A MARINE COMMUNITY.

BY A. W. ROBERTS.

One of the most intensely interesting occupations that I ever entered into was that of dredging for specimens of marine life. I have drawn and engraved but a mere fragment, so to speak, of some of nature's wondrous handiwork secured during a day's dredging at Buzzard's Bay, Mass.

In this marine community fraternity and equality were exhibited in a manner far superior to any republic, ancient or modern. But there was very little liberty, particularly in the case of the old hermit crab, whose residence was the empty shell of a winkle, which was so occupied by a living community of annelids, zoophytes, shellfish, etc., that it was next to impossible for him to navigate. Yet with these curious creatures communism prevailed to its fullest extent,

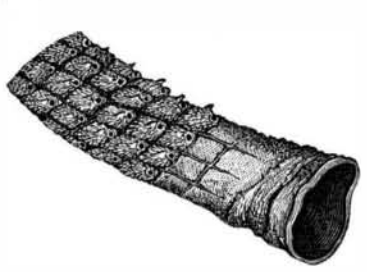


Fig. 1.—Lepralia.

one for all, and all for one. This mass of marine animals lived and thrived at the Aquarium for many months.

To begin, then, with the worms (or annelids, as they are called) contained in this community, I will select the *Serpula dianthus*, shown in the illustration as the central figure, and over which is shown a sea horse watching and waiting for small annelids, that he may suck them out of their tubes with his proboscis-shaped mouth.

The tubes in which the *Serpula* live are composed of shell. When a tube is broken it is immediately repaired or built up again by the *Serpula*. The *Serpula dianthus* always grows in a mass. At the base of the mass the tubes are twisted and contorted together, and where they come in contact with one another the outer walls of the tubes are joined together. In this way this united worm community obtain mutual strength for their otherwise fragile homes.

If a group of these annelids be taken into the hand they will appear to be empty, but if the tubes be not greatly contorted a something scarlet may be seen some distance down the tube, and by that sign the *Serpula* is known to be alive.

When *Serpulæ* are first placed in an aquarium they remain quiet for several hours, as if to become acquainted with the surroundings; but by very slow degrees the scarlet object is pushed nearer and nearer the mouth of the tube, and at last emerges, when it is seen to be a conically-shaped cork or stopper, its small end being prolonged into a kind of footstalk. In a short time a circle of scarlet feathery objects slowly and cautiously follow the stopper, which spread themselves out into a beautiful and elegantly-shaped plume. This plume is the feeding apparatus by which the minute forms of animal and vegetable life are arrested and conveyed to the stomach. Slowly as the *Serpula* protrudes itself from its tube, it is by no means slow in retreating. When one of these creatures is fully expanded in an aquarium, and the hand is rapidly moved outside without even touching the glass, the worm pops back into its tube with marvelous rapidity, so rapidly that the eye fails to follow the movement. The shadow of a person passing by will often have the same effect. It seems evident that the *Serpula* must be able to see, yet no eyes have been discovered.

The apparatus by which the *Serpula* performs its upward movement is a marvel of nature's mechanism. The body of the annelid is composed of seven distinct segments, and from each of these projects a pair of tubercles, each containing a bundle of bristles which can be thrust out at the will of the animal; at the end of each of the bristles are four short points, one being longer than the others. In ascending these bristles are thrust against the inner walls of the tube, which gives the creature an upward movement; contraction follows, when the hinder set of foot-like bristles are brought up, and so the movement is repeated till the end is accomplished. I extract the following from "Ocean Wonders," by my friend, W. E. Damon:

"Another curious little animal, also an annelid, is generally to be found rearing its cosy home amid the tubes of the *Serpulæ*. It cannot boast, perhaps, of as much beauty of color and waving plume, but its habits are so interesting and really wonderful, that I think it takes the lead as an object of curiosity of all the tube-building fraternity. Its tube is not homogeneous in its composition like that of the *Serpula*, but it makes an aggregation of separate particles, artistically welded or fitted together like a piece of mosaic work. This tube is not a secretion, like the cell of the coral-polyps; it does not *grow*, but is voluntarily and with great skill and care built up by the animal. In its construction it will use the very finest material—little specks of fine sand, and even dust that may chance to fall on the surface of the water. It also discriminates as to color, apparently preferring the brighter particles. For instance, I have ground red coral to powder, and put it into the water; upon this the little annelid would promptly seize, and immediately appropriate it for building purposes.

"A casual observer might see this wonderful worker many times without perceiving or appreciating its artistic movements; but get him once under a good lens, and you will see not only all the machinery in full operation, but also the object of its unwearied toil. Indeed this busy little work-

Fig. 4.—Chiton.

Fig. 5.—Purple Sea-urchin.

man lifts and carries bits of stone (hypothetical bricks), grains of sand, coral, glass, or shell, or any atoms which will serve its purpose, raises them to the top of its unfinished walls, and there places them with as much precision, neatness, rapidity, and in as regular order as the most experienced bricklayer. It is perfectly marvelous. One might watch them for hours together and never grow weary.

"But *how* do they do it?

"When the operation is seen, it is easily comprehended. The explanation presents some difficulties, though I have seen them build enough to create an annelidan city; but we will try to make it clear how the material for the construction of this little ocean tenement is hoisted up and placed in exactly the right position to complete its circular walls.

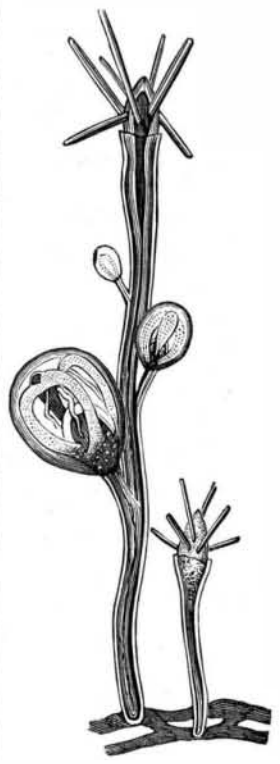


Fig. 2.—Hydractinia.

"In the first place, the creature has some twenty or thirty long, hair-like arms, which it propels out of the end of its tube. Extending these in every direction and to an incredible length, they become so attenuated as to be scarcely discernible in the water; but these fine, delicate cords or filaments, hardly discoverable by the unassisted vision, may be considered the ropes or tackling of its machinery for collecting the material which it needs for its sheath-like dwelling. Suppose a grain of sand, for instance, is lying at some distance from the animal: by some sense it perceives it, determines to appropriate it, and immediately sends forth one of its long, slender threads—*over* it or *to* it, for the extreme points are so fine as to be distinguished with difficulty, but the grain is reached. Watch it closely now! See! the bit of sand begins to move gradually along and upward, *gliding upon the surface* of this serviceable, rope-like filament. Observe, it is not grasped pincer-like with the end of the filament, but rides upward on the thread like that mysterious little wheel which thousands of our citizens see daily creeping up and over the wire which is one day to be a strand in the great cable of the East River Bridge. What the propelling or attracting force is which causes the grain of sand to rise up against the laws of gravity and approach the mouth of this annelid, I have not yet been able to discover; but in all probability there is a system of muscular contractile organs in this fine filament which a sufficiently strong magnifying lens may yet bring to observation and recognition. Be that as it may, we will in the meantime watch for what we can *see* of this process, and we find that when the object has reached the end of the filament it is placed for a moment in the mouth, where it is evidently coated with a glutinous

Fig. 3.—Crepidula Fornicator.

mucus and is then passed out again, and finally deposited upon the edge of its walls. The true level is kept, one side being built up at exactly the same rate as the other, so that no excrescences are left on the edge, but when finished, all is of a uniform and even surface. The general appearance of the animal when at work forcibly reminds one of an immense *derrick*, full-rigged and in vigorous operation."

For feeding *Serpulæ* I used the stomachs of oysters and clams ground to a smooth paste, which were diluted with water. When this substance was mixed with the water of the aquarium it caused the water to assume a very milky appearance, which in a few hours time became as clear as crystal, after being worked over by the *Serpulæ*, which had devoured all the oyster held in suspension. On the tubes of most *Serpula* will be found a reddish-brown or gray incrustation; this incrustation is called *Lepralia*, and consists of innumerable spine-crowned cells of exquisite structure arranged in rows like the scales of a fish, as shown in Fig. 1, when greatly magnified. Each cell is armed with a spine. If the fingers are passed over the surface of the *Lepralia* from the base of the *Serpula* tubes upward a peculiar rough and harsh sensation will be perceived, which is caused by the finger coming into contact with the thousands of spine-crowned cells. In the channels of Canarsie Bay, Long Island, this zoophyte is found encrusting shells and other objects which have been submerged for any length of time.

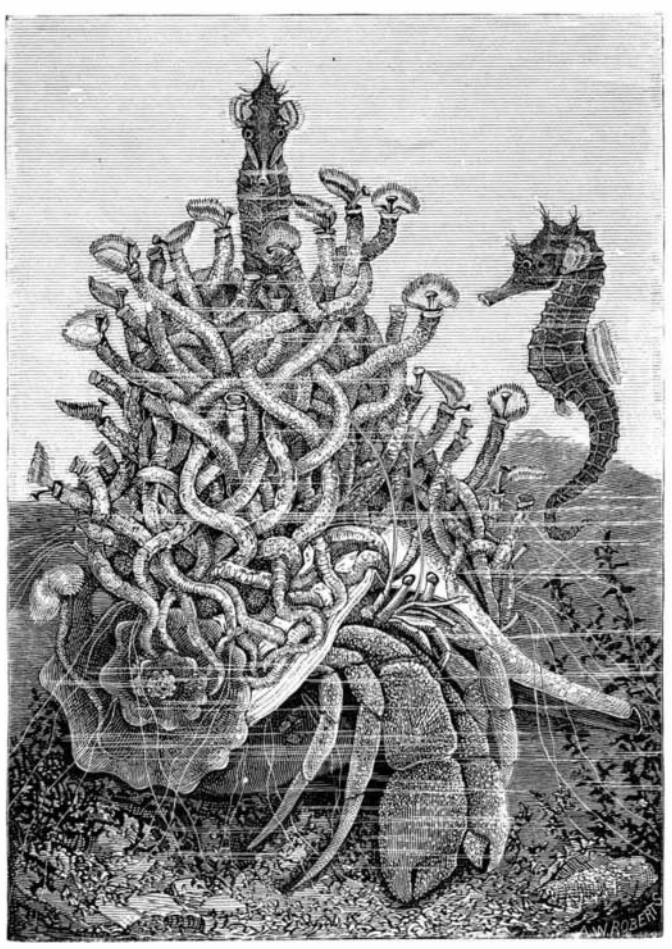
On certain parts at the mouth of the winkle shell, which were free from the abrasion of the hermit crab's claws, grew a thick rose-colored moss-like carpeting, which consisted of thousands of minute hydroids called *Hydractinia*.

All members of a *Hydractinia* colony are connected at the base by a horny network, which rises occasionally into points of a conical shape. A single individual of such a colony when placed under a microscope appears as shown in Fig. 2. The pear-shaped protuberances, which might be taken for buds, in course of time burst and send forth a crystal bell, no larger than a pin's head, but of perfect organism. These are the minute jelly fish (*Medusæ*) that crowd the ocean in countless numbers, illuminating the crest of every tumbling wave and marking the wake of every ocean steamer.

Fig. 3 represents a mass of shell-fish (*Crepidula fornicator*) adhering together; the lowest one in the mass was fastened so firmly to the winkle shell that it could not be removed without injury. These "boat shells," as they are commonly called, adhere by means of atmospheric pressure; raising the central parts of their bodies from the objects to which they are attached, and, pressing down the rim of their shells, they produce a vacuum beneath themselves. And so firmly does the air hold them in place that the unaided fingers will find great difficulty even to stir them. The rims of their shells always exactly fit to the object or convolution of the shell to which they are attached. At the mouth of the winkle shell were also attached a number of living specimens of *Crepidula plana*.

Fig. 4 represents a curious little creature which I found tucked away in the interstices formed by the *Serpula* tubes. In color he so exactly matched his surroundings and was in form so very flat and unobtrusive that almost any one would have overlooked him. With his eight movable plates on his back he was suggestive of a tiny marine armadillo; but when I picked him out from his hiding place, which was no easy task (as he can maintain a better vacuum than the boat shell), he curled himself into a ball which you would have pronounced to be a very aged pill-bug (*Oniscus*).

In the mass of *Serpulæ* I also discovered several very young specimens of the purple sea-urchin, Fig. 5. The shell of the sea-urchin is made out of several hundreds of pentagonal plates, varying in size according to their position. These are so closely connected that their marks of juncture are not perceptible. As the



A MARINE COMMUNITY

shell is composed of these plates it is wonderful how the creature increases in size, as it cannot, like the crab, cast its old shell when too small and take to itself a larger one. But in order to overcome this the delicate lining membrane with which the entire surface of the body is covered insinuates itself between the edges of these plates and deposits round the margin of each particles of calcareous matter, so that each plate simultaneously increases round its edges, and the original form of the shell is preserved.

The surface of a sea-urchin after a certain age becomes thickly studded with spines (in young specimens the spines are much less in number), which are employed as a means of locomotion, and therefore are freely movable. If a single spine be removed, and note taken of the part it previously occupied, it will be seen that on the shell is placed a rounded tubercle, and that the base of the spine is furnished with a hollow socket into which the tubercle fits, so that the spine has perfect facility of movement. The spine is bound to the tubercle by a tendinous ligament, connecting the center of each much as is the case with the larger joints of vertebrate animals. The power of motion is communicated by the membranous covering that envelops the body during the life of the animal.

Besides the animals I have described as being members of the marine community, were also very small clump-clawed crabs, numerous *Neris* worms, a small variety of the *Cardum*, and minute acorn barnacles. In fact this single mass contained enough animal organisms to stock an aquarium for many months' study. The young sea-horses were introduced into the aquarium occasionally that they might enjoy an extra feed of small annelids.

THE KING PENGUIN.

Most interesting, by far, among all rookeries of penguins which I have seen was one of king penguins (*Aptenodytes longirostris*) which I met with at Marion Island.

The rookery was on a space of perfectly flat ground of about an acre in extent. It was divided into two irregular portions, a larger and smaller, by some grassy mounds. The flat space itself had a filthy black slimy surface; but the soil was trodden hard and flat.

About two-thirds of the space of one of the portions of the rookery, the larger one, was occupied by king penguins, standing bolt upright, with their beaks upturned, side by side, as thick as they could pack, and jostling one another as one disturbed them.

The king penguins stand as high as a man's middle. They are distinguished at once not only by their size, but by two narrow streaks of bright orange yellow, one on each side of the glistening white throat.

Penguins were to be seen coming from and going to the sea from the rookery, but singly, and not in companies like the crested penguins.

The king penguins when disturbed made a loud sound, like "*urr-urr-urr.*" They run with their bodies held perfectly upright, getting over the ground pretty fast, and do not hop at all.

A good many were in bad plumage, moulting; but there were plenty also in the finest plumage.

On the small area of the rookery, which consisted of a flat space sheltered all round by grass slopes, and which formed a sort of bay among these, communicating with the larger area by two comparatively narrow passages, was the breeding establishment. These penguins are said by some observers to set apart regular separate spaces in their rookeries for moulting, for birds in clean plumage not breeding, and again for breeding birds. Here the breeding ground was quite separate, and the young and breeding pairs were confined to this smaller sheltered area. This was the only king penguin rookery which I saw in full action.

At Kerguelen's Land the king penguins were only met with in scattered groups of a dozen and twenty or so, and they were then not breeding, but only moulting. On this breeding ground, at its lower portion, numbers of penguins were reclining on their bellies, and I thought at first they might be covering eggs; but on driving them up I saw they were only resting. There was a drove of about a hundred penguins with young birds among them.

The young were most absurd objects. They were as tall as their parents, and moved about bolt upright, with their beaks in the air in the same manner; but they were covered with a thick coating of a light chocolate down, looking like very fine broom-fur. The down is at least two inches deep on the birds' bodies, and gives them a curious inflated appearance. They have a most comical look as they run off to jostle their way in among the old ones. They seemed to run rather better than the adults, but perhaps that was fancy.

Absurd in appearance as these young are, those that are just dropping the down and assuming the white plumage of the adults, are far more so. Some are to be seen with the brown down in large irregular patches and the white feathers showing out between these. In others the down remains only about neck and head, and in the last stage a sort of ruff or collar of brown remains sticking out round the bird's neck, and then when it cocks up its head it looks like a swell boy in stick-up collar.

The manner in which these young ones cock up their heads gives them a peculiar expression of vanity, and as they ran off on their short stumpy legs I could not resist laughing outright.

At the farthest corner of the breeding space, in the most sheltered spot, was a clump of birds of a hundred or more. The birds were, most of them, in a slightly stooping posture, and with the lower part of their bodies bulged out in a fold in front.

As I came up and bullied these birds with my stick a little they shifted their ground a bit with an awkward sort of hopping motion, with the feet held close together. It immediately struck me that they were carrying eggs with them, as I had read that king penguins do Their gait was quite peculiar and different from the ordinary one, and evidently labored and difficult.

I struck one of them with my stick, and after some little provocation she let drop her egg from her pouch and then at once assumed the running motion.

These birds carry their eggs in a complete pouch between their legs, and hold it in by keeping their broad web feet tucked close together under it. They make absolutely no nest, nor even mark from habitually sitting in one place, but simply stand on the rookery floor in the described stooping position, and shift ground a bit from time to time as occasion requires. I suppose the egg is not dropped till the young one begins to break the shell.

Charles Goodridge says that the period of incubation is seven weeks, and that the birds commenced laying in the croyets in November, and continued to lay, if deprived of their eggs, till March. The birds with eggs were sitting close together. When, on my frightening them, some were driven against others, savage fights ensued and blood was drawn freely, the birds whose ground was invaded striking out furiously with their beaks.

Round about the brooding birds were others, I think males, in considerable numbers. The males probably feed the females with which they are paired. There were also some young downy birds.

If one of these latter was driven in among the brooders it was at once pecked almost to death. The young ones utter a curious whistling cry, of a high pitch and running through several notes, quite different from the simple bass note of the adults.

The egg of the king penguin is more than ordinarily pointed at the small end. It is greenish-white, like other penguin eggs.—*H. N. Moseley, Challenger Notes.*

The Menominee Iron Mines.

A correspondent of the *Iron Age*, accompanying the American Institute of Mining Engineers on its excursion among the mining districts of Lake Superior, anticipates a revolution in iron making to result from the inexhaustible stores of cheap ore in that region. He says:

We have questioned the propriety of calling some of the great openings of the Marquette and Negaunee districts "mines," as they might with more propriety be called "ore quarries;" but what shall we call these Menominee openings? They are not even quarries. You strip off the surface, and beneath lie deposits of ore such as the eye of man hath not seen. We are amazed, astounded, confused. Some of us who are interested in Eastern mines even turn away disgusted; and what wonder, when we see miners working these vast deposits of steel ore with pick and shovel as easily as they would dig a cellar on a sand hill; when we see ore of unapproachable richness and purity loosened, loaded, and put in cars for 25 cents a ton, including everything except the royalty of 50 cents. We have been impressed from the first; now we are appalled. I do not exaggerate in any respect the feelings of those who saw these mines for the first time on Tuesday, and who had enough acquaintance with the iron trade to understand the meaning of what they saw. "There is nothing like it in the world," says every one, and no one can intelligently question the statement that in this Menominee range, with its incalculable wealth of ore in sight and its unlimited possibilities of development, has been found the solution of the ore question for a longer time into the future than any one now in the iron business has any occasion to look. . . . Description cannot do justice to the subject, any more than it could to the Falls of Niagara. Even when we see the falls we wonder how this mighty cataract is fed, and when the supply of water which pours over the precipice in never diminishing volume will be exhausted. But our question is answered when we cross the great inland seas which are its unfailing fountains. So it is with Lake Superior iron ores. We see them steadily flowing into the port of Cleveland in increasing volume, and have allowed ourselves to be deluded by the mistaken predictions of such authorities as Mr. Bell, that they are drawn from pockets of known extent, and that the end of the supply can be predicted. When we go and look for ourselves we see that the supply is not a matter of years, but of centuries; that as yet we have but scratched the surface of a mineral wealth for which the world has no parallel, and that within two or three years at most, the abundance and cheapness of these ores will so reduce the cost of iron as to materially change the condition of national industrial development and international competition. If any one doubts this let him go and look, and his eyes will be opened. For the first time your correspondent appreciates the value of the Lake Superior ores as a factor in the problem of our iron development.

The Menominee range is the latest and grandest development of this wonderful country. In 1877, 10,405 tons of ore were shipped; in 1878, 94,245 tons; in 1879, 269,089 tons. This year there have already been shipped 375,000 tons, and before the close of navigation between 500,000 and 600,000 tons will have gone forward. Every pound of this ore will make Bessemer iron. The average cost at all the mines will not exceed $2 per ton on cars. In the furnace they will melt like snow. In one instance the ore costs 20 cents a ton at the surface, and with a total force of 60 men at work the mine yields 400 tons per day. Nothing is shipped which does not contain 55 per cent of metallic iron or over. The 50 per cent ore is piled near the workings in the expectation that in the event of a sudden demand it may be wanted. This production can be increased as rapidly as it may be needed, and there will soon be no room for foreign Bessemer ores in a market so abundantly supplied from Michigan and Wisconsin. The time is not far distant when this ore will be delivered at Cleveland at $4 per ton, leaving the mining companies $1 per ton profit. At this point the purest ores will meet the Connellsville coke, the finest metallurgical fuel in the world, and the pure magnesian limestones of the lake shores, than which there are no better. The rest may be guessed.

Original Inventions and Supplementary Improvements.

The *Telephonic Exchange Reporter*, in its allusion to the large number of patents issued on the telephone since Professor Bell introduced his instrument, adds the following remarks concerning the importance of patenting supplementary improvements.

When an inventor, says the writer, files a proper application for a patent, the government will grant to him a patent for whatever he can justly claim as his invention. Such invention properly belongs to the inventor, not by reason of a government privilege, but by reason of his having been the creator of the property. The government grants no privilege; it simply recognizes a legal right. The Patent Office makes an examination into the novelty of the invention in order that official recognition may be given only to that which appears to be new. If the official inquiry be not subsequently proven at fault, the invention or improvement patented is solely for the use or let of the patentee. He may let it drop, and thus make nothing from it. He may put a prohibitory value on it, and thus get nothing from it. He may put a just value on it and reap a rich reward, if his invention has merit. The justness of the inventor's charges will be evidenced entirely by public acceptation. If he charges too much the public decline his invention.

Another man may add an improvement to the original inventor's device. The improvement may consist of an added element, or in a useful change in form of old elements. The improver can patent his improvement.

The fundamental invention thus belongs to the first man, and the improvement belongs to the second man. The first man is not at liberty to make, sell, or use the improvement without the consent of the party who owns the patented improvement.

The second party is not at liberty to make, sell, or use the fundamental invention without the consent of the owner of the patent on the fundamental invention. In the absence of an arrangement, the first party must do without the improvement, and the second party must do without the fundamental invention. The first party can operate his invention without the improvement, but the second party can do nothing with his, because he has no fundamental invention to which he can apply his invention. He invented and patented his improvement with the hope that the owner of the fundamental patent would appreciate its merits and arrange for the use of the improvement. Without the allowance of the fundamental inventor, the improver is rock bound. He may have fine quarters on an upper floor; quarters which the party down stairs might envy him the possession of, but if the down stairs party has a sole title to stairs and exit, the up stairs party must leave his quarters vacant, or come to terms with the base.

In the case of patented inventions there may be hundreds of improvers on a fundamental invention; there may be improvements on the improvements; and many of the improvements may not be improvements at all, but may be fallacies based on wrong observation or incorrect experiment.

The status of patents is generally well understood by inventors, and they also well understand that the reward of the improver is likely to be handsome if his improvement will create a marked advance in the merit of the invention improved upon. The wise inventor does not cease his labors because his invention is a tributary one. Howe patented the essential fundamentals of sewing machines, but Singer was not thereby deterred from patenting an improved Howe sewing machine which he could never make without Howe's consent.

Bee Keepers' Convention.

The eleventh annual convention of the North American Bee Keepers' Society met in Cincinnati, Ohio, September 29. About one hundred and fifty delegates, from nearly all the States of the Union and from Canada, were present at the first session. In the annual address by President W. T. G. Newman, of Chicago, the honey crop of this year was said to be but half the usual amount, owing to bad weather. Papers were read on honey-producing plants and trees, new discoveries in the cure of foul brood, the yellow race of bees, Cyprian bees, etc.

The Cologne Cathedral.

Since 1821 the public and private contributions to the building fund of Cologne Cathedral have amounted to $4,500,000. Adding the contributions of past centuries, notably the money expended on the colossal foundations, a German paper finds that as it now stands the cathedral represents about $10,000,000.