryological science by laying their eggs. Patience and ingenuity have been severely taxed in endeavoring to coax to good humor these contrary creatures.

On the same floor, and opening either into

THE DIVER AT WORK.

the main passageway or into smaller halls, are thirteen other rooms, many of which are fitted up for single workers. There are also a number of small laboratories on the ground floor as well as in the third story.

Opposite the large laboratory, on the other side of the passageway, is the library,—a long, pleasant room, opening by three doors on the broad loggia which runs along the southern side of the building, and from which one obtains a fine view of the bay. The library contains at present something over three thousand volumes, a large part of which is made up of the private collection of Dr. Dohrn, the founder of the Station; besides which all the important biological journals and reviews (about sixty in number), published in the four principal languages, are received here. Additions of new books are constantly made, and a great number of works are contributed directly by their authors. The library is especially rich in embryological works.

THE ZOÖLOGICAL STATION.

The progress in biological inquiries is now so rapid in every direction, the number of works published so great and constantly increasing, that the man who works by himself, not keeping up with the current literature, is soon found to be quite ignorant of the state of knowledge even in his own special line, and may be wasting his time over problems already solved. It is of the highest importance that he have access to a library which will furnish him with everything of value on his subject. The Station library leaves little to be desired, and its value is very greatly enhanced by the freedom with which the books may be used. They are well arranged and catalogued, and one has only to notice the simple arrangement readily to find the books he desires; then, without further ceremony, he takes them from the shelves, leaving in their places cards bearing his name, so that if any one else desires the same books he will know where they may be found.

THE DIVER'S BOAT.

THE BIOLOGIST.

AT THE SORTING-TABLE.

The Station itself issues three important publications: (1) A series of magnificent monographs, prepared by the staff, upon the fauna and flora of the Bay of Naples. (2) A collection of papers entitled *Mittheilungen*. The publication of these papers was begun in 1879; they consist of articles and memoirs by the staff, and also by persons not permanently connected with the Station, but engaged there for a time in biological research. These papers may be written in any of the four principal languages, French, English, German, or Italian; and the four numbers which appear yearly make a large quarto volume. (3) The yearly "Zoölogical Record" *(Zoologischer Jahresbericht)*, which furnishes lists of all the published biological works of the year, giving also a summary of their contents. This supplies a great need, and is very useful to zoölogical workers. It is an expensive undertaking, and depends for its existence upon the subscriptions of societies and academies. Its first volume was issued in 1879.

THE DIVER.

Besides the regular publications of the Naples Station, many important papers and monographs published elsewhere since 1874 are the results of studies pursued there by eminent scientists from all parts of Europe.

But we must not dwell longer on the literary productions of the Station. On the same floor with the library and great laboratory, in the rear of the building, is a series of rooms smelling strongly of the sea. They are reached also from the gardens, by a small back door and a narrow stairway. In these quarters may often be seen a dozen or so of rugged Neapolitan fishermen, who in their humble way are also doing a very important, indeed a necessary, work for the advancement of science. They may be seen bringing in loads of strange-looking mixtures, which might be said to be the refuse of sea and land. They seem to consist chiefly of broken-up plants, mixed with sand, water, dirt, stones, and formless things, among which the passer-by, if he lingers a moment, will see here and there a slow movement indicating the presence of some living thing. The uninitiated visitor would hardly think of taking a second glance into these tubs of heterogeneous things. In the early days of the Station, and before the picked crew of collectors were trained and regularly employed, considerable sums were offered to the ordinary fishermen of the bay for the animals which they accidentally took, and were in the habit of throwing back into the sea; but these sturdy fellows respected themselves too much to engage in what

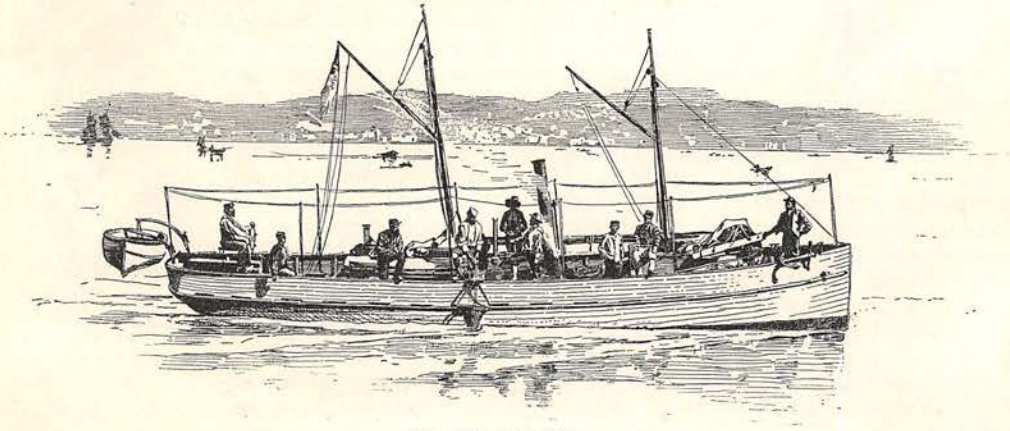
DOMENICO, THE FISHERMAN.

appeared to them most disreputable traffic, and for a long time it was difficult to secure even the animals that were known to be most abundant. A few of the more unscrupulous, however, by large offers of money were finally persuaded; but ashamed of what they were doing, they stealthily worked in the darkness. By degrees they became bolder, and finding it more profitable than fishing for the market as their fathers had done before them, they recklessly sacrified themselves to Mammon, and very soon the fishermen openly engaged in the despised traffic in broad daylight. This was in the early days; ideas have changed some-

THE DREDGER.

GIOVANNI, THE FISHERMAN.

what since then, for the strange scientists have borne themselves well, and have gained the respect of even the fishermen. But old prejudices are not easily outgrown. The chief of the fishermen declares that up to the present time he often has trouble with those men even who work exclusively for the Station. When in the same boat with them, if he is not watching closely they will catch and throw overboard again the very objects he has brought them out to secure. They cannot be made to believe that this material for which



THE JOHANNES MÜLLER.

their contempt is so strong can possibly be of any interest to their employers.

All that is dredged, fished, skimmed, or strained from the sea is brought up the back stairs to these rooms, which are fitted up for the purpose with aquaria, with all variety of vessels and tubs, sieves and the like. Here, under the direction of the skillful conservator, Salvatore lo Bianco, the laboratory boys are set at work, selecting and sorting out all that science can make use of.

The unscientific visitor, whose first feeling was that of disgust, or at least of indifferent curiosity, if he lingers will meet with great surprises. The gelatinous masses among the wet sea-weed and sand and stones, which seem to be without shape, life, or interest, when carefully taken out and put into the large vessels of crystal-clear sea-water, slowly expand into most exquisite shapes, revealing all delicate and lovely tints, iridescent bands and spots giving back all the colors of the rainbow. Then when these objects, as delicate in texture, shape, and color as they are beautiful, start off of themselves and with graceful contractions sweep through the water, it is impossible for even the most indifferently disposed to repress exclamations of delight and admiration.

From among the sticks and rubbish of the tubs are brought out clumps of something, perhaps as large as one's fist, sometimes resembling pieces of flesh. It is only when they have been left quiet some time, in the glass jars filled with sea-water, that the polyps, which have drawn themselves in, come out again, and expand like exquisite and delicate flowers. These are the coralloids. One not familiar is astonished at the transformation; instead of tubs and pails full of disagreeable-looking masses, the rooms are soon filled with bright glass vessels, containing thousands of living things of different kinds, plants as well as animals. They are now ready for distribution. First of all the wants of the investigators are consulted. Salvatore is already informed of their various needs, and unerringly gives his orders. "Antonio, take these siphonophores to Dr. Korotruff; Francesco, these jars of *auftrieb* to the laboratory, one for each table; Cicillo, the cephalopods to Prof. Grenacher," and so on. The pans and glasses, with their varied contents, are soon scattered all over the building, and each one of the score and more of workers finds himself with abundance of material. Of the animals left, some go to the great public aquarium below, others Salvatore sends to his own room. He is master of the art of preserving animals, and his room is one of the most interesting in the Station. It has a gallery on three sides, and from floor to ceiling is lined with shelves, on which are ranged bright glass jars of all sizes containing a great variety of animal forms in the most perfect state of preservation. Many organisms which hitherto it had been thought impossible to preserve are here seen, not only naturally and fully expanded, but retaining their beautiful transparency and exquisite tints. Ingenuity has been successfully employed in discovering means of killing instantaneously those animals which so contract when disturbed that their natural expanded form could not be guessed. Others still are so delicate and of such liquid consistency that ordinary preserving fluids reduce them to a shapeless, opaque mass. But most of these long and patient experiment has at last found means to preserve, so that not only the form and anatomy of the animal can be made out, but even its entire histology. The recent rapid progress in biology is very largely due to improved methods of preserving animal tissues and to other technical methods originating at the Station. With the object in hand which he wishes to study, the biologist often finds himself baffled in all his attempts to solve its problems; technical difficulties check his progress, and many important questions are waiting for new technical processes to help them on towards solution. Hence matters of technique are receiving a large share of attention from the members of the scientific staff, and useful discoveries are constantly made.

The great quantity of material preserved by Salvatore is not only used so far as it is needed in the researches prosecuted at the Station, but is sent away, as desired, to biologists at a distance who carry on their work by means of subjects supplied from Naples. Nowhere else is such a feast spread for the zoölogist's eyes. The abundance of life in the Mediterranean, and especially in the Bay of Naples, has been for many years an attraction to the zoölogists of Europe. This Station has quite a little fleet of its own,— sail-boats, row-boats, and two steam-launches. The larger of the steamers, the *Johannes Müller*, was presented by the Royal Academy of Berlin in 1877. It has sleeping room for four besides the crew, carries coal and water for four days, and is sometimes absent for several days at a time. It is fitted out with sounding and dredging apparatus by means of which the fauna from the depths of the sea is collected and studied; its dredge is hauled in by machinery, and it has on board harpoons and fusil revolvers for the chase of the dolphins. The cabin was originally fitted up with tables, tanks, vessels, optical instruments, etc., for sorting out and examining the contents of the dredge; but

experience has shown that this can be better done in the laboratories.

The able and ingenious engineer of the Station has lately devised a new method of bringing things from the ocean depths; it is simply a system of hooks attached to cords, which are dragged along the sea-bottom.

But one other method of collecting and studying marine animals must still be noticed. It is not only necessary that they be taken from their haunts to aquarium and laboratory, it is important that the biologist visit them in their native homes and examine their surroundings. Incased in a heavy water-proof suit, his head in a casque of steel and iron, the biologist is let down from the boat, and allowed slowly to sink to the bottom; by means of tubes he is supplied with air, so he can remain three hours and over walking about among the seaweeds and rocks, with from thirty-five to one hundred feet of water above him. That which strikes one first in the splendid kingdom of the fishes is the beauty of the colors. Blue is predominant everywhere, but in the blue are distinguishable the richest tints and most varied shades; then, when you reach the bottom of the sea, this general blue, which is only the color of the water at different depths, is enameled with other hues borrowed from the algæ, the hydrozoa, the bryozoa, which form enormous mossy tufts upon the rocks,— from the crinoids, the star-fish, the mollusks and crustacea which creep or frolic with each other. Fish with glittering scales come fearlessly towards you, so that you could catch them with your hand, or with a butterfly net, so to speak. The transparency of the water is so great at thirty or thirty-five feet below the surface that the minutest characteristics of a plant or animal can be distinctly observed. It is possible to make use of a lens, and one can seize with pincers the tiniest objects. We discover that the diving-suit, so heavy and cumbersome in the air, leaves the utmost freedom to our movements under the water. At first the pressure of the caoutchouc investment itself is oppressive, but one at length becomes accustomed to this, and with a little dexterity a diver would succeed in performing under the water elementary gymnastic exercises. This entire ease of movement enables one to slip through narrow passages between the rocks, to creep under their projecting ledges, and to follow into the most hidden recesses the objects of which one is in search.

The observer feels but little discomfort until he descends below fifteen feet or so. Respiration is so normal that one experiences no oppression. Salivation is generally accelerated, especially on the first descent, but the saliva never becomes so abundant but that it can be overcome by repeated movements of swallowing. The pressure upon the tympanum is great, but this also, on being a little accustomed, passes away; even when it seems almost unbearable on the first descent, it is almost unperceived on the second. It would be dangerous for a person to descend the first time lower than fifteen or twenty feet; at thirty-five feet the pressure begins to be considerable, yet the experienced diver will descend two or three times as low. M. Peterson, our engineer and master of the art of diving, a very robust person and much accustomed to the effort, descends as low as a hundred feet at times; but this seems to be the extreme of possibility, for under the enormous pressure to which one is subjected — a pressure so strong that the investments are crushed into the skin — the respiratory movements become exceedingly oppressive, and it is hardly possible to endure it more than twenty or thirty minutes.

In general there is a feeling of great security in the water; one experiences no sentiment of danger. This is not, however, because one is entirely free from it, but the precautions ordinarily taken reduce it to a minimum rarely attained. The diver is followed in his submarine wanderings by a skiff, where one on guard is attentive to every movement and signals the least danger. A condition essential to the comfort of the diver is the regularity of the current of air in the casque. It is therefore necessary to confide the management of the pump to experienced men. Besides the tubes connecting the diver with the boat, he is always securely attached to a strong cord by means of which he communicates with the persons on guard in the boat, and with which also he is let down and drawn up. Thus if he gathers in an abundant crop, he will give one pull to the cord, which will be translated at the surface by the phrase, "Let down the sack." Two pulls signify, "All goes well"; three pulls, "I wish to ascend." A series of little strokes sharply and rapidly given to the cord are a sign of alarm, and immediately the guards pull up the diver to the surface.

The results obtained by diving, dredging, sounding, fishing, skimming, and digging are carefully put on record. In this way the whole submarine region is coming under accurate knowledge. Not merely the number and character of the species to be found are noted, but the physical conditions under which they live, their breeding season, the depth at which they are found, and the dates of their appearance and disappearance, many animals coming and going periodically. All this exact information is very valuable to the investigor. Even before coming to Naples he knows definitely what to expect and is able to make his plans.

The "scientific staff" of which mention has been made consists of Dr. Anton Dohrn, the founder of the Station, and seven assistants, among whom is divided the management of the different departments of the Station. Dr. Dohrn is the director and official head, and represents the Station to the outside world. The assistants are each specially engaged upon a monograph of some group of marine animals found in the bay. Besides the monograph of one division of annelid worms with which he is occupied, Dr. Eisig is charged with the administration of the laboratory and takes the director's place in his absence. Other assistants, in addition to their own special scientific work, have charge of the systematic collections and of the great aquarium, of the botanical laboratory and herbarium, of the library, and of the conservation of specimens for sale to universities and laboratories. Besides the scientific staff, a number of men and boys are permanently in the employ of the Station, and, being well trained in their special duties, they render most valuable assistance to the scientists at work.

The Naples Station was equipped, and is now supported, it is manifest, at no little expense. Its annual income is derived from admission fees to the public aquarium, the sale of its publications and its microscopic preparations and preserved animals, governmental subsidies, and "rented tables." By an annual payment of four hundred dollars the right is obtained to send an investigator to work at the Station for ten months of the year. This right has been obtained by universities, governments, and societies.

Since the founding of the Station at Naples, zoölogical stations of varying extent have sprung up in many localities — along the Atlantic, the British Channel, the North Sea, the Adriatic, along the coast of the United States, and even in Japan; but the magnitude and permanent character, and also the international tone, of the Station at Naples give it an importance altogether exceptional. The general reader may possibly ask why these centers of investigation should in all cases be located by the sea. The problems with which the zoölogist now occupies himself are different in character from those of an earlier day. In the kindred science of botany, the time is past when the man who could call by their scientific names a thousand plants was esteemed a botanist, and he who could name ten thousand was eminent in science. What we now require is a knowledge of the anatomy and physiology of plants, of the progressive steps of their development, and of their geographical and paleontological distribution, before we recognize the scientific man. So in zoölogy. What began as a scheme of classification has now become a science which boldly grapples with all the great questions touching the history and origin of life. Now the rôle of the lower animals in zoölogical problems is a very important one. The more elementary the organism, the better, often, for these purposes. Besides containing the more primitive forms, the sea teems with animal life, offering material absolutely inexhaustible. Among the European sea-coasts, the Italian and Sicilian shores of the Mediterranean offer especial attractions to naturalists. Ever since Johannes Müller, who may be regarded as the leader of the new school of German biologists, with a little group of students accompanying him, found his way to these shores, not a year has passed without some German savant making his pilgrimage to Naples or Messina to pursue there his zoölogical studies.

Emily Nunn Whitman.

A SONG OF THE MOCKING-BIRD.

DEDICATED TO AN ENGLISH SKY-LARK.

OH,
How I long to go,
On a seaward-blowing breeze,
To the garden of the seas —
To brave King Arthur's land,
To that fair island Alfred made so free,
To the haunt of chivalry,
Where master-birds sang (in the days of song)
So long
And strong!
Oh, let me dwell a space by Avon's tide,
Or hide
In some old grove, where still a note may linger
Of Herrick's flute,
Of Sidney's lute,
Or of some precious rondel voiced by a forgotten singer!

Hark!
Even now I hear a lark,
The lark of England's ripe and mellow story,
The lark of England's fallow fields of glory,
Springing,
Singing,
Far and high in heaven's remotest blue,
His wings still cool with dew,